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Differences in Thinking Styles among Low-, Average-, and High-Achieving College Students

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Abstract

The purpose of the present study was to examine the differences in thinking styles among low-, average-, and high-achieving United Arab Emirates college students. Thinking Styles Inventory was used to assess students' thinking styles. Results indicated that low-achieving students scored significantly lower on Executive, Hierarchical, Anarchic, Local, Conservative, and Internal styles. Low-achieving students scored significantly higher on Legislative, Oligarchic, and Liberal styles. A discriminant analysis revealed that Executive and Conservative styles were the most discriminating factors that separated low-achieving students from their high-achieving peers.

Keywords: Thinking styles, academic achievement, college students.

1. Introduction

The relationship between thinking styles and academic achievement has received a great attention over the last two decades (Albaili, 2006, Sternberg, 1997, Sternberg & Wagner, 1992). Research has shown that certain thinking styles could be used as notable predictors of students' academic achievement and performance. Thinking styles are defined as our preferred ways of using the abilities that we have. In managing our activities, we choose styles with which we feel comfortable (Sternberg, 1988, 1997). Sternberg contended that styles are thought to be distinct from abilities, and involve preferences, not necessarily conscious, in the use of whatever abilities one has. Styles are not connected solely with ability, but rather, preferred ways of expressing or using one or more abilities (Armstrong, 2000; Cano-Garcia & Hughes, 2000; Grigorenko & Sternberg, 1997; Sternberg, 1997; Zhang, 2000; Zhang & Sternberg, 1998; 2000).

Sternberg (1988, 1997) proposed the theory of mental self-government representing stylistic aspects of intellectual functioning. The basic assumption of the theory is that people, like societies, govern themselves and their mental processes and establish systems and organizations for this governance. In the theory, Sternberg (1988, 1997) provided categories and characterizations of how people organize, direct, and manage their own thinking activities, and he proposed 13 thinking styles, which fall under five dimensions aspects of mental self-governance. These 13 styles are briefly described in the following sections:

Functions: Government systems typically have different branches serving various functions; presumably, people also have different styles for focusing on different functions or tasks. There are three functions of people's mental self-government: legislative, executive, and judicial. People who have a Legislative style prefer tasks that require using creative strategies and generating new approaches and solutions. People who have an Executive style are more concerned with the proper implementation of tasks within a set of guidelines, and those having a Judicial style are concerned with evaluating the work process and products of other people's activities.

Levels: In most countries, governance operates at different levels: national, regional, provincial, municipal, and so on. Similarly, in people's mental self-government, in which individuals may vary in terms of their concern for detail, two levels of governance are defined: local and global. People with a Local style prefer activities that require them to attend to very specific and concrete details, whereas those with a Global style prefer dealing with problems that are general in nature and that require abstract thinking.

Leanings: In governance, political orientations range from the most conservative to the most liberal. These two major leanings, conservative and liberal, are also identified in mental self-government. People with a Liberal style prefer tasks that require them to go beyond existing rules and structures and tasks that are aimed at effecting substantial change. Those with a Conservative style prefer familiar tasks that require the application of and adherence to existing rules and structures.

Forms: According to Sternberg, just as there are different forms of government, there are various ways in which individuals govern themselves: monarchic, hierarchic, oligarchic, and anarchic. People with a Monarchic style prefer engaging in activities that require them to focus on only one thing at a time. Those with a Hierarchic style prefer distributing their attention and energies over several tasks that are prioritized. Those with an Oligarchic style prefer working toward several objectives all at the same time without prioritizing the tasks. Finally, individuals with an Anarchic style prefer working on tasks that require no system at all, and, thus, allow for greater flexibility.

Scope: Governments typically have both domestic and foreign affairs, which are comparable to the internal and external approaches of mental self-government. Individuals with an Internal style prefer tasks that require working independently of other people. In contrast, those with an External style prefer activities that allow for interaction with others.

According to the theory of mental self-government, people vary in their relative preferences for these styles and may use more than one style as well as flexibly switch from one to another as they adapt to changing task requirements. The stylistic preferences are also viewed as being socialized and as functions of one's interactions within the sociocultural environment (Sternberg, 1988, 1997).

There is a considerable cross-cultural research documenting that certain thinking styles of school and college students were associated with various measures of academic performance in many cultural groups. For example, Stemberg and Grigorenko (1993) examined the relationship between thinking styles and academic achievement of American gifted children and found that whereas the Judicial and Legislative thinking styles correlated positively to students' success in a variety of academic tasks, the Executive thinking style tended to correlate negatively to success in these tasks. On the other hand, Zhang (2002), whose research participants were U.S. university students found that the Conservative style positively predicted students' grade point averages, whereas the Global and Liberal styles negatively did so. Similarly, Zhang (2001), and Zhang and Stemberg, (1998), with Hong Kong students, found that the Conservative, Executive, Hierarchical, and Internal styles were positively related to academic achievement. Legislative, Liberal, and External styles tended to contribute negatively to academic achievement. Furthermore, the investigation of the relationships of thinking styles to academic achievement has also been conducted among university students in Spain (Cano-Garcia & Hughes, 2000). Findings from this study also supported those obtained in Hong Kong. That is, the higher academic achievers tended to be those who preferred to adhere to existing rules and procedures (Executive style), who preferred to work individually (Internal style), and who preferred not to create, formulate, and plan for problem solutions (Legislative style in a negative sense). In another study that involved Filipino university students, Bernardo, Zhang and Callueng (2002) obtained results that were consistent with those obtained in the studies of Hong Kong students. That is, in general, thinking styles that require conformity, respect for authority, and a sense of order were positively correlated with academic achievement. The Judicial style was positively related to academic achievement among Filipino students. More recently, Zhang (2004), with Hong Kong students, found that the Hierarchical, Judicial, and Monarchic styles were significantly contributed to the prediction of students' academic achievement.

To summarize, all existing cross-cultural studies have indicated that thinking styles significantly contribute to academic achievement. Furthermore, there is much similarity in the specific ways in which thinking styles predict academic achievement across the different cultural groups. With the exception of the studies of U.S. gifted children and the mainland Chinese university students, the studies of all the other cultures indicated that the Executive, Conservative, and Hierarchical styles correlated positively with academic achievement. However, it is unknown whether thinking styles of the Arab students would be related to academic achievement, as was found in the Asian and American studies. For the reason that different countries value different types of student behavior and achievement, stress diverse modes of assessment, and encourage different approaches to succeeding in school, differences in the degree to which thinking styles relate to academic success would be anticipated among United Arab Emirates college students.

The purpose of the present investigation was to examine the differences in thinking styles among low-, average-, and high-achieving UAE college students. It was hypothesized that would be significant differences in thinking styles among the low-, average-, and high-achieving groups. Moreover, it was predicted that certain thinking styles would be discriminating variables that separate low-achieving students from their high-achieving counterparts.

2. Methods

2.1 Participants

A total of 228 undergraduate students at United Arab Emirates University participated in this present investigation. Participants were classified into three achieving groups based on their grade point average (GPA) scores: (1) low-achieving group: students on academic probation with GPA scores below 2.00 (n= 63); (2) average-achieving group: students with GAP scores in the range of 2.00 to 2.99 (n= 98); and (3) high-achieving group: students with GAP scores in the range of 3.00 to 4.00 (n= 67). The GPA was used as an index of college academic achievement.

2.2 Instrument

The Arabic version of the Thinking Styles Inventory TSI-A was used to assess students' thinking styles (Albaili, 2006). The TSI, which was originally developed by Sternberg and Wagner (1992), is a self-report inventory with 65 items divided into 13 scales, each containing 5 items that correspond to one of the 13 thinking styles described in Table I. For each item, participants are asked how well the statement describes them, responding to the question on a 7-point Likert-type scale in which 1 indicates that the statement does not describe them at all, and 7 indicates that the statement describes them very well. Examples of items from the inventory are: (1) "I like tasks that allow me to do things my own way" (Legislative), (2) "I like situations in which it is clear what role I must play or in what way I should participate" (Executive), and (3) "I like to evaluate and compare different points of view on issues that interest me" (Judicial). Albaili (2006) reported acceptable reliability and validity estimates for UAE sample.

2.3 Procedures

After informed consent had been obtained, participants were given the TSI-A during the Fall Semester. The participants received written instructions that specified the purpose of the study and explained the procedures to be followed in responding to the items. They were told that there was no right or wrong response, but, rather statements that reflect their preferred ways of using the abilities. In addition, participants were asked to report their GPA scores.

2.4 Analysis

Analysis of variance (ANOVA) procedure was performed with three achieving groups (low, average, high)) as the independent variable and the scores on the TSI-A styles as the dependent variables. Post hoc analysis using the Scheffe method was also performed to examine the pairwise differences. Furthermore, a stepwise discriminant analysis was used to determine which of the TSI-A styles, as the independent variables, best separated low-achieving students from their high-achieving peers.

3. Results

Analysis of variance procedures followed by Scheffe method were performed to compare low-, average-, and high-achieving students in terms of their scores on the TSI-A styles. Means and standard deviations for each TSI-A Styles for three groups plus F ratios are presented in Table 1. Results indicated that low-achieving students scored significantly lower than average- and high achieving students on Executive, Hierarchical, Anarchic, Local, Conservative, and Internal styles. On the other hand, the low-achieving students scored significantly higher than average- and high achieving students on Legislative, Oligarchic, and Liberal styles. However, no significant differences were observed between average- and high-achieving groups on any of the styles.

Table 1: Means and Standard Deviations and F Ratios for Scores on TSI-A Styles of Low-, Average, and High-Achieving Groups

Style	Low (n= 63)		Average (n= 98)		High (n= 67)		
	M	SD	M	SD	M	SD	F (2, 225)
Legislative	26.93	5.64	24.53	5.49	23.09	5.55	7.96***
Executive	22.68	5.80	25.32	5.04	27.30	4.72	12.98***
Judicial	23.37	4.92	24.89	4.87	25.15	4.61	2.67
Hierarchical	23.60	5.47	25.90	4.49	26.98	5.87	7.18***
Monarchic	25.81	5.16	24.62	4.01	24.25	4.23	2.23
Oligarchic	26.11	6.11	24.85	4.68	23.16	5.32	5.09***
Anarchic	23.25	5.16	24.90	4.30	25.84	5.29	4.71**
Global	24.41	5.05	23.24	4.73	22.48	4.13	2.84
Local	23.35	5.18	24.14	4.79	25.72	4.70	4.04*
Internal	22.79	6.61	23.52	4.91	25.72	5.61	4.92**
External	27.14	5.56	26.39	5.43	25.60	5.43	1.30
Liberal	26.87	6.17	24.60	5.21	23.51	4.53	6.80***
Conservative	21.92	6.45	24.63	5.00	26.24	7.13	8.31***

* $p < .05$.   ** $p < .01$ *** $p < .001$

Considering the significant differences observed between the low-achieving students and their high-achieving counterparts on 9 thinking styles, a stepwise discriminant analysis revealed that Executive and Conservative styles were the most discriminating factors that separated low-achieving students from their high-achieving peers. The results of the stepwise discriminant analysis and the discriminant function are presented in Table 2.

Table 2: Summary of Stepwise Discriminant Analysis for the TSI-A Styles

Step	Style	Wilk's Lambda	p
1	Executive	.89	.0001
2	Conservative	.82	.0001

Function	Eigenvalue	Wilk's Lambda	Chi-square	df	p
1	.41	.71	79.23	10	.0001

4. Discussion

The present study examined the differences among differences in thinking styles among low-, average-, and high-achieving college students. Analysis indicated that low-achieving students scored significantly lower than average- and high achieving students on Executive, Hierarchical, Anarchic, Local, Conservative, and Internal styles. On the other hand, the low-achieving students scored significantly higher than average- and high achieving students on Legislative, Oligarchic, and Liberal styles. These results are similar to those reported by Bernardo et al. (2002), Can-Garcia and Haghes (2000), Zhang (2002), and Zhang (2001), who observed significant correlations between Executive, Hierarchical, Anarchic, Local, Conservative, and Internal styles and academic achievement among Filipino, Spain and Hon Kong students. However, the results didn't concur with Stemberg and Grigorenko's (1993) study, who found that the Judicial and Legislative styles correlated positively to a student's success in a variety of academic tasks, whereas the Executive style tended to correlate negatively to success in these tasks. These results would lend support to the notion that students who adapted thinking styles that require respect for authority (Executive), conformity (Conservative), preference for working individually (Internal style) and sense of order (Hierarchical) tended to be more successful in learning and achievement as determined by their academic achievement scores, where are students who tended to adapt thinking styles that are creativity generating (Legislative, Oligarchic, and Liberal styles) tended to be less successful in their academic achievement.

The subsequent stepwise discriminant analysis indicated that the Executive style was the most powerful factor that separated low-achieving students from their high-achieving peers. This result is similar to those reported by Bernardo et al. (2002), who found the Executive style was positively correlated with GPA within the Philippine educational context. This result would suggest that high-achieving students appeared to be more apt to work on academic tasks with clear instructions and choose academic tasks that allow them to maintain the existing rules and procedures in performing such tasks than the low-achieving students.

In conclusion, the various findings of this investigation suggest a plausible link between the thinking styles and academic achievement in the United Arab Emirates culture, where students were exposed to different educational practices, and different cultural context. Additional research is certainly needed to probe college academic achievement and to identify the contextual and environmental factors that influence the development and management of students' thinking styles. Further research should also be needed to perform cross-cultural comparisons regarding the nature of thinking styles and clarify the socio-cultural developmental processes that shape how different thinking styles become interrelated.

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Improvement of Thinking and Problem Solving Skills of Engineering Students as a Result of a Formal Course on TRIZ Thinking Tools

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Abstract

Forty two engineering students at RMIT were enrolled into a course on Theory of Inventive Problem Solving (TRIZ), which was conducted over 13 weeks in semester 2 2006. Results of the student surveys show that most of the students' perception of their abilities in problem solving changed vastly as a result of the course. Students reflected that they would never have expect themselves to come up with the ideas they though of and suggested while conducting their final project if they had not been properly taught the tools of problem solving.

Key words: Thinking, problem solving, TRIZ

1. Introducition

1.1 Challenges of engineering education in the 21st Century

Over the last fifteen to twenty years the engineering profession has changed vastly. This change requires engineering education to adjust to the new conditions and the new requirements. The following are the three challenges, which request engineering educators to seriously consider introducing thinking and problem solving tools into the curriculum.

The natural life of products shortens every year. Sony, for example, releases over 5,000 new products a year. Some of these new products make the existing products, which are often only a couple of years old, obsolete. This shorter life of products is gradually putting the product development time down. Drug manufacturers, for example, have already reduced the development time of new drugs by over two times – from ten years to four. Shorter development times put pressure on engineers and scientists to deliver novel solutions quickly.

Moreover, engineers of the 21st Century are facing very different challenges to what they were just 20 years ago – more and more problems they face become open-ended. In the words of Charles Handy, "Life seems to be a succession of open-ended problems with no right answers, but problems, nevertheless, which demand an answer" [1]. In other words, engineers now have to find solutions to the problems they have never experienced before, with solutions which might be unheard of.

Another challenge in educating engineers is related to the amount of information created in fields of science and engineering annually. It already exceeds what an ordinary engineer is able to comprehend and the rate at which new information is created is rapidly growing. It is practically impossible to teach all these new things during the four years of the engineering degree.

All these factors: the need to be able to resolve problems quickly, the ability to consider open-ended problems, as well as the ability to cope well under the information overload, put an engineer under unfamiliar pressure. It is expected that engineers and scientists would be capable of coping with this pressure much more efficiently if they acquired advanced thinking and problem solving skills.

In his profession, an engineer is expected to create new products and to resolve problems related to existing products. A lack of formal education in thinking and engineering problem solving means that trial and error is the most widely used approach in day-to-day engineering work. It is also common for an engineer to use brainstorming and deploy various analogies when faced with a problematic situation [2]. These approaches to problem-solving are not systematic. The thoughts and actions of an engineer using trial and error are unstructured, so

the result of the thinking process is unpredictable and is heavily dependant on the personality of the problem solver and his experience. This explains why in the opinions of engineering managers, thinking and problem solving skills are evaluated as one of the most important skills of an engineering professional. As it has already been pointed out, these skills are becoming even more vital in the extremely competitive world of today, when a delay with a product launch or erroneous engineering design may result in a company loosing its market forever.

Consequently, engineering education requires changes, which ensure that engineers of the next decade will be able to quickly and flawlessly deal with open-ended problems, which often occur under uncertainty and with considerable information overload. To achieve this, engineering graduates need to be more creative – they must become more systematic in their problem-solving work, they need to think better.

1.2. Importance of thinking and problem-solving skills

Thinking is defined as using the mind *"to consider something, to form connected ideas, to try to solve problems..."* [3]. Over the years, many authors have investigated the skills of problem-solving and creativity [4-6]. They have suggested that in order to be able to approach open-ended problems and to do it efficiently, a practitioner needs to improve his thinking skills. Moreover, they found that those thinking skills can be taught [5, 6]. Furthermore, it has been found, that teaching children to think effectively impacts on everything they do, including their learning skills [7]. Recent educational assessments have concluded that "among other things, students lacked basic critical thinking skills" [8]. Therefore, more and more educational institutions introduce thinking tools to students. This is accomplished both by embedding thinking tools into the existing professional courses and by offering separate stand-alone thinking courses. The former approach can be used with thinking tools which do not require sufficient time to learn (e.g. Random Word, Brainwriting, Six Thinking Hats). Some thinking tools, though, require extended time to learn (e.g. Substance-Field Analysis, Morphological Box, Method of the Ideal Result). They are unsuitable for embedding into existing discipline-based courses and need to be taught separately. This increases interest in stand-alone courses on thinking and problem solving. In 1993 over 800 colleges and universities in the USA offered thinking courses to their students [9].

Scholars model thinking processes by emphasising various aspects of cognition. They have subdivided thinking into many areas: systematic thinking, systems thinking, critical thinking, lateral thinking, wishful thinking, big-picture thinking etc. [10-12]. Researchers have also proposed various thinking tools to improve human thinking [2, 5, 6]. However, data on whether different thinking tools suit different professions better than others are ambiguous.

Critical thinking has been the focus of educators over the last few decades. Thus, most of the published results are related to the outcomes of courses in critical thinking. Carr has found that while teaching thinking as a separate skill is useful, it develops best when learnt in connection with a specific domain of knowledge [13]. This reinforces the likelihood that different professions require different thinking tools to enhance their thinking skills.

Our recent experience of teaching thinking and problem-solving to engineers show the effectiveness of the thinking tools of TRIZ. Results of the training programs conducted to engineers working for the companies in Australia and Singapore indicate that not only have the problem solving skills of engineers been enhanced, but the course has also helped engineers to use their existing knowledge more effectively [14-17].

The following is a reflection of an engineer from Singapore, who was involved in learning TRIZ thinking tools for six months [17].

> *"After spending six months trying to understand and adopt the TRIZ problem solving methodology, I personally feel that it is an innovative thinking process which*

effectively reduces the traditional thinking process. Through our educational system, we have been taught/brainwashed on how to solve problems with the correct solution. We are always eager to look for the correct answer, and most often neglecting the minor details which are critically related to the problem. With the help of TRIZ, I began to understand the importance of looking at a task from a wider perspective, recording down the thinking process and generating a more discipline and systematic approach when it comes problem solving, and this is especially beneficial when it involves a complex system.“

This reflection as well as opinions of many engineers involved in TRIZ training programs, identified the need for a formal university thinking course to boost thinking and problem solving skills of future engineers.

2. Method

Forty two engineering students, in their second to forth year of study, were enrolled in a RMIT-wide elective course "Systematic and Inventive Problem-solving" in the second semester of 2006. During the 13 weeks of the semester they studied the following four thinking tools of TRIZ: Situation Analysis, Method of the Ideal Result, Substance-Field Analysis, 40 Innovative Principles with the Contradiction Table [18, 19]. Every student had to complete four individual assignments, which were related to individual thinking tools and participate in group project work over a three week period. The projects undertaken by the student groups were related to various needs of the Australian community. The following are some of the project titles: "Improving safety of traffic lights", "Getting rid of cane toads", "Detection of rip currents".

The project had to be conducted using the Seven Steps of Systematic Thinking [14].

3. Results

The results presented here come from three different sources:
- RMIT Course Experience Survey (CES), independently conducted by the university during class in week 10 of the semester and completed by 34 students,
- Pre- and post-course surveys conducted by the author in week 1 and in week 13 of the course and completed by 30 and 32 students respectively,
- Student reflections on their achievement and experience (step 7 of the formal Project Report, completed by 42 students).

3.1 RMIT CES results

Students evaluated the course very highly. All but one of them were either strongly satisfied (25) or satisfied (8) with the quality of the course. One student was unsure. Similar opinions were expressed on the usefulness of the course for their future career (22 – strongly agreed, 11 – agreed, 1– unsure). Exactly the same was the distribution of the student answers to the question "This course contributes to my confidence in tackling unfamiliar problems" (22 – strongly agreed, 11 – agreed, 1– unsure).

The following are some of the students' opinions:
"Course is very interesting and relevant to engineering. It should really be a core subject..." *"It just makes you look at things from wider angle and from all angles. Therefore it exercises your brain to think of things you do not think of."* *"The course is extremely useful in enabling a person to deal with unfamiliar problems with a systematic approach."* *"... able to learn how to think and come up with a solution that seems far fetched yet possible."*

3.2 Pre- and post-course surveys results and student reflections
The following are student opinions of their ability to resolve problems they face, collected in week 1 (Figure 1, left) and week 13 (Figure 1, right) of the course.
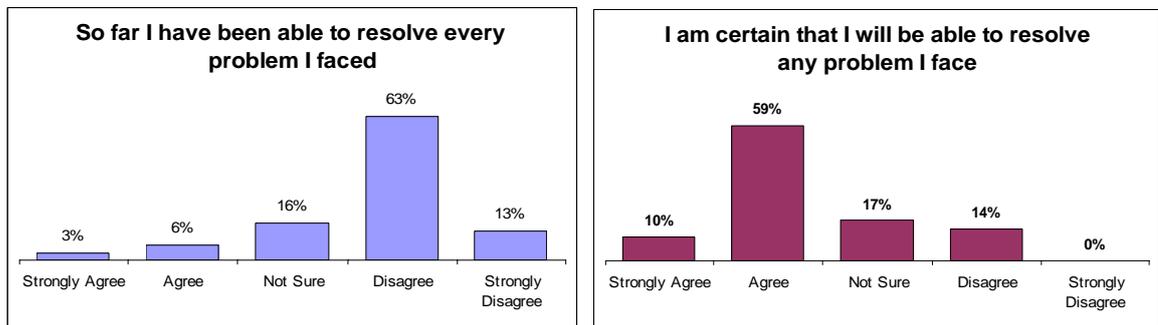
Figure 1. Student opinions on their ability to resolve problems they face: week 1(left), week 13 (right)

The data pictured in Figure 1 shows that the number of students, who were certain of their good thinking and problem solving abilities increased nearly eightfold – from 9% to 69% as a result of the course. Also, in week 1, 76% of students thought that they were unable to resolve every problem. This number went down more than 5 times – to 14% in week 13, after the course had been completed.

It is also of interest to consider a self-evaluation of the students' problem solving skills, presented in Figure 2 which represents their responses to the statement: "I am very good at problem solving". The shift from the average response of "Not Sure" to the average opinion of "Agree" is clearly visible and is significant.
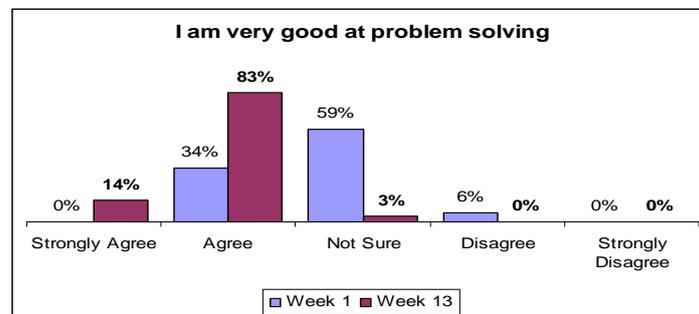
Figure 2. Change in the students' self-assessment in problem solving as a result of the course

Student opinions depicted in Figures 1 and 2 are very encouraging. They clearly show that the students' perception of their thinking and problem solving skills have improved significantly as a result of studying the tools of TRIZ and applying these tools to assignments and the project. It is, however, unclear how reliably student opinions identify real improvement of their thinking and problem solving skills. To measure this improvement some universal problem solving test is required, which the author is yet to find.

As the 14th Century proverb says there is "no smoke without a fire". Students have learnt a number of efficient tools for systematic thinking and problem solving and were able to use these tools to generate many good ideas. These, for certain, helped them to become better at thinking and problem solving. Therefore student opinions of their own abilities improved, as well as their abilities in thinking and problem solving.'

The following are the opinions of students, which further support the findings. Student opinions are grouped to highlight the changes in thinking and problem solving of students related to the three main challenges in educating engineers, identified earlier.

3.2.1 Improved ability to tackle open-ended problems
The following are quotations from the student questionnaire answers as well as from their project reflections related to their ability to deal with open-ended problems:

> "I feel more confident to undertake unfamiliar problems knowing there is a systematic approach to solving the problem."   "(I have developed) ability to approach unfamiliar tasks and overcome them."   "I am able to see problem as a challenge, not an intimidation."   "I have developed more confidence in approaching unfamiliar problems."   "I have been able to learn new tools and become more confident with tackling both technical and non-technical problems."
> "Have the confidence to tackle new problems effectively."   "(I have developed) clear thinking, ability to tackle unfamiliar problems."   "(I have developed) an ability to tackle any problem."   "I learnt how to tackle problems I never thought that would have been faced or solved by me."   "After completing this task and the TRIZ course I believe that I am in a much better position to tackle problems in the future, both engineering related and anything else that comes my way."

3.2.2 Improved structured and systematic thinking
The following student opinions relate to enhancement of their systematic thinking:

> "(I) know what to do and how to solve problems. Not just rushing to solve the problem based on experience and knowledge only."   "(I) can think of unique solutions to problems."   "(I gained) better systematic and analytical thinking."
> "(My thinking) follows a far better structure; instead of hitting my head on the desk, hoping for a solution, I have a method to make me realise a viable solution(s)."
> "(the course) helped me to follow a systematic way in order to solve problems."
> "I feel I am approaching problems in a more logical manner."   "I normally attack problems to the core, now. I can at least use the tools of TRIZ to attack problems in a different manner and may end up saving a lot of time effort and understand more about the problem."   "My thinking mindset has become more structured."

3.2.3 Looking beyond the current knowledge
The following student opinions relate to the changes in their thinking, which help them to look beyond the current knowledge.

> "(My thinking) did change, as in, it made me think of all possibilities rather that only technical results."   "(The course) just makes you look at things from wider angle and from all angles. Therefore it exercises your brain to think of things you do not think of."   "Using the TRIZ tools has forced my mind to think of a problem from different perspectives in order to come up with good solution to the problem."
> "... my thinking ... broadened to look at previously ignored possible solutions."
> "My thinking changed. It helped me generate a wider range of ideas and to identify the problems."   "(The course) helped me to think outside the square that I usually think in."

3.2.4 "Has your thinking changed"?
The following are student answers to the questions "Do you think that your thinking changed as a result of this course? How did it change?"

> "Yes it changed my thinking because now I look at things from different angles.

Therefore, having a wider view."   "My thinking in regard to the every day problem has changed. I intend to analysing the problem using the TRIZ tool, instructed in this course. Solving problems for me personally became more fun."
"I personally think it will take quite a bit of time for my thinking to change 100%, however this course has definitely provided a new way of thinking that will be developed over a period of time."   "Yes, it allowed me the tools to help myself in everyday as well as technical life."   "Yes. I can think more effectively."
"Yes. I break problems into smaller tasks now."   "Yes, the ability to look at problems from a different perspective. Not always looking for the technical solution."   "Yes, my thinking mindset has become more structured."   "Yes, it did. Ideas are more formed neatly and ways to come up with the solution is more systematic."

4. Conclusion

The Survey completed in week 1 identified that most of the students were unaware of the existence of any formal tools of thinking and problem solving. Also many of them were uncertain that their choice of the course was wise. Nonetheless, the outcomes of the course on thinking and problem solving clearly support the opinion of engineers on importance of involving engineering students in specialised courses on thinking and problem solving.

The tools of TRIZ do not represent the best set of tools for every individual and are unlikely to help everyone in enhancing their thinking and problem solving skills. They do, however, fit the thinking needs of engineers and scientists very well. Other thinking tools, taught as a separate course are likely to make a similar impact on the thinking skills of students in other professions.

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Design of a Mobile Support for Physically Challenged People, Adapted to Home Environment

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Abstract

In this paper we will present a design solution for a mobile support that will allow physically challenged people to move about inside homes or institutions in a safe way. This design is based on new applications from existing materials and production technology, with a very high human interface in line with the sustainable philosophy and being able to age with grace. We would be fully satisfied with a positive response from the users who are choosing our design, and with a product that have a high acceptance level.

Keywords: Design, integration, mobility, support, humanize, furniture, attractive, safety, sustainability.

1 Introduction

We believe that a very good way to counter ageism would be to design not only functional, safe, economical and long lasting products for our elderly, it is also important to show that we care about and respect them by giving them utensils that are beautiful. There is no good excuse for not applying the same requirement for the user/owner satisfaction, as is normally placed on commercial consumer products, i.e. in addition to fulfil functional requirements, they should also be attractive and beautiful and to create a positive affection/relationship with the user.

There are a tremendous amount of things specially designed for elderly that might or might not substitute the ordinary range of products they are supposed to replace. Many of them are so ugly and odd looking that they are put away and never being used.

2 Background

The population in the western world is getting older and healthier. The effects of an aging body reflects in the need of resources in the health care sector, the budget bursts, and the over work illnesses are increasing and affecting the quality of the health care service. To counter this it is necessary to develop products that will make older people being more independent. One of such a product is the walking support, in this paper called Rollator.

The safety always must be the main feature in any product, but also the emotional and affective impact on the users can play a significant role in the process of acceptance. The more complex and technical a product looks like, the higher is the mental mountain that has to be climbed.

Even a simple feature function like a handbrake can create confusions: "what is a brake, when do I use it and how do I use it?" It is an increasing part of the geriatric population today who are suffering from Alzheimer´s Disease and who are having to face the above problems daily.

In the case of the Alzheimer´s Disease, one very important thing is to encourage them to do exercises like walking; this will also make the person taking initiative to social interaction.

Another and a more common problem among ageing people is balance disorders. This is causing most of the accidents that involve falls. The costs for this was 4,8 billion Swedish crowners in 2006. Immobility will have a very negative effect on any person, taking into account that this group of people are disposed to suffer from a multiple range of problems like post-stroke symptoms, hearing problems, partial or total loss of sight, weaker muscles and arthritis can be disastrous for the individual.

In most cases where walking support products are used, it is important to simplify technical functions. For example in the case of people suffering from Dementia, the decline in cognitive function due to damage or disease in the brain, the individuals can not remember instructions like: "-when A happen you have to do B."

The effect of having problems with the balance causes the person to avoid situations like standing up or walking. This tends to make them passive and unwilling to move about and creates a domino effect with other negative symptoms like degenerating muscles, stiff joints, bad circulation, etc. and above all, those symptoms will cause other problems like depression and deteriorating social skills. Both of the latest mentioned symptoms gives relatives and staff at institutions a much harder and heavier work load to deal with.

To counter the negative effects and encourage people affected to move about and improve the circulation, the bowl movements and other important things that are conditioning the body, several products have been developed and marketed mainly in Northern Europe and North America.

Today we can see an increasing demand of walking aids not only in the traditional markets but also in other parts of the world like the rest of Europe and Japan. The needs and the demands are of course global.

One type of support is marketed under the name "Rollator". It is used in order to give mobility to people with restricted walking ability. This is a high quality product with a good reputation among the users. Wherever you can find people that would get a better quality of life by using a walking support, you will find a demand for this kind of product. Unfortunately, in most developing countries the economic situation does not make it possible to spend this sort of money on people with that kind of needs, having to choose between food and other primary things like medicine there is not much of a choice.

The use of rollators is increasing, but the models you can find on the market are designed as a very "machine" looking apparatus with a mixed use for both interior and exterior situations and there is no design that blends into a normal living environment giving you a feeling of a home product and matching the rest of the home.

It was because of this miss-match of home interior look and the very machine looking support of the existing rollators that we got the idea of being able to improve on the design using for this category of people, more accepted materials and make it look like just another piece of furniture.

3   Philosophy and goals

One of the main objectives that we were aiming for was to create a design that would make people's perception, emotions and cognitive reaction of the rollator to be similar as that of a mobile piece of furniture. Enabling them to move about in their homes safer and with the possibility of transporting things with a lesser risk of dropping or spilling. As an extra plus it could serve as a table beside the favourite armchair and being used as a bedside table in the same time as it would give support when going to bed or out of the bed.

In Sweden products like rollators are prescribed through the health care system that also supports and finances the rollators to the physically challenged people who need it. This could mean that the product we designed with the added features would come under the prescribed products category.

Another very important function is the brakes. When starting up a project like this and facing a product that has been on the market for a couple of decades there are features that you would have problems altering too much or remove completely in a new design. People tend to be rather conservative when it comes to drastic changes in an established product with a very specific function, and even more so if this product must have a high safety profile, a fool proof handling and have to be approved by authorities in the health care sector.

Is it possible to take away the brakes as they look, replacing them with another system? How should it work? Is it possible to make it intuitive or slow down the wheel movements reducing the risk of having accidents caused by the speed of the existing wheel solution?

When it comes to materials. Today, when the human effects on the environment start to surface on a grand scale, it is very important to implement changes in traditional material and process thinking.

Our philosophy and goal is therefore to find less harming and better way to produce this new concept and use sustainable materials well recognized and tested in other areas, for example bamboo and cane, they are both fast growing, strong, biodegradable and they grow abundantly in developing countries.

4 Method

The method we used was what is called *"the design process"*, there are many *Design Methods* with multiple sub methods that usually can be mixed and matched in different constellations. For our design task we choose to explore as many possibilities, and after wards having a close look at the eventual constrains. The second strand of action should be to create possible scenarios and solutions that would add qualities or significantly improve the existing product.

The first thing we did was to write our self a brief that was based on our philosophy and the aims we wanted to reach.

We took a close look at the market, to find out the state-of-the-art and what kind of solutions technical solutions and what type materials was being used.

After this came literature searching and hours on the internet to establish a documentation consisting of articles, notes and pictures on the subject.

From what we could see most of the rollators was very look alike, just like they had been developed in the same research and development department where there was a lot of surplus aluminium tubes and leftovers of bicycle handbrakes.

When all the basic research was done, we arranged a meeting with Dolomite AB, in Anderstorp a small community in south Sweden. Dolomite is a subsidiary of Invacare Corporation, and is the world leader in rollators. We were very well received and we are still getting some good advices and following ups from our first contacts.

Dolomite has more than 20 years of experience in making mobile supports for walking and their advice and their positive attitude have certainly helped us a lot, reaching the right solutions in the technical, marketing and the end users area.

They gave us one of their rollator, a model for outside use. From this we could then obtain the adequate measurement and do some experiment like handling exercises, how it was performing beside an armchair when looking at TV, how it was fitting in beside a bed, kitchen tables, the work in the kitchen and other performance tasks that are common in a home.

Following those studies, we started sketching and modelling. To be able to evaluate ideas in this phase of a design work it is very important to make quantities to be able to compare and mix different ideas or parts of an idea with another.

After several of this scale models were made, and the conceptual sketches for the presentations were selected, we contacted experts in the different areas of geriatric and health care science for an evaluation of our ideas.

Since three years we have, at Department of Management and Engineering, already collaboration with the Occupational Therapy students and teachers at the Faculty of Health Science, in the department of Social Welfare Studies. This was a real advantage that we now could benefit from. We set up meetings and discussed the material we had produced so far, from those meetings we got many and valuable comments, and advise that we could apply to the second step of the design development.

Even though the different experts in the areas not always agree in details about what are the right or wrong we could still obtain a generic idea and draw a conclusion from what had been filtering through. The comments gave us rather good understanding of how to proceed with the further development and from this material we were able to fine tune the product concept into a digital prototypes.

In this phase the main consideration was to investigate the different facts surrounding the end users situation, the different tasks a product of this sort should be able to perform, the user's perception and interaction when presented and using the product. The last mentioned was our main objectives and that we were particularly interested in, due to the fact that existing designs did not seem to have taking emotions and affections in to account. This is a rather normal thing that is happening in technical environment where construction and production details are the things that comes in the first place. Not many engineers are trained in psychology or know very much about cognitive science, affection or emotions.

It is of course much easier to estimate and measure the physical needs than even coming close to an approximate when it comes to the psychological needs, for example what are the emotional stimulus that should be in place and how to design a rollator that will create a positive affection.

Next step was to introduce our concept, to be evaluated by production experts. We contacted two of the best producers of products made in laminated wood. It is a very high-tech area with a natural material, not one piece is the other alike and the staff has to be very skilled.

We have had lots of encouraging words from all our supporters and advisers, especially from Dolomite, because of this we intend to follow up the work producing some prototypes for a pilot test.

About the brakes and the wheels, we are still developing and testing different options and combinations. The reason for trying several kinds of system, is that we from the very begining had our doubts about the combination of old people and brakes. Elderly usually have slower reactions and this in combination with weaker muscles can be disastrous and even fatal in some situations.

Because of this we thought it would be better to try to replace the existing braking systems with an arrangement where we could slow down the speed, and by doing so, giving the user a better control over the performance and giving them a feeling of being in charge of the handling.

Depending on the users capability and preferences we could combine different option and combinations of possible brake systems, respective adjustable friction pads. We are going to test the different brake and speed limitations on the actual users. This has to be carefully done, testing them on a wide range of people with different capabilities, i.e. physical, psychological and mental status

In December last year Kenneth Bringzén traveled to Brazil to visit production facilities that have been experimenting in technologies using bambo. We are convinced that bamboo as a material is a good alternative to wood. It is the strongest and fastest growing plant on the planet and its unique properties and possibilities are important factors that could replace the slow growing wood from trees and in this way decrease the speed of deforestation. Besides the above mentioned it would also create job opportunities in countries where the bamboo grows and this will have a positive effect on those countries economy and infrastructure. This will of course also be applicable to materials like rattan.

The future choice of materials will certainly take into account, those sorts of factors like we have mentioned, promoting the development of technologies in line with the new philosophy of sustainability, is an attempt to provide the best outcomes for the human and

natural environments both now and into the future. It relates to the continuity of economic, social, institutional and environmental aspects of human society.

AIDIMA's designer/researcher is going to have a closer look at the roll of the rollator in the Mediterranean countries and cultures to be able to adapt the design of the product towards their likings.

5   Results

The new product is adapted to the domestic environment and blends in with the other interior artefacts with its furniture looking design. As well as supporting a person that have mobility problems; it can also be used as a mobile piece of furniture like a sideboard or bed side table.

This will make those items unnecessary as they could be replaced by this new product that will serve the same function when its so needed, as well as in between those functions, is being used for its mane purpose as a walking support.

The design has a furniture character, humanizing the product away from the very technical machine look of today. As pointed out in the objectives, a very important part of this work was to de-mystify a very much needed product and by this increase the acceptance mood vice the users.

The brake and friction pads results will be ready for presentation at the 13[Th] International Conference on Thinking.

6   Key Conclusions

The key conclusions are that when designing products for a specific category, like physically challenged people, you must take into account the human factors like integration of the object, so it will not be perceived as made for this category.

Rather try to make it acceptable for everyone and that way designing for all of us.

Choosing the sustainability as a key factor in our project, we are sure that the final product will have a higher profile and acceptance among people in the technical as well as the institutional fields.

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The Intuitive Practitioner:
Cognitive Aspects on the Development of Expertise

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Abstract

In recent years the interest in expertise and proficiency has been raising, in educational research, knowledge management as well as in cognitive science. The expert's know how or procedural knowledge is often hidden even for him or her self, it is tacit. *"We can know more than we can tell"*.(Polanyi, 1967) This paper is an "Integrative research review", trying to show new aspects of experience-based learning and the development of expertise. Several new results from brain imaging studies and from neuropsychology gives reason to believe that experts utilize nondeclarative, implicit memories to perform better. These results delivers new ways of understanding how experts perceive, assess, decide and take action.

Keywords: Implicit learning, Situated knowledge, Pattern recognition, Tacit knowledge, Intuition.

1   Introduction

Patricia Benner who published the first study using the Dreyfus model of development of expertis adresses an expert nurse in the following way: "*If you take a moment to evaluate your practice, you'll see that you can look at your patients and notice the smallest changes in them. When something is wrong, you can almost feel it, even if it doesn't register on a monitor. You observed subtleties-a slight variation in breathing pattern or an alteration in color. From past clinical experiences, you know when there's about to be a major change in a patient's status, and combining experience with scientific knowledge, you instinctively prepare for treating that challenge. You are an expert nurse. Your responses are shaped by a watchful reading of the patient without recourse to conscious deliberation. Your performance is fluid, almost seamless. When you recall an event, you focus on informed action, rather than organization, priority setting, and task completion*".(Benner, 1997)

In recent years the interest in expertise and proficiency has been raising, in educational research, knowledge management as well as in cognitive science. John Stevenson defines expertise as the ability to do something well; "*Better than others just starting out on the undertaking*" (Stevenson, 2003), He proposes several interesting research questions; What do we mean by doing something well? What enables an individual to do something well? Why does this capacity improve with practice? Is this capacity confined to a specific field, or is it general? Can the capacity be learned, and how? Where is it located?

The quest of eliciting knowledge from experts has eluded science since the beginning of the development of artificial intelligence in the 1960s'. The database of an Expert System has to be loaded with knowledge from human experts and these experts seems unwilling or incapable to tell about their rules and methods. When we are using standard interview techniques we are probing the conscious, rational and logic mind of the interviewee. The informant may want to please us and tell us what is appropriate, logic and sound. Our data will be full of general rules and standard procedures and not the individuals' own subjective way of coping with problems. The experts "know how" is hidden even for him or her self, it is tacit. *"We know more than we can tell"*.(Polanyi, 1967) This tacit knowledge is apprehended in an implicit way often outside our own awareness. It is often used automatically and is therefore difficult to elicit by introspection.(Nisbett & Wilson, 1977) In modern psychology several Dual or Multiple Cognitive Systems theories have been designed and they have given

us new ways of understanding tacit knowledge, expertise, intuition, insight and automation. (Cronin, 2004; Epstein, Lipson, Holstein, & Huh, 1992; Ericsson & Charness, 1997; Lieberman, 2000; Nightingale, 1998; Arthur S. Reber, 1989; Sloman, 1996; Sun, Slusarz, & Terry, 2005) The purpose of this paper is to shed some light on experts and expertise using results from different domains of Cognitive Science and discuss the implications for research and educational design.

2 Method

Cognitive science consists of many different domains of research; psychology, neurophysiology, neuropsychology, neuromedicine and others. Modern science is drilling deep holes to find new knowledge and the adapted method of specialisation and reduction has made its different domains separated from each other. This paper is an "Integrative research review", trying to find and show new aspects of experience-based learning and the development of expertise. "*Integrative reviews summarize past research by drawing overall conclusions from many separate studies that are believed to present the state of knowledge concerning the relation(s) of interest and to highlight important issues that research has left unsolved. From the reader's viewpoint, an integrative research review is intended to replace those earlier papers that have been lost from sight behind the research front and to direct future research so that it yields a maximum amount of new information.*"(Backman, 1998; Cooper, 1984; Light & Pillemer, 1984) Its reliability and validity can only be assessed by the extent to which the devised model can "explain" the phenomena it is addressing.

The complexity of the human brain makes it essential to use appropriate tools in the design of the model. Modern technology, dealing with complex systems, has developed intellectual tools, a systems approach, for this purpose.(L. Björklund & Klasander, 2004) The first cognitive constraint to address is our brain's limited resource of working memory, in which all conscious cognitive processing occurs. The working memory can handle only a very limited number, possibly no more than two or three interacting elements. (Paas, 2003) Therefore the complex has to be described in an appropriate scale of detail with just a small number of separate units. A second aspect of a systems approach is the importance of functional descriptions.(Lars Björklund, 2006) Functional modelling provides an abstract, yet direct, method for understanding and representing an overall product or artifacts function." (Hirtz, 2002) In Technology a difference is made between the structure and the function of an artifact and this is also recognized in Science, especially in the Biosciences.(Hmelo-Silver, 2004)

Three system levels are identified and described in this paper;
1. Abilities and behavior of experts as described in studies in different domains of practice.
2. An intermediate psychological level where the individual behavior of novices and experts are studied and described using controlled experimental methods.
3. A neurophysiologic level where brain-structures and their corresponding functions are studied.

The first level has been studied for a century, the intermediate level for half a century and the lowest level is a contemporary highly evolving area of research. The author is trying to find causal connections between these levels of descriptions to enhance our understanding of the development of expertise and endorse directions for future research.

3 Results and synthesis

3.1 Experts and expertise

The nature of expertise has been studied extensively in the last 100 years, either by the inspection of the truly exceptional individuals chosen by their well established and recognized discoveries, works, results and innovations or by studying relative expertise and the development of higher level of abilities and skills. (Chi, 2006) The earliest literature was focusing on exceptional individuals; composers, chess players, athletes, writers, scientists, innovators and others and was trying to find intrinsic causes and explanations to the outstanding expertise of an individual. Co-variation with talent, genetics and general IQ was searched for but was found very weak. A common result of these studies was that the expert had practised more and had acquired more knowledge in a specific domain and that this knowledge was structured, organized and better represented.(Chi, 2006) Contemporary research takes a more relative view of expertise, studying what differentiates an expert from a novice in a specific domain of practise. The level of expertise is not absolutely defined but viewed in relations to other individuals on a lower level of proficiency. The causal reason for expertise used to be the idea of a higher, faster, more abstract general thinking ability. Today this view is changing; "*Thinking at its most effective depends on specific, context-bound skills and units of knowledge that have little application to other domains. To the extent that transfer does take place, it is highly specific and must be cued, primed and guided; it seldom occurs spontaneously. The case for generalizable, context-independent skills and strategies that can be trained in one context and transferred to other domains has proven to be more a matter of wishful thinking than hard empirical evidence*".(Perkins & Salomon, 1989)

An interesting strand of research emanates from Herbert and Stuart Dreyfus and their description of human abilities and the development from Novice to Expert in five stages.(H. L. Dreyfus & Dreyfus, 1986) The behaviour and abilities of the individual are according to their model developed during deliberate practice, caused primarily by two factors; an influx of contextual and situational data and a personal responsibility for the outcome of decisions and actions. The rule-following novice will in time be more contextual aware and use more experienced-based intuitive knowledge. Their model have been used in many areas of expert research; teaching,(Berliner, 1986) nursing, (Benner, 1984), managing (Stefl, 2003) and several others.

Traditional research on expertise and the users of the Dreyfus model have defined their stages of proficiency in different ways and care must be taken not to mix them. Initially the following descriptions of different levels of expertise where recognised: Naïve, Novice, Initiate, Apprentice, Journeyman, Expert and Master.(Hoffman, 1998) The Dreyfus brothers particularized the following stages of development: Novice, Advanced beginner, Competent, Proficient and in the final stage the intuitive Expert.

3.2 Psychological studies of unconscious, implicit learning

Psychologists have been performing a multitude of experiments during the last part of the 20th century focusing on memory and learning-processes but models of human reasoning and behaviour are even older. Ryle distinguished between knowing how and knowing that.(Ryle, 1949) Bruner (1969) contrasted memory without record and memory with record. In the 1970s a similar distinction was discussed in the artificial intelligence literature between procedural and declarative knowledge. The study of implicit memory emerged from the decade of the 1980s at the forefront of memory research.(Schacter, 1992) Implicit memory is an unintentional nonconscious form of retention that can be contrasted with explicit memory, which involves conscious recollection of previous experiences. Brain damaged amnesic

patients with severe impairments of explicit memory can exhibit intact implicit memory, a fact has been recognised by practising doctors for a long time.(Damasio, 1996). In experimental psychology several different models for learning and behaviour have been proposed. Reber used the concept of implicit learning to be able to explain unconscious learning of abstract grammar rules.(A.S. Reber, 1967) The idea of a dual cognitive system grew out of a multitude of experimental results during the last decades of the 20th century. Logan proposed a model of an implicit memory based on pattern recognition, the "instance theory". (Logan, 1988, 2002) Several similar models using dissociation between explicit and implicit memories have been proposed but the task of modelling the black box of the brain has been hard using only external tools. Implicit learning is now seen as non-episodic learning of complex information in an incidental manner, without awareness of what has been learned. It associates environmental stimuli that are relevant for behaviour.(Dienes & Fahey, 1998; Frensch & Runger, 2003; Seger, 1994)

3.3 Structural level: Neurophysiology

New brain imaging tools, functional magnetic resonance imaging (fMRI) and positron emission tomography (PET), made the black box of the brain transparent. It is now widely accepted that many brain systems are capable of learning and storing information. Some of these function explicitly and give rise to conscious declarable memories, while others function implicitly and store memories that are accessed and used automatically and unconsciously. Many brain-systems are using memory and its underlying neuronal plasticity to allow them to adjust and perform their function (emotional control, sensory processing, motor regulation, etc.) more effectively.(Phelps & LeDoux, 2005) Contemporary models of the brain uses a hierarchy of several memory systems, divided into Declarative and Nondeclarative memory systems, see Figure 1.
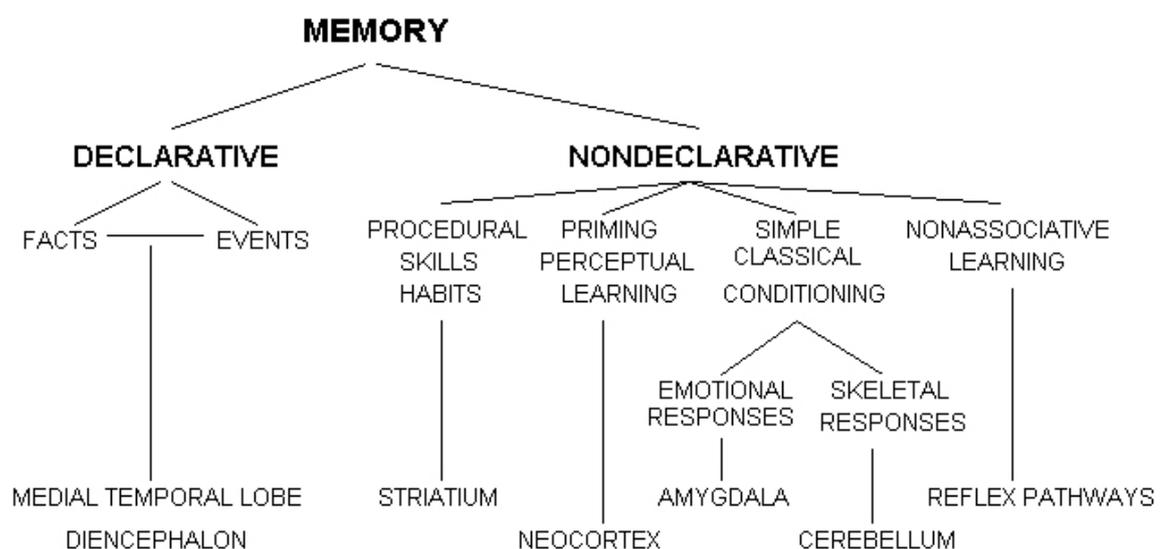
Figure 1 a taxonomy of long-term memory system.(Squire, 2004)

The memory systems of the brain operate in parallel to support behaviour, sometimes competitive, sometimes supportive. The various memory systems can be distinguished in terms of the different kinds of information they process and the principles by which they operate. In the case of declarative memory, an important principle is the ability to detect and

encode what is unique about a single event, which by definition occurs at a particular time and place. In the case of nondeclarative memory, an important principle is the ability to gradually extract the common elements from a series of separate events.(Squire, 2004) The hippocampus is crucial for conscious, explicit memory(Degonda et al., 2005) and components in the striatum/ caudoputamen and amygdala are dedicated to the processing of reward, reward contingencies, or positive affective states. For example, dopaminergic transmission in the caudoputamen, which is implicated in a range of positive affective and reward processes, may play a role in safety conditioning.(Rogan, Leon, Perez, & Kandel, 2005) The caudate nucleus supports incremental learning of stimulus-response associations, or more specifically, the acquisition of place-appropriate responses leading to habitual. In contrast, the hippocampus is central to the rapid acquisition of declarative knowledge about the environment, generating a so-called cognitive map.(Voermans et al., 2004) Studies have found a series of subcortical visual structures that plausibly comprise a subcortical pathway terminating in the amygdala. This pathway, proceeding from the retina to the superior colliculus to posterior nuclei of the thalamus and on to the amygdala, bypasses detailed cortical processing and is thought to provide the amygdala with lower-resolution but more rapidly processed visual input (LeDoux, 1996). Some accounts emphasize the bias of this system for stimuli that are informative about potential dangers.(Pasley, Mayes, & Schultz, 2004) The basolateral amygdala modulates the cognitive and habit memory processes mediated by the hippocampus and caudate nucleus, respectively and may therefore "amplify" cognitive processes and direct attention to matched patterns. it has the capacity to process higher-order knowledge.

3.4   Synthesis and linkage

3.4.1   Automation and capability for dual tasks.

Experts often develop automaticity for the repetitive operations that are needed to accomplish their goals. They show high accuracy in reaching appropriate solutions, even under time constraint. (Berliner, 1994; Chi, 2006; de Groot, 1946; Groot, 1965; Sternberg, 1998)

   In psychology there are several studies of automation and dual task capability. In a study of golf experts the authors find that "*expertise leads to proceduralized control that does not require constant attention. Resources are free to devote to secondary task demands*".(Beilock, Wierenga, & Carr, 2002; Swan, Otani, Loubert, Sheffert, & Dunbar, 2004)

   A neurophysiologic study in wayfinding connects specific brain structures to this phenomena: "*The first, place learning, is dependent on the hippocampus (explicit memory) and permits the formation of a cognitive map that is flexible enough to facilitate navigation via a novel route. The second, response learning, is dependent on the caudate nucleus and supports an action based representation that is inflexible (only supporting navigation via the same well-learned route) but which may have the advantage of mediating fast, automatic responses*".(Hartley, Maguire, Spiers, & Burgess, 2003)

3.4.2   Contextual, situated knowledge and pattern recognition.

Expertise is specific to a domain, developed over hundreds and thousands of hours. Experts recognize meaningful patterns faster than novices. They impose meaning on ambiguous stimuli and make substantially more inferences from and assumptions about the information presented to them than do novices. Their inferences, assumptions, and predictions allow them, like hockey pro Gretsky, to "*go where the puck is going to be.*" Experts can detect and see patterns and features that novices cannot see. (Benner, 1984; Berliner, 1994; Cellier , Eyrolle, & Mariné, 1997; Chi, 2006; S. E. Dreyfus, 2004; Sternberg, 1998)

Implicit learning and memory has been linked to an ability to detect fast subliminal events but also to recognize complicated patterns and sequences otherwise undetectable from reportable declarative memory. Transfer performance is linked to the degree of similarity of the context. (Chen, 1995)

Initially hippocampal learning, rules, are used to control action but after a long time of repetition caudate nucleus takes control, reacting on primed stimuli. The striatum is not only involved in the implicit automatization of serial information through prefrontal cortex-caudate nucleus networks, but it also plays a significant role for the selection of the most appropriate responses in the context created by both the current and previous stimuli, thus contributing to better efficiency and faster response.(Peigneux et al., 2000) The evaluative function of amygdala and caudateputamen will also gain from experience and make the expert better in recognizing outcome of perceived contextual patterns.

3.4.3   Problem solving and flexibility.

Experts are more likely to be able to plan their solutions at a descriptive meta-level. Experts exhibit a forward inference/ reasoning rather than a backward inference in problem solving. They predict accurately the difficulty of their own problem solving capability but have problems in predicting difficulties for other experts and novices.(Dhillon, 1998; Priest, 1992; Sternberg, 1998) Experts are flexible opportunistic planners, they develop self-regulatory processes and are quick to change tracks whereas inexperienced novices exhibits a functional fixedness. The moment of action and the parameters of the action seem to be defined in the course of the interaction between the expert and the task. The experts solves problems in a non reductive manner, describing order as an emergent property of decentralized interactions in a system, and considers nonlinearity and random factors.(Berliner, 1986; Cara & Lagrange, 1999; Jacobson, 2001)

Several psychological experiments have studied the relations between different modes of thought and the generation of 'creative' and original ideas. Conscious thought may be focused and convergent, unconscious thought may be more associative and divergent.(Dijksterhuis, 2006; Nightingale, 1998)

Studies of activites in the brain during problem solving show how novices and experts use different structures.(Göcker, 1997)

3.4.4   Tacit knowledge and intuition.

It is difficult for experts to describe exactly how they do what they do, especially with respect to their use of judgment, experience, and intuition. This is called the knowledge-acquisition problem.(S. E. Dreyfus, 2004) Not only in artistic judgement but in all their ordinary judgements of the qualities of things, experts recognise and describe deviations from a norm very much more clearly than they can describe the norm itself. (Schon, 1987) Experienced teachers are able to function on automatic pilot. Much of the interaction between teachers and students is automatic, over-learned patterns of behaviour that teachers could invoke and perform without conscious effort. Experienced teachers appear to have organized their knowledge of students and classrooms in particularly effective patterns that could be retrieved unconsciously from long-term memory via classroom cues. (Johansson & Kroksmark, 2004; Kagan, 1988; Kroksmark, 1997)

The idea of "a Somatic Marker" linked to memory was proposed by Damasio to explain intuitive assessment of situations, fear reactions, gut feelings and bias.(Damasio, 1996; Gärdenfors, 2000)

This hypothesis has been confirmed, as fMRI studies of the brain support a role of the amygdale in choice behaviour, both in the appraisal of inherent value of choice and the signalling of prospective negative outcomes. Amygdala is used for the recording of

emotionally important patterns, if the feedback is missing or is weak, no patterns will be recorded. (Daw, O'Doherty, Dayan, Seymour, & Dolan, 2006; Kahn et al., 2002; Smith, Stephan, Rugg, & Dolan, 2006)

4   Conclusions and implications

Results from brain imaging studies and from neuropsychological experiments gives strong reasons to believe that experts utilize nondeclarative, implicit memories to perform better. The emotion sensed when a situation is assessed by amygdala or striatum may be what we refer to as intuition or gut-feelings and corroborates the models of tacit knowledge by Polanyi and holistic pattern-recognition by Dreyfus. On the other side, implicit learning is probable the cause for biases, prejudice and preconceptions. Most of the brain-structures involved in expert behaviour are separate from declarative memory structures and cannot be introspected, any verbal description is a construction made from other explicit data. If the knowledge of experts is tacit, new interview methods must be found, maybe the Repertory Grid Technique can be used for the elicitation process.(L. Björklund, in press) The knowledge, experts use in clinical reasoning is an ability to sense familiarity and automatic evaluation, directly linked to personal experience. This enhanced way of perceiving the world is what the Master is trying to teach the Apprentice and it is almost impossible to apprehend this by your self using personal reflection or conscious analysis, you need to learn by doing! Further research on experts and expertise using a model of several parallel implicit memory structures will be prosperous and important.

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The Role of Dialogue-Based Ethical Inquiry in Educating for a Just Democracy: An Intervention Study

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Abstract
This paper describes the implementation of a study designed to assess the effectiveness of a dialogue-based *Community of Inquiry* approach in developing the skills and dispositions requisite for engaging in the processes of *rational ethical justification*. The intervention study involved approximately 250 South Australian students from a diverse range of social and educational backgrounds. Findings indicate that the program trialled is effective in developing students' abilities and readiness to engage in the processes of rational ethical justification, and functional, in that it worked well within the constraints of prevailing educational structures.

Keywords: Ethical inquiry; community of inquiry; intervention

1 Introduction: rational ethical justification

The argument of this paper outlines one strand of an ongoing interdisciplinary research project, the 'Cultivating Reason-Giving Project', grounded in both philosophy and cognitive psychology. The project is aimed in part at the development of an educational programme for fostering the skills of *rational ethical justification*, as well as the *disposition* to apply these skills widely. One significant strand of this work has been the development of a dialogue-based ethical inquiry approach to teaching social and environmental education. This paper describes the implementation of an intervention study designed to assess the effectiveness of employing this *Community of Inquiry* approach in developing the skills and dispositions requisite for engaging in the processes of rational ethical justification.

Although there is continuing philosophical debate about the nature of these processes, we have argued elsewhere that there are well established procedures for engaging in rational ethical justification based on an understanding that ethics is grounded in good and harm (suffering); more over, that human beings and indeed all sentient beings, share common capacities for suffering and happiness. Further, we argue that it is necessary to *weigh up* suffering and happiness, or harm and good in the interests of all concerned (Knight & Collins, 2006). This understanding or insight provides an *ethical yardstick*, a principle which forms the basis of rational ethical justification. It does not in itself deliver a procedure for making ethical judgements or decisions. But we can also draw on some other well established elements of ethical justification, such as assessing arguments on the basis of truth and relevance, considering as fully as possible the consequences of one's behaviour, taking circumstances into account, empathising with others, and ensuring consistency between one's beliefs and between one's beliefs and actions. While it is beyond the scope of the paper to discuss the complex interplay between these elements, it is important to note that these are *necessary* features of rational ethical justification.

We should note here too that our goal is not merely one of equipping individuals with the skills of rational ethical justification, but more than this, to foster a readiness to employ these skills widely. In other words, we are aiming at the inculcation of a *disposition* to engage widely in the processes of rational ethical justification. Moreover, the development of such a disposition depends not only on fostering the appropriate skills, but also on the development of certain epistemological understandings; more precisely, an understanding that justification of beliefs, including ethical beliefs, is both possible and necessary (that is, that such justification matters). How then should we set about fostering these crucial skills and dispositions?

2   The central role of dialogue

Theoretical and empirical work from within both philosophy and cognitive psychology (reviewed in Garcia-Moriyon et al, 2005 and Collins, 2005) points to the effectiveness of engaging individuals (of all ages) in dialogue with their peers about complex real world issues, including ethical issues, in fostering both the skills and dispositions required for engaging in the processes of rational ethical justification. The dialogue here is not mere discussion, but discussion disciplined by the procedures of rational, and in this case ethical, justification. Further, students' attention is drawn to the procedures of reason-giving and evaluation; they are afforded the opportunity to apply and practise the relevant skills in the company of their peers and under the guidance of their teacher, so that they gradually come to understand and appreciate for themselves the power and value of rational ethical justification. For such an approach to work, participants must value and respect the contributions of others, even when these contributions run counter to their own. This does not mean simply accepting the opposing view, even when it is the view of an authority figure; nor does it mean adopting the attitude that all views are equally acceptable, equally likely to be true. It means instead focussing on the reasons participants advance for their views, and a commitment to assessing these reasons in the light of the criteria of rational ethical justification.

The collaborative nature of this dialogue is important too. Reason takes the form of dialogue; reasons are advanced, counter examples raised, reasons modified in the light of counter examples. This process can be carried out by an individual, but as Vygotsky (1978) has shown, the process is more fruitful when it becomes a dialogue between peers, or as philosopher and educator Mathew Lipman (2003) puts it, between members of a *Community of Inquiry*. Importantly, cognitive psychologists, Kuhn and Udell (2003) report that extended engagement in Community of Inquiry style dialogue, even in the absence of further instruction, appears to be sufficient for the improvement of individuals' justificatory reasoning. Building on this research effort, our goal was to develop a dialogue-based ethical inquiry driven educational programme which would be effective in developing students' abilities and readiness to engage in the processes of rational ethical justification. We turn now to a description of an intervention study designed to trial this approach within the context of primary level social and environment education.

3   The classroom intervention

Ten upper primary level teachers agreed to join the study. Their professional backgrounds were diverse, as was their degree of familiarity with the notion of rational ethical justification. Five of these teachers, each working in different schools across the metropolitan area of Adelaide volunteered to take an active part in implementing a newly developed *Society & Environment* (S&E) programme (Collins & Knight, 2006). The S&E programme was designed to actively foster the skills of rational ethical justification through Community of Inquiry methodology. In each case, their students agreed to act as participants in the study.

The research project took the form of a matched intervention study, that is, each of these five classes was matched with a control group from within the same school. We will focus here on the experimental group classes only. The student participants ranged in age from ten to twelve years and were enrolled at either year six or seven level. Their school settings were socio-economically diverse in terms of the families they served, ranging from low, to middle, to high socio-economic status. While students from across the five schools were largely of Australian-European or Australian-Asian background, in one class there were a number of Aboriginal Australian students, as well as several students who spoke English as their second language. There was also considerable variation across the population in relation to students' literacy levels.

Implementing this newly developed (and in many ways, radically different) *Society & Environment* curriculum in five schools by way of a six-month intervention afforded many challenges for all involved. It demanded considerable commitment on the part of the participating teachers, who were required to undertake an intensive professional development programme and to work collaboratively with the researcher in planning and implementing two term-length units of work, while at the same time adopting a methodology markedly different from their usual approach to teaching *Society & Environment*. The students too found themselves in unfamiliar territory, participating in the lengthy pre and post testing procedures and being actively involved in discussing ethical issues with their peers, their teacher, and the visiting researchers.

The intervention took place in the first two terms of the school year, during which time students were engaged in up to four *Society & Environment* lessons per week; these included both research-based lessons and at least one or two weekly whole class ethical inquiry discussions. The Community of Inquiry discussions typically lasted for around one hour, although at times they were extended when student interest and engagement levels seemed high. For eight weeks of the first term, students from all five classes studied the same specially written unit of work on the topic of 'The Treatment of Animals', which incorporated several exercises and discussion plans from Lipman & Sharp's (1985) 'Ethical Inquiry Manual to Accompany Lisa'. In the second term the programme comprised activities and discussions drawn from five diverse, specially written units of work, the topics of which varied from class to class, and ranging from 'The Ancient Greeks' and 'Federation' to 'Antarctica' and Ecologically Sustainable Development' to the then emerging issue of 'Reality TV'.

4   The evaluation

While empirical work from within both philosophy and cognitive psychology points to the effectiveness of engaging individuals in dialogue with their peers about complex ethical issues, the research effort to date has been hampered to some degree by lack of an efficient standard instrument to measure ethical justificatory reasoning abilities. In response, we developed and trialed a questionnaire suitable for use with upper primary aged students.

The first section of the questionnaire attempts to identify possible changes over time in relation to this aspect of participants' justificatory reasoning ability, and in particular, their abilitiy and readiness to evaluate reasons and arguments presented in support of opposing views on a number of ethical issues. The issues selected here were based on contemporary Australian social and environmental issues wchich would be familiar and hopefully, of interest to the participants and included: whether the Australian Prime Minister should apologise to indigenous Australians for past treatment; whether whaling should continue; whether mining (in relation to a particular example) should be allowed; and whether wild animals that have killed a human being should be hunted and killed.

The eight ethical issues (four in the pretest and four in the posttest) were presented in a standard form:

Firstly, a scenario was introduced in which a number of children were discussing the issue at hand. Within the scenario, a brief overview of the issue was given in which two main opposing views were presented. The 'Whaling' issue from Form A serves as an example of the scenarios:

A group of students was discussing a brochure they'd read about whaling. Some people from countries like Japan and Norway want to hunt and kill whales. It is part of their tradition and culture; they have always done it. They use all parts of the whale for food, oil, soap, ornaments etc., some for themselves, others for exporting. On the other hand,

some environmental groups say that whaling is wrong. They are concerned about the effect it might have on the natural balance of the ocean. The teacher asked the students to give reasons for their views on whaling. Their responses are listed on the following two pages. How do you rate these reasons?

It was then explained that the following pages contained a list of the reasons given by each of the children in support of their view on the issue. The following examples are drawn from the pre-test questionnaire: *Fran says [whaling] is wrong because her older brother says so; Veronica says [whaling] is not wrong for her because she doesn't care about whales, but it is wrong for people who do care about whales; Lee says [whaling] is wrong because if whale numbers decrease, the ecosystem will be harmed, and the well-being of living things (including us) will be at risk.* The reasons presented as items in this section reflected several different kinds of fundamental principles (or ethical yardsticks) that individuals commonly employ when attempting to justify their stance on an ethical issue. (The examples above reflect, respectively, an appeal to a perceived moral authority, a relativist claim, and a principle focussed on considering and weighing possible consequences.)

The participants were then asked to *rate* the strength of each of the reasons on a five-point scale ranging from 'not really a reason' to 'an excellent reason'. The data gathered from this section of the questionnaire were statistically analysed through application of factor analysis and various semantic analyses.

The second section of the questionnaire invited students to write a brief argument in relation to one of the previously raised ethical issues. This crucial written component of the questionnaire was included as a means of gathering and analysing data (from participants' written arguments) to identify whether the intervention had impacted positively in terms of transfer of the disposition to engage widely in the processes of rational ethical justification; that is, whether the skills and dispositions developed as a result of the intervention would transfer to a context other than the dialogue-based context in which the skills and dispositions had been fostered.

Drawing on previous work from within cognitive psychology, we developed a relatively simple three-step coding system in order to analyse participants' written responses in terms of justificatory reasoning (or argument) quality (Anderson, Nguyen-Jahiel, McNurlen, Archodidou, Kim, Reznitskaya, Tillmanns & Gilbert, 2001; Kuhn & Udell, 2003; and Reznitskaya, Anderson, McNurlen, Nguyen-Jahiel, Archodidou, & Kim, 2001). In brief, the system was based on identifying the number and complexity of reasons provided and on assessing the quality of the participants' overall argument. As indicated earlier, there are also several key elements which contribute to effective justificatory reasoning about *ethical* issues, among them, the need to consider and weigh consequences for all concerned, and to be empathetic when considering the needs of others. Again, we devised a relatively simple two-step coding system to identify possible changes in participants' use of these two particular aspects of ethical justificatory reasoning. The relevant major findings of the study are summarised and discussed briefly below.

5   Relevant findings and discussion

Several significant findings emerged from the statistical analyses. Very briefly:

A highly significant treatment effect was found on the first section of the questionnaire; that is, following the intervention, participants in the experimental group improved in their ability to evaluate reasons presented in support of opposing views in relation to ethical issues, compared to participants in the control group. (ANCOVA: **(F (1,247) =12.2, p< .001)**)

A significant effect was found on the posttest score in the number of relevant reasons participants offered in their written arguments; that is, following the intervention, participants in the experimental group provided more relevant reasons than did the control group students. (ANOVA: **(F (1,78) = 8.7, p = .004)**)

A significant effect was found on the posttest score in the complexity of reasons participants offered in their written arguments; that is, following the intervention, the experimental group participants' reasons were found to be more complex than did the control group participants' reasons. (ANOVA: **(F (1,78) = 4.9, p = .003)**)

A highly significant treatment effect was found in the quality of participants' written arguments; that is, following the intervention, the experimental group participants had significantly higher argument quality scores than did the control group participants. (ANOVA: **(F (1,78) = 52.8, p < .001)**)

Participation in the intervention's ethical inquiry discussions then, lead to a significant change in students' ability to both *evaluate* arguments and to *produce* higher quality arguments (in relation to the number and complexity of reasons offered in support of a claim and in terms of an overall quality score), thus bearing out our original hypothesis. Importantly, the findings also demonstrate *transfer* of the disposition to engage in the processes of rational ethical justification; that is, from participants' engagement in ethical inquiry sessions, to their attempts at both evaluating reasons presented in support of opposing views in relation to real-world ethical issues and in producing' written arguments about real-world ethical issues.

Moreover, the impact of the treatment which resulted in significant improvements in experimental group participants' argument quality scores was shown to be totally independent of pre-existing literacy levels. That is, improvements in argument quality were demonstrated in participants' written arguments regardless of their level of literacy at the outset of the intervention. Further, it was evident that the greatest gains on the posttest argument measure occurred in the case of those students who started at the lowest levels on the argument measure (that is, level 1 'poor' and level 2 'OK') on the pretest measure.

Clearly, students who have either low levels of literacy or low levels of justificatory thinking skills, should be afforded regular and ongoing opportunities to engage in ethical inquiry discussions as part of their curriculum-based lessons, particularly considering that it is these students who are most likely to benefit significantly from such opportunities, at least in the short term. These findings deserve the attention of researchers, educators and administrators concerned with the development of thinking well in *all* students.

A highly significant effect was also found for the 'Consequences for all' variable at posttest level; that is, the experimental group participants were more likely to consider and weigh consequences for all concerned in their posttest written arguments, than were the control group participants. (ANOVA: **(F (1,78) = 27.1, p < .001)**)

Finally, a significant treatment effect was found for the 'Lack of empathy' variable at posttest level; that is, a significant decrease occurred over time in the number of experimental group participants exhibiting a clear lack of empathy in their written arguments, a change not reflected in the written arguments of control group participants. (Chi-square test: **(x^2 = 6.05, 1df, p = .014)**)

Participation in the intervention's ethical inquiry discussions then, led to a significant change in the participants' ability and disposition to consider and weigh consequences for all concerned, and to be empathetic when considering the needs of all concerned, thus bearing out our original hypothesis. Here too, the findings are important in that they demonstrate *transfer* of the disposition to think well about ethical issues; that is from participants' engagement in Community of Inquiry sessions to their attempts at producing written arguments about real-world ethical issues which take into account the weighing of consequences for all concerned, and the need to be empathetic in so doing. The empirical findings of the study were very encouraging for both the researchers and the teachers involved in the study. Importantly, the educational programme was also deemed to be functional in that it seemed to work well within the constraints of prevailing educational structures.

While space does not allow the inclusion of detailed qualitative reports of our experiences and observations in individual classrooms, it is worth noting that the verbal and written feedback (both formal and informal) we received from participating students and teachers, along with our own anecdotal observations from across the five classrooms, indicate clearly that the S&E programme was functional; that is, it fitted well within the constraints of prevailing educational structures. Moreover, four of the five teachers involved in the intervention continue to teach their S&E programme using the approach outlined here.

6   Conclusion

The findings of this interdisciplinary study indicate that a Community of Inquiry approach is effective in fostering the skills and dispositions requisite for wide engagement in the processes of rational ethical justification. Moreover, it appears that the *Society & Environment* programme developed, implemented and evaluated as part of the intervention study has been effective in this task, and in fitting well within the constraints of prevailing educational structures. The findings of the study are very encouraging for those of us concerned with the important role dialogue-based ethical inquiry might play in educating for a just democracy. Importantly, our current work in preparing and supporting both pre-service and practicing teachers to implement a Community of Inquiry approach in their *Society & Environment* curriculum is proving to be both successful and rewarding for all concerned.

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Engaging Students in the Processes of Rational Ethical Justification: A Way Forward for Social and Environmental Education?

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Abstract
It seems clear that the fundamental goal of social and environmental education is one of helping students to develop the skills and dispositions to participate fully as citizens in a just democratic society. We argue that making significant progress towards this worthy goal depends crucially on engaging students in the processe of *rational ethical justification*. Yet, on the whole, teachers of social and environmental education are rarely prepared or equipped to go beyond research-based classroom lessons. This paper outlines a way forward.

Keywords: Rational ethical justification; ethical inquiry; social and environmental education

1 Introduction: rational ethical justification

This paper outlines one strand of an ongoing research project we have called 'The Cultivating Reason-Giving Project', grounded in both philosophy and cognitive psychology. The project's aim is the development of a programme for fostering the skills of *rational ethical justification*, as well as the *disposition* to apply these skills widely. Part of this research effort involves work within the field of *social* and *environmental* education. It seems clear that the fundamental goal of the *Society & Environment* learning area (as it is known in South Australia) is one of helping students to develop the skills and disposition to participate fully as citizens in a just democratic society. We argue in this paper, that making significant progress towards this worthy goal depends crucially on ensuring that, as part of their *Society & Environment* curriculum, students of all ages are afforded regular and ongoing opportunities to engage in the processes of *rational ethical justification*.

Although there is continuing philosophical debate about the nature of these processes, there are strong and widely accepted arguments which rule out certain commonly held approaches of rational ethical justification. One of these is the process of appealing to a moral authority – the church, the law or the mores of society: homosexuality is morally wrong because the Church condemns it; cloning of human beings is morally wrong because the law forbids it; killing animals for food is morally right because it is part of our way of life. Yet, as is well known, appeal to authority alone can never constitute adequate justification. What is more, justifying ethical judgements or decisions on the basis of mere appeal to moral authority brings with it very real social dangers. History provides countless examples of ideas which were cruel and absurd, yet were followed to the point of death by the people. Think of Nazism, the Sarin gas attacks or the London Underground bombings.

A second widely practised approach to ethical justification, that of ethical relativism, is just as dangerous. Ethical relativism is the view that ethical justification is impossible, that we cannot say that one moral or judgement is better than another. And if we focus on particular examples, this seems to be an enlightened attitude. In a multi-cultural society, we find many different cultural practices: different food practices, different ways of caring for the aged, different family systems, and society is undoubtedly the richer for it. But suppose the focus shifts to other examples: honour killings, a racist social group such as a neo-Nazi group, or bullying in the school yard. Although time does not permit detailed defence of the argument here, it seems plausible to suggest that our confidence in the moral wrongness of these practices stems from the *significant harm* that such practices bring. Here we find a form of *evidence* on which to base ethical judgements. Generalising from these examples, we argue

that ethics is grounded in good and harm (suffering); moreover, that human beings, and indeed all sentient beings, share common capacities for suffering and for happiness.

Of course this is too simple. The long lasting harm caused to victims of bullying far outweighs the happiness or satisfaction felt by the perpetrator. It is also necessary to *weigh up* suffering and happiness or harm and good here. This insight provides an *ethical yardstick*, a principle which forms the basis of rational ethical justification. It does not in itself deliver a procedure for making ethical judgements or decisions. But we can also draw on some other well established elements of ethical justification, such as considering as fully as possible the consequences of one's behaviour, taking circumstances into account, empathising with others, and ensuring consistency between one's beliefs and between one's beliefs and actions. While it is beyond the scope of this paper to discuss the complex interplay between these elements, it is important to note that these are *necessary* features of rational ethical justification.

We should note here that our goal is not merely one of equipping individuals with the skills of rational ethical justification, but more than this, to foster a readiness to employ these skills widely. In other words, we are aiming at the inculcation of a *disposition* to engage widely in the processes of rational ethical justification. The foregoing discussion demonstrates that fostering such a disposition depends not only on the development of the appropriate skills, but also on the development of certain epistemological understandings; more precisely, an understanding that justification of beliefs, including ethical beliefs, is both possible and necessary (that is, that such justification matters).

In the field of social and environmental education, where the primary goal is to help students develop the requisite skills and dispositions to participate fully as citizens in a just democratic society, it seems clear that making significant progress towards this worthy goal depends crucially on engaging students of all ages in the processes of rational ethical justification, to equip them to make considerable progress in answering complex ethical questions such as, 'Is the off-shore processing of asylum seekers morally right?' and 'Should we allow tourism to expand in Antarctica?'. Yet, a review of the literature and associated curriculum materials in reveals that *Society & Environment* (in Australian primary classrooms at least) is all but void of opportunities in which to raise and deal with relevant ethical questions and to foster the skills of rational ethical justification and the disposition to apply these skills widely.

2   Society & Environment: an ethics free zone?

Wide-ranging research indicates that the vast majority of classroom questions, including questions from within *Society & Environment*, call for little more than clarification, recall or facts acquired through research-based activities, that on the whole, very few ethical questions are raised in the classroom by either teachers or their students (Collins, 2005, Harrop & Swinson, 2003; Myhill & Dunkin, 2002). In particular, two Australian empirical studies (Collins, 1998; Lucas, 2000) specifically targeting the area of ethical questioning in *Society & Environment* lend direct support to the more general findings. While the primary school teachers surveyed in these studies overwhelmingly agreed that ethical questions *are* worth asking in the primary school context, only a tiny minority indicated that they would consider ever asking those questions cited, even if teaching parallel topics as part of their *Society & Environment* programmes. In these studies, the questions related to the topics of 'food' (for example, 'Is it acceptable to keep battery hens?' and 'Is it ever OK to eat whale or kangaroo meat?'), and of 'Indigenous Australians' (for example, 'Should Australian government members apologise to Aboriginal Australians over the stolen generation?' and 'Should mining companies ever be allowed to mine on sacred sites?').

The reasons for such widespread reluctance among teachers to raise and discuss ethical questions as part of their programmes are well-known, ranging from concerns that attempts to

answer them will lead to indoctrination, to concerns that asking controversial questions may offend some students, their parents, or the school administration (Brown, 1991 and Newmann & Onosko, 1990). Such fears and concerns may well be generated primarily however, by a general lack of understanding that there *are* well-established procedures within philosophy for making progress in answering ethical, and even highly controversial ethical questions; procedures which may well help to avoid and allay teachers' fears and concerns. In other words, teachers themselves appear to lack the epistemological understandings we would argue underpin a readiness to engage widely in the processes of rational ethical justification. Even where teachers do recognise the importance of raising and dealing with ethical questions in their classrooms, they will in all likelihood lack the knowledge and skills to do so effectively. After all, engagement in the processes of rational ethical justification is not common within contemporary Australian teacher-education programmes (Collins, 2005).

Moreover, the social and environmental education curriculum resources do relatively little to counter such a shortfall in teachers' knowledge of how to foster the skills of rational ethical justification in their own students; on the whole, authors either abstain from mentioning the possibility of raising ethical questions in primary classrooms, or they acknowledge the seriousness of current controversial issues, recommend teaching *about* these issues, but offer little or no practical advice on how to deal with such complex and controversial ethical questions or issues once they *have* been raised in the classroom. There are noteworthy exceptions of course. Paul, Binker and Charbonneau (1987) and Paul, Binker, Jensen and Kreklau's (1987) handbooks for remodeling social studies lessons are helpful at least in raising the embedded ethical questions in standard *Society & Environment* topics, while various teaching associations with a focus on social justice provide lesson plans which raise ethical questions relating to current social issues, even if they offer few guidelines as to how ethical inquiry should proceed in the classroom (Bigelow & Peterson, 2002; Preskill, Vermilya & Otero, 2002). Many of the exercises and discussion plans available within the burgeoning collection of Philosophy for Children curriculum materials too, are relevant to social and environmental education (Lipman & Sharp (1985); Cam (1995). But unless teachers are au fait with the content of these curriculum materials and trained in the pedagogy of conducting teaching for the development of the skills of rational ethical justification, they will be unlikely to see the connections between philosophy and *Society & Environment*, ill equipped to adapt them to their empirically-based *Society & Environment* curriculum units and as a result, be unable to implement them effectively.

In summary, the *Society & Environment* learning area (in Australian primary schools at least) is driven by a strong empirical research emphasis; the learning area appears to be lacking the ethical inquiry approach most likely to affect real progress towards achieving the central aim of *Society & Environment*, that is, to foster the skills of rational ethical justification and the disposition to apply these skills widely. We argue that making such progress depends on transforming the *Society & Environment* curriculum area from its current empirical research platform to a learning area which encompasses and deals effectively with *both* the empirical and the ethical components of existing and emerging social and environmental topics**.** We turn now to an account of what must be involved in designing a programme for teaching *Society & Environment* aimed at on engaging students of all ages in the processes of rational ethical justification.

3   A way forward?

The *Society & Environment* learning area encompasses a vast range of possible study topics drawn from a number of disciplines and fields; no attempt at representing them here could do justice to the virtually inexhaustible array of relevant topics. Moreover, a wide range of possible factors is likely to direct the process of selecting suitable topics for inclusion in any

Society & Environment programme. Yet, the more fundamental question of why *any* individual topic ought to be included in *Society & Environment* remains to be asked. What do we hope to achieve by teaching students about oceans, or ancient Egypt, or about the lives of asylum seekers? What is our underlying aim? Such questions are surely crucial in the beginning stages of preparing a unit of study, and we should try to be explicit in our attempts to answer them. The following example should help to illustrate the point.

Suppose we were to ask a middle-level primary teacher why her class is studying 'Rainforests' in *Society & Environment* this term. She might respond in a number of different ways:

> It's an interesting topic – children are curious about the natural world and rainforests are part of their world so they will be curious about them too. And I'm interested in them as well; rainforests are remarkable because of the large numbers of plant and animal species they harbour, and the sheer size of some of the trees and insects and so on.

We should not dismiss the teacher's arguments altogether of course; we certainly would not want to dismiss children's curiosity, or the importance of fostering it. But we could reply that there are many other things in the world that her students would be even more curious about. We could say (truthfully) that the students will be *more* curious about and interested in their computer games, and go on to ask why computer games would not be a better topic for them to study. Her response here might be that:

> Studying rainforests will (while studying computer games will not) enhance the children's research skills and their problem solving skills. And it will help them learn to work collaboratively.

But again, there is an easy response. Studying computer games *may well* enhance the students' research skills: they will need to find the 'cheat sites' for example, or research details about the characters in the games, or the media techniques used to create them. What is more, playing many of these games clearly requires the use of problem-solving skills, to say nothing of the potential for collaborative activity in both playing and sharing the games.

We cannot justify teaching 'Rainforests' rather than computer games by pointing to the former topic's potential for enhancing research or problem-solving or collaborative skills. Nor is the topic's intrinsic interest sufficient to justify its inclusion in the teacher's *Society & Environment* programme: there are many other topics the children find decidedly more interesting than rainforests. Yet surely there must be some way to justify teaching 'Rainforests', some reason why the teacher has included this topic, rather than the topic of computer games in her programme. Why is it important for children to study rainforests? Perhaps the following line of argument will provide the justification we are looking for.

It is important that children study rainforests because they need to understand both the rate at which rainforests are being destroyed and the importance of rainforests to the environment: their role in counteracting global warming, as well as their role in maintaining biodiversity. Once children understand all this, they will come to realize the need to plant trees and to reduce their use of rainforest products (actions they can take now), as well as the need to lobby governments to restrict or halt logging in rainforests and to cast their votes accordingly (actions they can engage in as adults). In short, we hope that the knowledge children gain from studying rainforests will cause children to think and act in such a way as to make society better. We hope that children will take with them a commitment to caring about the conservation of the earth's rainforests. Teaching 'Rainforests' then, is aimed not so much at individual betterment (in the way that numeracy and literacy teaching are), but at the

betterment of society. The aim is ethical in nature. And we ought to be able to follow a similar explicit chain of reasoning whenever we attempt to justify the inclusion of a particular topic in our *Society & Environment* programmes. We teach about child labour for example, because we want students to understand the significant harm caused by such practices, in the hope that they will make responsible choices when purchasing garments; and we teach about reducing, re-using and recycling waste products in the hope that students will come to understand the consequences of their own consumption and disposal practices and modify them for the sake of the environment.

But of course, having even a deep understanding of the empirical content of a topic is not in itself sufficient to bring about a commitment to the betterment of society. Understanding the important role rainforests play in the global ecosystem, together with an awareness of the consequences of wide-spread logging, will not in itself be enough to foster an ongoing commitment to conservation. There are after all significant *benefits* which come from logging rainforests. Logging might enable South American farmers to grow more crops for example, and this may well help to protect their families from starvation. How are we to decide whether this seemingly positive consequence of logging is outweighed by the environmental harm caused by the practice? How are we to find a solution to this complex real-world ethical issue? In addition to being explicit about the aim of the topic we are teaching, and asking appropriate *empirical* questions about rainforests (or child labour, or recycling), it appears that we also need to unearth, ask and try to answer the *ethical* questions that underpin the topic at hand. In order to have grounds for the ethical commitment we are after then, students need to work towards answering important ethical questions about the topic. We need then, to work out *which* questions to ask..

As indicated earlier, looking to current practice in *Society & Environment* primary classrooms is, on the whole, unhelpful in this regard. Teachers rarely raise or deal with ethical questions as part of their *Society & Environment* programmes. Rather, they develop or adapt empirically-based curriculum units on particular themes or topics comprising sets of activities and research tasks in which children find out about and present information on the topics at hand. All in all, connections between the activities appear tenuous and it is often unclear how these activities and research tasks will help students to think well about the topic they are studying. Rob Traver puts it well:

> Many cherished school curriculum units are intellectually weak and fragmented because teachers and students really do not know what students are supposed to learn. Consider for example, the typical elementary unit on ancient Egypt. In this curriculum, kids learn about the pharaohs, the pyramids, Egyptian myths, and geography. They examine hieroglyphs, view the video Treasures of Tutankhamen, and make papyrus-like paper. This hopping from activity to activity goes on until the teacher decides it is time to study something else. Unfortunately, the intellectual outcome is a group of youngsters who recall pieces of information: perhaps a pharaoh's name, a strange custom, or a mental picture of the Sphinx. When these students and teachers are asked what they've been doing for the past few weeks, the answer is usually, "We've studied the ancient Egyptians." But one can study forever and not get anywhere when the goal of learning is not clear. Regardless of how carefully the individual activities and lessons are crafted, on close inspection, the…[curriculum units] reveal a lack of intellectual focus and coherence because the goals of study are not explicit. (Traver, 1998, p. 70)

Under this model, a study of our rainforest topic would involve a research project in which students are required to access and present information about a particular region of rainforest, directed by a set of guidelines, lessons and activites on the topic. Clearly, such a study could

be of interest to some students; it might well bring about understanding in relation to the ecological concepts they have been taught; it may extend students' general knowledge and in the future, help them to recall important information about rainforests; it might even inspire some individuals to care about the conservation of rainforests. But, studying rainforests via a set of loosely connected or disjointed activities (no matter how interesting or "hands-on" they might be), and doing so with little or no understanding of *why* the it is important to learn about the topic, is unlikely to bring about the ethical aim we are after in *Society & Environment*. We need to find a better way of developing and teaching curriculum units, and, Traver suggests that we should begin this process by formulating 'guiding questions' to direct classroom studies:

> A guiding question is the fundamental query that directs the search for understanding. Everything in the … [unit]is studied for the purpose of answering it. As a result of this function, guiding questions can direct the curriculum author's choice of ideas and activities and can transform the often disparate topics from a scattered survey of the subject, problem, or theme, into a logical, coordinated instrument for attaining knowledge. (Traver, 1998, p. 70)

Traver's notion of the guiding question provides a significant first step in the process of transforming the *Society & Environment* learning area. On this model teachers need firstly, to be explicit about their empirical and ethical goals for the topics they teach, and secondly, they must formulate both empirical and ethical guiding questions to direct *Society & Environment* units of study. The very purpose of these units will then be to support students in making progress towards answering the guiding questions, and in so doing, bring them closer to meeting the broader aim of the learning area, that is to foster the disposition to engage in rational ethical justification in relation to real-world social and environmental issues.

The task ahead seems clear: it is that of developing and implementing *Society & Environment* curriculum units based on coherent and logically sequenced sets of lessons and activities designed to enable students to make progress in answering guiding ethical and empirical questions. While the constraints of the paper prevent us from including examples of such curriculum units, much work has been undertaken in South Australia on developing as well as implementing them in the primary school settings (Collins, 2005 and Burgess, 2006). And, several curriclum units have been trialled in a recent large-scale study involving more than two hundred upper primary students, the findings of which demonstrated the model's effectiveness in fostering the skills of rational ethical justification as well as the disposition to apply these skills widely (Collins, 2005). We can it seems, be optimistic about transforming the *Society & Environment* learning area to one based on the processes of rational ethical justification, and in so doing, come closer to meeting the goal of supporting students to participate fully in a just democratic society.

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Effects of Increased Physical Activity and Motor Training on Motor Skills, Attention and Learning

An intervention study in school years 1–3 in Sweden

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Abstract

Effects of an extension of Physical Education and extra motor training were studied in a Swedish compulsory school (n=251). The study was hypothetic-deductive and had three hypotheses: 1. Children's motor skills, 2. attention and 3. academic achievements in Swedish and Mathematics will improve with extended physical activity and extra motor training in school. Results showed positive effects on motor skills, attention and academic achievements in Swedish and Mathematics.

Key words: Balance, cognition, coordination, physical education, cognition, screening.

This article is a summary of the doctoral thesis *Motor skills, attention and academic achievements,* written in Swedish with the title Motorik, koncentrationsförmåga och skolprestationer, (Ericsson, 2003). The aim of the thesis was to add to the knowledge about relationship between motor skills and cognition. Effects of an extension of Physical Education and motor training in school were studied in two intervention groups and one control group. The study was hypothetic-deductive and had three hypotheses: 1. Children's motor skills will improve with extended physical activity and extra motor training in school. 2. Children's attention will improve with extended physical activity and extra motor training in school. 3. Children's academic achievements in Swedish and Mathematics will improve with extended physical activity and extra motor training in school.

Materials and methods

All pupils in three school years at one compulsory school were studied until school year three. The two intervention groups had Physical Education and physical activities on the schedule five lessons per week and also if needed one extra lesson (45 minutes) of motor training per week. Physical Education was increased from two to three lessons per week and different local sports clubs had physical activities based on playful motor training two lessons per week.

An important goal of the intervention was for pupils to feel motivated and enjoy taking part in physical activities. Children who needed extra motor training were offered this according to the *MUGI model* - Motor skills as Foundation for Learning (in Swedish: Motorisk Utveckling som Grund för Inlärning) (Ericsson, 1985-87), an education program, which started in Lund in the early 1980s. An evaluation of the MUGI model had shown that the motor training had positive effects on children's motor control, perception and ability of remembering details (Ericsson & Lindström, 1987).

The control group had only the school's regular Physical Education two lessons per week. As the project started in the autumn of 1999 school year one consisted of three classes (intervention group 1), school year two of four classes (intervention group 2) and school year

three of five classes (control group). All parents were informed and gave their written consent; only two pupils did not participate in the study. In total 251 pupils were included in the study; 152 and 99 in intervention and control group respectively.

In order to study development of motor skills in relation to physical activity in school, motor skill observations with the MUGI observation scheme (Ericsson, 1998) were conducted by the school nurse and the children's teachers at project start, in school year two and in school year three. How children with difficulties in motor skills and attention were affected by the intervention was studied with special interest. The MUGI observation scheme consists of nine gross motor tasks measuring two variables of motor skills: *balance/bilateral coordination*, e.g. hopping and balancing on one leg and *eye-hand coordination* with tasks like throwing, bouncing and catching a ball.

Conners´ 10-item abbreviated questionnaire (Conners, 1999) concerning the pupils' attention was answered by the teachers every year and by the parents at the project start and in school year three.

School results in Swedish and Mathematics were also studied in relation to motor skills. Results from Reading development tests were obtainable for most of the pupils in the control group (n=62) already from autumn term in 1997 when they started school. Results from the national tests in Swedish and Mathematics were collected during spring term in school year two. In school year three the pupils were given a word test and a reading test, consisting of five short essays with questions about the contents.

Validity and reliability

The Reading development tests used in this study is a commonly used test in Swedish schools as are the national tests in Swedish and Mathematics. Also the word test and the reading test given in school year three had earlier been used in a national evaluation. These tests were considered to be valid for measuring academic achievements in the age groups of this study.

After motor skill observations with the MUGI motor observation scheme of 245 pupils in the school years 1-2, an exploratory factor analysis was carried out, i.e. 9 items were rotated to a varimax solution. Two components were found: Component 1 measuring *balance/bilateral coordination* (item 3, 4, 5, 6, 7 and 8) and component 2 measuring *eye-hand coordination* (item 1, 2 and 9). All variables had a loading between 0.50 and 0.80, which means that all tasks were relevant to measure the two components of motor skills. The balancing tasks 4, 5 and 8 grouped together, with static and dynamic balance not separated. The lack of separation was consistent with findings in other studies and indicated that there was no need for separate subtests to measure balance (Bruininks, 1978; Keogh & Sugden, 1985).

A test of reliability with Cronbach´s alpha showed the following values for the two components of motor skills: 0.76 for balance/bilateral coordination and 0.65 for eye-hand coordination. A sum of all items gave the value 0.80. One would have wished for higher reliability values, especially for the component eye-hand coordination. However, the values show that the MUGI observation scheme is reliable enough for comparing groups. The sum value of 0.80 is quite acceptable, considering the number of tasks in the observation scheme being so few.

An exploratory factor analysis was also carried out of Conners´ 10-item abbreviated questionnaire. Teacher's ratings of 245 pupils in school years 1-2 were rotated to a varimax solution. Two components were found: Component 1 measuring *attention/hyperactivity* (item 1, 3, 4, 5 and 6) and component 2 measuring *impulse control* (item 2, 7, 8, 9 and 10). All variables had a loading between 0.70 and 0.91, which means that all questions are highly relevant to measure the two components of attention ability.

A test of reliability with Cronbach´s alpha showed the following values for the two components of attention: 0.89 for attention/hyperactivity and 0.88 for impulse control. A sum of all items gave the value 0.92. The values show that Conners´ 10-item abbreviated questionnaire is reliable. The sum value 0.92 is very high, considering that the questionnaire has only 10 questions.

Statistical Analyses

Collected data have been analysed in the program Statistical Package for the Social Sciences SPSS (Aronsson, 1994). Non parametric tests (Kruskal-Wallis and Mann-Whitney U test) were used to study differences in motor skills, attention and academic achievements between the groups. The Wilcoxon Signed Ranks Test was used to compare pre to post changes. All comparisons between intervention and control group were made when the pupils were the same age. To make presentation of the results easier to follow, the two intervention groups are considered as one (n=152) when comparing results with the control group (n=99).

The sample in the study was not randomised, which means that the sample is not strictly representative of a larger population. However, since the study included all pupils in the school years 1-3 at one compulsory school and since base line data concerning motor skills and attention were consistent with other studies the results may still be generalised to other similar populations. According to this, analyses of significance (One-Way ANOVA) have also been used to study differences between intervention and control group. An alpha level of 0.05 has been used for all statistical tests.

In order to estimate differences between the groups, Cramér´s index and values of eta squares have been used. Cramér´s index lower than 0.22 is considered to be a small difference, 0.22-0.30 a rather large/moderate and above 0.30 means a large/major difference. Differences with values of eta squares smaller than 0.05, between 0.05-0.09, and greater than 0.09 are considered small, rather moderate and large/major respectively.

Base line data, external and internal validity

The pupils in the intervention group and in the control group were as alike as possible concerning the following demographic aspects. They all lived in the same area and 15 of the children in the intervention group had the same parents as 15 children in the control group. 11% of both groups spoke another language at home than Swedish. There were no significant differences between the groups concerning the pupil's age or mothers´ or fathers´ education. Circa 40% of both fathers and mothers in both the intervention and the control group had higher education (from university). Parents´ attitudes to physical activity and reported time spent in physical activity were not significantly different between the groups.

Contextual school factors were similar for intervention and control groups. All pupils were educated by the same teachers and the school's three special teachers gave the same amount of special education in Swedish and Mathematics in both groups. Education in motor skill observation and motor training was given to the teachers in the same way in both intervention and control group. The pupils in the control group took part in all the school's health promoting activities except for the increased physical activity and the extra motor training.

All together the pupils in the intervention group and the control group were considered to be alike, concerning school situation and demographic background.

Base line data concerning motor skills and attention were consistent with results from other studies (e.g. Hendersen & Sugden, 1992; Gjesing, 1997, Gillberg, 1981; Kadesjö & Gillberg, 1999; Kadesjö, 2000).

Results

The results from motor skill observations confirmed the first hypothesis of the study that children's motor skills improve with extended physical activity and extra motor training in school. The Wilcoxon Signed Ranks test showed significant improvement from pre to post test in the intervention, but not in the control group. After one year, the pupils in the intervention group had better motor skills than pupils in the control group and the differences between the groups were rather large (Cramér's index 0.24). In school year three the differences were very large (Cramér's index 0.37) and largest in the variable balance/bilateral coordination. When the project started, the pupils in the control group had significant better motor skills than the pupils in the intervention group (which is logical since they then were older than the pupils in the intervention groups).

Both boys and girls improved significantly in motor skills and the differences between them decreased with extended physical activity and extra motor training in school. In the control group, however, differences between boys´ and girls´ motor skills increased from school year two to school year three. But in the intervention group there were no significant differences, neither in balance/bilateral coordination nor in eye-hand coordination between boys and girls in school year three. At this point, 90% of the boys and 94% of the girls had good motor skills. The corresponding values in the control group were 46% and 83% respectively.

In the intervention group, pupils with deficits in attention improved significantly in motor skills, while motor skills for pupils with similar difficulties in the control group did not improve.

In the control group, which had the school's ordinary Physical Education, there were no significant differences between pre and post test for pupils with small and large deficits in motor skills. This indicates that motor skill deficits do not disappear by themselves, and that the school's two lessons of Physical Education per week are not sufficient to stimulate improvements in motor skills for these pupils. These results are in line with other studies (Cratty, 1997; Cantell, 1998; Kadesjö & Gillberg, 1999; SEF, 2000), which confirm that without any remediation program many children with deficits in motor skills will keep these problems for many years.

Attention

The second hypothesis of the study, that children's attention will improve by extended physical activity and extra motor training in school, could only be confirmed by the results regarding girls and children with large motor skills deficits. The pupils in the intervention group improved significantly (Wilcoxon Signed Ranks test, $p<0.05$) and had significant better attention according to teachers, after one and two years of intervention than the pupils in the control group (Mann Whitney U test, $p<0.05$). This was true for both pupils with good attention and pupils with small or large deficits in attention at the start of the project. In school year two, there were significant differences between the intervention and control group in both variables attention/hyperactivity and impulse control, as well as in total attention. But the differences were small and did not remain in school year three, which makes it hard to draw any conclusions about whether the pupil's attention had been affected by the intervention or not.

For girls there was a positive change in attention according to parents' opinions. In school year three there were no significant differences between girls in intervention and control group, although girls in the intervention group had significant worse base line values for attention when the project started than the girls in the control group.

Additionally, for children with large motor skills deficits who received extra motor training, positive effects on attention remained from school year two to three according to both parents and teachers.

Academic achievements in Swedish and Mathematics

The third hypothesis of the study, that children's academic achievements in Swedish and Mathematics will improve with extended physical activity and extra motor training in school,l could be confirmed by several parts of results in the study.

In school year two the pupils in the intervention group had better results than the pupils in the control group in the national tests of Swedish, especially when it comes to writing and reading. In reading and writing ability there were clear connections (Cramér's index 0.27) between results and group belonging, which means that the pupils in the intervention group performed significantly better than the pupils in the control group. Also in Swedish overall, the difference between results for pupils in intervention group and control group were rather large (Cramér's index 0.29).

Pupils who had extended physical activity and extra motor training in school also had better results in national tests of Mathematics than pupils who had only the school's ordinary Physical Education. This was especially true concerning room conception/spatial ability and number conception/thinking proficiency, where the differences were significant. The largest difference in Mathematics between intervention and control group was in the results concerning room conception/spatial ability (Cramér's index 0.22). Also in Mathematics overall, the differences were significant (Cramér's index 0.21).

For boys, the results indicated that extended physical activity and extra motor training in school could be of importance for achievements in Mathematics. Apart from room conception, i.e. spatial ability, and number conception/thinking proficiency, there were also significant differences between boys in the intervention and control group in logical thinking and creativity; in other words, in all parts of the national tests of Mathematics being investigated in this study.

For pupils with deficits in motor skills, the results showed significant differences between the groups. Pupils with small and large deficits in motor skills at the project start, who had extended physical activity and extra motor training in school, had significantly better results in all measured parts of the national tests of Mathematics and in three of four measured parts of the national tests of Swedish than pupils in the control group with similar deficits, but who had only the school's ordinary Physical Education.

Discussion

The results of the study are encouraging. However, the studied groups of pupils were not randomized samples and therefore not strictly representative of a larger population. We also don't know whether the positive effects in academic achievements noticed in this investigation will be sustained beyond school year three. Therefore more controlled studies are required in order to be able to make general conclusions about the effects of increased motor training in school.

One effect of the project could be that more physical activity and movement enjoyment in school have led to a spirit of community and a general increase in comfort with school work, which could have had positive effects also for the pupil's academic achievements. Furthermore it cannot be excluded that the teachers have expected a positive intellectual development and therefore been more attentive and encouraging to the pupils in the intervention groups than usual. This positive attention could have made the pupils more motivated so that they also learnt more. In this case however, the teachers' expectations are

still caused by the intervention, which then have had indirect effects on the pupils´ academic achievements.

The results indicate that extended physical activity and extra motor training in school are of great importance to pupils with small and major deficits in motor skills, but also to pupils with small and major deficits in attention when it comes to their development in motor skills. Motor training seems to be more important the larger the deficits in motor skills displayed by the pupils; similarly when it comes to academic achievements in Swedish and Mathematics. One may assume that motor skill observations at the school start could be a useful pedagogic instrument to predict academic achievements in Swedish and also in Mathematics during the first three school years. Furthermore, the results indicated that differences in academic achievements between pupils with good motor skills and pupils with deficits in motor skills may decrease with extended physical activity and extra motor training in school.

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Towards a New Perspective on Innovation
– With Empirical Inspiration from Creation of an Opera Scene

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Abstract

This study is about innovation in a non-technical context. The case deals with the transformation of a lime quarry into an opera scene. Innovators can break free from common thinking styles. However, rethinking something is not enough for making innovation happen. Innovation is not only about creativity. Transforming thinking to the act of physical creation is s also needed. Innovation is a new thing or concept, which also enter society. In most cases this means success on the market. Therefore innovative processes are interwoven with marketing.

Keywords: Innovation, creativity, nature factors, culture, experience industry, Dalhalla

1   Introduction

Jensen (1999) argues that society is shifting from knowledge economy to experience economy. The theoretical domain in this study is *innovative processes in cultural and idealistic contexts*. The analysis concentrates on the *early phase* of innovative processes. The problem addressed is how to understand which factors that are most vital in the early formation of innovative processes. The theoretical purpose is to articulate an embryo of an innovation-oriented theoretical frame of reference. This should not have a bias towards technical context like widespread models such as Cooper (1971) or van de Ven (1986). The frame of reference should treat the time dimension explicit in contrast to, for example, the national system of innovation model (see Freeman, 1982). Moreover the proposed frame of reference should be based on other postulates than most economic theories regarding what external (related to focal innovators) factors are important for innovative processes. By traditional I refer to a focus on primary customers, competitors and suppliers (see Porter, 1980). It is, for some reason, often taken for granted, that these factors should be endogenous, and other factors exogenous in the models (Frankelius, 1999). An empirical delimitation in this project is to analyse the innovative process from the central innovator's point of view.

2   Research method

The groundwork for this research was the extensive research project *Innovative Processes*, funded by the Swedish Government and published in Gidlund & Frankelius (2003). The study included an international literature survey on innovation theories. We conducted, over a two years period, about 50 case studies on innovation, and we focused not only on technical or business domains. One of the cases in the study was Dalhalla. My interpretation, derived from that study, was that the line of events in the Dalhalla case to a great extent was fuelled by one person at the early phase. Therefore the research after 2003 continued and focused on deepening the empirical data from the innovator's point of view. Many semi-structured interviews were conducted by the author with Margareta Dellefors, not least to collect narratives of the process. This work was done during 2004–2006. The data collection method also included participation, photographing and archive-work. The comprehensive empirical material was then used as a source from which the extract presented here was derived. The condensation process of the fully empirical material became not finished until February 2007. Feedback on drafts, from anonymous reviewers were very helpful.

3   The Dalhalla story

Outside Rättvik in Sweden, there was a limestone quarry whose business ceased in 1991. A gigantic hole was left in the bedrock after centuries of digging. What would become of this monument from the heyday of mining? Could it perhaps be used as a municipal rubbish dump? Another idea was hatched on 18 May 1991, from an opera singer, later a radio producer, named Margareta Dellefors, then aged 65. The idea was to create a summer stage for opera in the enormous quarry. She had been responsible for the opera production department at the Swedish radio since 1980 and this job had included reportage-visits to different festivals round Europe, such as Verona, Bregenz, Glyndebourne and Savonlinna. Dellefors reconstructs that moment of imagination: "As soon as I saw it I knew: this is the place for the international opera festival place I had been looking for quite some time."

But how, really, was Dellefors connected with the limestone quarry? Let her words speak: "I started try finding a place for a similar festival in Sweden, but maybe something different. I have a summerhouse in Rättvik and knew that there, in the beginning of last century, was the limestone industry." During some years she had asked different people for tip of a good place. In November 1990 she explored the woods around Rättvik searching for old quarries. She had a local map, but she did not find any of them. They were well hidden, partly because of safety reasons. One of the persons Dellefors asked was Rättvik's cultural director, Åsa Nyman, in a phone-call around new years day 1990/91. On 18 May Dellefors got the strategically information about the site Draggängarna from Nyman. They went to the quarry the same day. When she came to the place, she sang and recited poetry. Let her memory speak: "Draggängarna was beautiful. The cliffs had different pastel colours because of different kinds of rocks in vertical lines … black, pink, bluish, white and brown. At the bottom of this emerald there was a coloured little lake, not ever ceasing, because it was under groundwater level. And the enormous size!"

Lots of activities started after the first impression. "I got a kick from the very first moment I set eyes on it. To be sure I invited lots of friends – conductors, musicians, singers – people whose judgement I could trust and started to work for my, as I thought, splendid idea." Dellefors wanted second opinions – confirmation – from people she trusted. At the same time, she wanted to market the project to opinion leaders. How did she choose these opinion leaders? "As I had a long career behind me in the Swedish music world I knew persons or organisations I thought could be of value for my idea. And most of them knew who I was." Not least one should remember Dellefors had been an opera singer for 15 years. Dellefors was aware of the fact that this coincidence was "very good timing for my project".

After having taken photos of the place, she magnified the best one and went to a bookshop to buy transparent paper. She wanted to visualize her vision by drawing on the photos taken. She drew a scene in the middle of the lake, and a grand stand opposite it. This pedagogical trick was to be used at a forthcoming meeting in September with a construction company, and in December with decision makers from the municipality of Rättvik.

Among the chosen opinion leaders there were some journalists. Did she communicate different with them? "No, everyone who was interested in Dalhalla was important for me, but – of course – those who had the opportunity to even write about it, got perhaps some written material, for instance the little brochure I soon wrote." Besides herself and opinion leaders in the music sector, there were many more people to convince in this very early part of the process, not least the locals: "Everyone in the little country town of Rättvik considered me more or less crazy, but as I presented letters and documents from musical and well-known Swedish authorities I did manage to overcome the first scepticism."

The period between the first visit in May 1991 and the first written project plan in July 1992 was about intense marketing, including hundreds of contacts and meetings. The project plan in the summer 1992 had many targets: It was addressed "to those who were able to make

this idea develop, and the key was the county community of Rättvik." The county community was a very vital part of the social context of the innovative process.

Besides marketing, much work was devoted to investigating the conditions and practical problems in detail. The fascinating hole was found to be 400 metres long, 175 metres wide, and as deep as 60 metres. Its walls were nearly vertical and the acoustics were on a par with Greek amphitheatres. Moreover, it lay far from the noise of cities, roads and factories.

But a lot of money was needed, and the main problem was to find and persuade sponsors. In retrospect, about 50 million Swedish crowns should be needed to fulfil the dream. But Dellefors conforms: "The first 100 000 were the most difficult to get, as they were the key to the whole project." She needed to convince a lot of people of her vision. The perfect marketing concept for that, she thought, was to arrange a test concert. Such event costs a lot of money. "After about two years I managed to raise the necessary money to make a test concert, which would prove among other things the extraordinary good acoustics Dalhalla had." The fund-raising process, thus, was crucial. The problem was that many observers did not believe that Dellefors was serious. She reflects: "It always arises suspicions, when something new is initiated. 'We cannot do this, it has never been done before', 'We must do this, because, that is what we always have done', 'Opera – that is something where people only shout and you can't hear a word of what they are singing', 'And who is she, who wants to come here and tell us, what we shall do'."

Others thought it was a nice idea, but would never have dreamt of investing money in such a project. Dellefors encountered resistance from sceptics including experts in engineering and economy. Articles in newspapers were also written about the impossibility: "I don't know if that was because I was a woman with Stockholm as my home address, or my age. And as opera is something so out of nowhere for most – I would say particularly people in Dalarna, the landscape of Swedish folk music." Yet she did arouse great enthusiasm from a few. In January 1993 the County Administrative Board, decided to support the project with 50 000 Swedish crowns. The Municipality then also decided to support it with the same amount.

In May 1993 it was time for a meeting: "I invited the local people to a meeting in the library hall in Rättvik on Tuesday 25th May, and showed a video taken by my brother. I talked about all possibilities and what it could mean also economically for little Rättvik." She got unexpected support: "One person – totally ignorant of classical music or opera – was curious enough and asked some very important questions: Roland Pettersson." He was a local automobile dealer and embraced the idea even though he himself had never set foot in an opera. He also helped her with the coming trial concert. How did the meeting come into place? The meeting was made known through advertising in *Rättviksnytt* and *Leksandsbladet*, two for free-papers for every household in this area. And the library hall was crowded.

The first years Dellefors mostly worked alone with the project. One helping hand arrived in December 1992; the architect Erik Ahnborg: "I remember one occasion, when Ahnborg was discussing with the NCC engineer at one end of the table and I at the other end was talking to Boverket [the Swedish state agency for living matters] in Karlskrona negotiating for more money. That was in the spring 1994, were 400 000 crowns were still missing." Altogether, Dellefors was able to gradually awaken commitment by numerous people, both private individuals and foundations. But even so, very much money was needed.

A project group was appointed in the spring 1993. They managed to get more and more money from sponsors. The Barbro Osher Pro Suecia Foundation, situated in San Francisco, gave Dalhalla 2 millions for opera production. Later the Barney Osher foundation also gave money and a first class text machine. An important part of the financing process, was the ability of Dellefors to get idealistic help from professionals.

On 18 June 1993, a trial concert was held with a specially invited audience. How did they choose the persons to invite to this concert? "I and K-G Holmén, the chairman of the [County

Administrative Board], decided on whom we should invite. He on the local plane, I on the national level." She adds: "And I choose people who were connected with music and opera in particular and music writers and critics and of course people connected with state organizations who supported culture with money." In total there were 120 persons on the list. The trial concert was successful. To take the edge off the criticism that the idea did not suit Rättvik's folk music, Dellefors spiced the programme with traditional fiddlers and birch-bark horn blowers. She will never forget this concert: "The local people ... had contributed with big bowls full of wonderful wild summer flowers and were all there in their national costumes. Birgit Nilsson sat there in her mink coat. I introduced the programme by singing the first lines of Elisabeth"s area from *Tannhäüser*, 'Dich teure Halle, grüss ich wieder…' Big!" Eight young singers sang opera arias, folk music was played, and a choir of Latvian singers sang 'Hallelijah' from *Messiah* by Hendel.

The trial concert was a vital ingredient in the strategy: "The aim was to prove the substance in the project for everyone that mattered in Swedish music life." That was not only musicians and opera managers, but also the head of the Royal Academy of Music and of course the press and television, both local and nationwide. In fact, part of the problem was also to convince the members of the project group that Dellefors really *had* the important contacts she talked about. The first fund raising phase has been to finance this concert. The second phase started on the next Monday, 21st June 1993. That Monday Dellefors applied safety for the name Dalhalla. And more things were done: "I do not know, how many applications I have written. It must be a couple of hundreds. But the initial money of only 100 000 crowns, were the most difficult." Every success during the process was used to promote later steps to fulfil the vision. Dellefors continues: "After the important and successful test concert I invited people to become members in the Society of Friends of Dalhalla. It soon became a very big society with today more than 3000 members. Our world famous Wagner soprano Birgit Nilsson, my great friend, was our honorary chairman."

The test concert was also followed by concrete construction. What, then, happened the following year? Dellefors tells: "For the summer 1994 we had got enough money to do the first real test, if Dalhalla would become an asset for the opera lovers of Sweden. They were invited to an opera concert on 23 July." A provisorial stage had been built on the sea. The canal between the stage and the audience was there and there were seats for 1620 people. The concert was sold out in no time. And the reason was, that now Dalhalla had got the recognition from the state, as the Ministry of culture had given Dalhalla 250 000 crowns. In their press release they had described Dalhalla as the future Verona of the north, an attribute that still is connected with Dalhalla." But all this needed boosting marketing. Dellfors comment: "I advertised in the big national papers and of course in the local ones."

In the summer of 1995 the audience capacity was expanded to 2 670 seats. Parking places were arranged and a protected path was laid down into the quarry. The stage, with an aesthetic roof of sailcloth, was placed on a peninsula in the emerald-coloured water, farthest down in the quarry. About 40 000 tons of limestone masses were exploded and used as material for the stage. The 11 metre broad canal between stage and audience was ready.

The official inauguration of Dalhalla took place on 21 June with a major opera concert that was broadcasted on Swedish Television. Unfortunately, that very day, the area suffered an awful storm and the concert had to be stopped halfway through. Dellefors comment: "But – as someone said – A dramatic place like Dalhalla must have a dramatic ouverture." Despite (or partly because of?) the disaster Dalhalla soon became known throughout Sweden and its fame spread abroad like wildfire. The broadcast by the television was very important. Dellefors confirms: "The Swedish television did manage a whole planned programme, even if the total concert not took place. From the very beginning TV has shown a lot of Dalhalla, which of course has been of gold's value, as you don't exist, if you are not on the telly."

The activities became more intense and more formalized. In May 1996 a company called Dalhalla Production was established, wholly owned of the Society of Friends. This company should take care of the productions. The workload was rising. The company got a CEO Håkan Ivarsson (employed half time), and Dellefors as responsible for art direction. All facilities were still owned directly by the society. The place was owned by the Rättvik municipality.

In the summer 1999 a tornado destroyed the expensive sail-roof. More money was needed to this and other needs. The fund-racing process was always in focus. Dellefors fills in: "11,4 million Swedish crowns were given by a rich couple."

In June 2000 Dalhalla had become a well-planned opera arena. They had a big concert on June 7th with the Swedish king and queen invited. At this time Dalhalla had 4000 seats, heating for the orchestra pit from the depth of the mountain – and likewise in the house behind the stage for the artists. A steady roof was supported with pylons secured down deep in the ground 26 meters. They had a professional light system and a smaller stage going up and down using hydraulic power.

As mentioned only a few of the locals were positive in the very beginning of the project. But the attitudes changed. Dellefors reflects: "It has been a long struggle, but a good one. Most of the time I have felt an enormous sympathy and got encouragement from the local people, who have really been proud of their contribution to the Swedish summer festivals." Since the start, numerous opera performances and concerts have been staged in Dalhalla.

4   Theoretical discussion

Most innovation literature focus on technology contexts, not cultural contexts (see Cooper, 1971 or van de Ven, 1986). In my perspective an innovation is something new but not necessarily technical. However, to be defined as an innovation the new thing also needs to enter society. In most cases that means succeeding on a market. A new innovative concept (product, service or piece of art) is not an innovation by definition. The new concept has to be adopted by investors or customers if someone will put in a claim for calling it an innovation. Adoption, however, is not something that happens automatically.

How it is happen when a person identifies opportunities in something, for example an old quarry, that other can see but not understands as opportunity? First of all *strategic information* about the opportunity is needed. Who are the persons that identify such opportunities? Part of the answer is that these people have *power of imagination*. They have the power to break free from what Fleck (1935) called *thinking styles*. One explanation to this ability can be that they come to a place from other social contexts, and thus other thinking collectives. But rethinking something is not enough for bringing innovation to reality. *It is one thing to think of an opportunity and another to transform that thinking to the act of creation.* The most important skill probably is marketing – to sell the vision so that work can be financed and therefore done. One can conclude that Dellefors did not use traditional marketing strategy in the sense trying to reach as many people as possible. Rather she used what in Sweden as been called surgical marketing: targeting a few but well chosen persons, and then addressing a lot of communication energy to each of them, including formation of tailored messages (Frankelius, 2002). Probably the best communication occurred when she persuaded some opinion leaders to visit the sight and see it with their own eyes – or hear it with their own ears.

External factors, in relation to the innovative process, included both social (humans) and non-social factors. Among the social factors there were many related to traditional economic factors (customers, suppliers and competitors). But there were *also other kind of actors*, like the media and donors. These are not common in main-stream economic theory. Moreover we identified *non-social* external factors that are miles away from the focus in traditional economic theory. An example was the weather, not least a tornado that passed the sail-roof away. Another quite important non-social factor was the limestone quarry. That factor was

external at the beginning, but became internal over time. External factors that are important for an innovative process, but at the same time not in focus in traditional economic theory, I call *X factors*. Many modern researchers in innovation or entrepreneurship focus on only social factors (an example is Steyaert & Hjorth, 2006). This postulate regarding relevant external factors is different from my way of looking at the world. We can talk about two paradigms. One kind of X-factors, that were important in the Dalhalla case, is nature-related. An early theory on the interplay between innovation and nature factors was in fact developed by Carl Linnaeus in the 18th century (Frankelius, 2007).

Last but not least the Dalhalla case is an illustration of how processes develop over time. The time dimension has many shapes in the case. One aspect is the importance of timing, for example to start a project one specific year or arrange a test concert a specific day. Another aspect of time is that mental maps take time to form in the mind of interest groups. Still another time aspect is that events logically have to come in a specific order over time. Therefore the empirical study calls for a need of an explicit time dimension in theory.

5   Conclusion

A widespread paradigm is the innovation system framework (Fagerberg *et al*, 2004). Networks and clusters are central, but *the time dimension is not obvious.* One conclusion from the Dalhalla case is that time matters. Moreover the innovation system framework has a technology bias. This study pointed at *cultural* context. Innovation is defined here as new concepts *in whatever area* entering society. The *entering processes* do not happen automatically. Transforming thinking to the act of creation is needed, and thus *creativity theory is not enough*. One aspect of this entering process is *marketing* and another is sponsors or customer *adoption*. To understand the interplay between these two aspects we need to understand the external context that affects the line of events. In doing so *new postulates is needed regarding the meaning of context*. I question the old but still used economic model where the relevant external world, in relation to an enterprise, is assumed to consist mostly of sellers and buyers, and not for example the media or nature phenomena.

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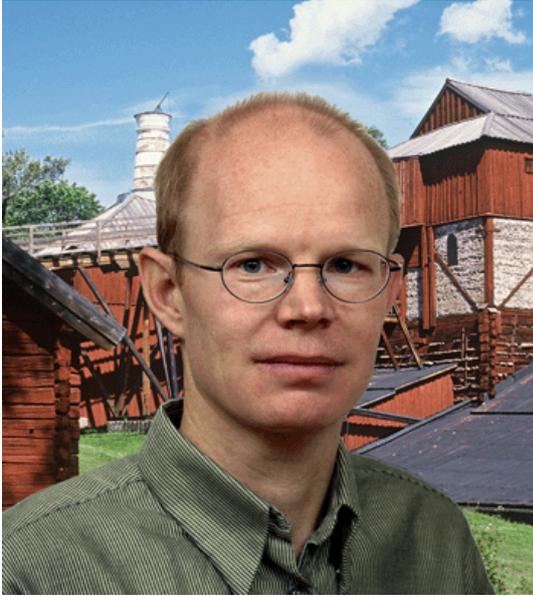
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Close Encounters – University Course at Lunarstorm

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Abstract
During autumn 2004, a course equivalent to 7.5 ECTS credits was located to the Internet community of LunarStorm, a website of the greatest importance of its kind in Sweden. The purpose was to let the students get a deeper understanding through an ethnographic perspective. Many of the functions that the website provides were used in order to communicate in different ways and unexpected positive results arose. The evaluation of the course indicated that the ethnographic perspective had functioned as it was meant to, but also that the group developed a spirit of community that resulted in other interesting and positive spin off effects.

Introduction

The purpose of this paper is to report on findings made during a course on the subject of net cultures. The course was located to the community LunarStorm as an attempt to let the students have more opportunities to learn about the subject, how young people use the internet. At the beginning of the semester, the students protested against being forced to use LunarStorm, a website they considered childish and disorganized, and asked for a more traditional way of communication, i.e. FirstClass. After a while however, the students reconsidered, expressed appreciation and encouraged continues use of LunarStorm in this course.

Description of the course

The objective of this course was to learn more about what children and young people do on the internet. The platform used for communication during the course was the website LunarStorm, the largest net community in Sweden. There were four different fields of assignments given as frames for the fundamental content of the course: technical matters, games, Law-Legal Problems related to Information technology and net communities. Students produced their own questions within the fields and answered each others questions. The central activities when they conducted their tasks were self-reflection and connection to adequate literature. They were also making an evaluation of a modern computer game.

   The last assignment, the strategy assignment, developed continuously during the course. It related to the experiences from the other assignments and was issued from the students own working field. The strategy had to be commented on by an employee of a learning environment, i.e. a principal of a school, avoiding the strategy to be a desk product.

LunarStorm as a platform for the course

From a constructivist point of view, the context for a learning situation is important (Dewey 1998). In our case we chose the website LunarStorm, since it is the largest and most well-known net community in Sweden, and many young people use it on a daily basis. Due to the fact that the student used and reflected on functions, observed and reflected on phenomenon and was given first hand experiences by the surrounding environment used during the entire course, we believe conditions for learning were created in a way that won't occur as easy in other forms of education and teaching. The discovery of problems in a specific environment leads to reflection and a search for knowledge to be able to solve the upcoming problem

(Larsson, 2001).

It can be interesting to consider the importance of placing the course in an environment which is neutral in that aspect that the control of the environment is relatively equal between student and teacher. The website is not originally designed for education, but is a common and open website primarily designed to facilitate private communication. The informal and personally controlled environment is dominating for a user of LunarStorm. Some of the central functions are Lunarmail – the possibility to send messages to other users of LunarStorm, the Guestbook where all can read and give their input, and the Diary where you can choose to different levels of accessibility, open to everyone or just the ones you have on your so-called buddy list. There are also a huge amount of other functions for communication, but the ones mentioned are the primary ones that are being used during the course.

Pedagogical experiments

When developing the course, the focus has all the time been on improving the conditions for the students learning. Our definition of learning is to a great extent based on thoughts that support the theories of social constructivism. One main assumption is that meaningful learning happens when individuals are active in a social context (McMahon, 1997).

The importance of the context and culture for the perspective of knowledge is another starting-point. (Derry, 1999; McMahon, 1997). One consequence of this is us putting the course to LunarStorm, but other methods have been used to achieve this purpose. The most important thing has been the open assignments where the students have been able to select the content of the different questions themselves. The purpose is to a certain extent making the students being able to create an answer in their own mind, when creating their question. By doing so, we believe that the prerequisite for a better quality learning increases, compared to the situation where questions that are considered are chosen by the course management in advance. We believe that this creates conditions for wider, deeper discussions with more inputs from different students on the issues that have arisen. The students have also had the opportunity to read the diary of the teachers, which in this case have been used as indirect feed-back to the students. The students have also been encouraged to write diaries of their own and write into each other's guest-books - this being voluntary though. Another voluntary assignment has been called "The Question of the Week" and has been used by the course management to catch any current questions or to put a deeper perspective on something that has been seen in one of the students' diary or in a forum. This way there has been a opportunity for the students to have an decisive impact on the content of the course, not only as suggestions in an final evaluation.

Experiences from the fall semester

In total 17 students where registered for the course (of 30 applicants) and 8 of these followed through, which means a throughput of 47%. Within the course two obvious groups appeared. One active group which had a high level of communication between each other and one passive group which to a varied extent performed the tasks of the course but behaving passive in both the common discussions and having few contacts with their fellow students as well.

One essential hypothesis for the design of the course is that there is a positive relationship between social activities (with regards to communication student to student) in a course and

learning, where more active cooperation between students has impact towards a deeper understanding. This change of paradigm has grown during the last

decade (Jonassen, Peck and Wilson, 1999). With this background, we report (as follows) a lot of things that we find interesting and worth shedding light upon. It needs to be said, that

for all observations more research is needed as well as more basic data to verify these relations scientifically.

What we have experienced is that there is a relation between student use of the informal area and activity in the formal. More informal communication meant more activity in common discussions. Here we can draw a parallel to the importance of activities besides lectures and seminars that help students get to know each other during physical meetings on online courses. Those who were active in social activities like writing comments in others guest-books or reading others diaries also were they who answered most frequently on "the Question of the Week" or answered each others contributions.

Our experience from ordinary online courses is that there is a lower frequency of drop outs amongst the students for those who have had physical meetings with social activities, compared to those who have not – or those that have had no meetings whatsoever. In our course at LunarStorm, the communication at the informal arena is here replacing such happenings. We can notice a connection between activity and completing the course and marks on the course – the students with higher activity had a higher standard of performance and got higher marks in the end. Amongst the inactive most of the students dropped out for several reasons.

A third connection, somewhat surprising here (in a website designed primarily for young people) is the correlation between age and activity – higher age meant higher activity. Here a hypothesis can be that older students have more experience and it is more likely for them to have opinions, while the younger students keep a lower profile since they feel they do not have much to give to the group – a kind of lurking.

A fourth connection is the relationship between activity and when the student started the course; where late admitted students were more active compared to those that started by the beginning of the semester. Finally, those who in the end got the best result at the course were those who were older (35 an over) and admitted late. They were active, they related to each other and they formed a community together.

In general the course got positive evaluations from the students. They pointed out some things that they felt were of importance for experiencing the course as beneficial. Above all they felt that the possibilities to communicate with others strengthened the community between students. Also the construction of the assignments as well as the feedback they got from the teachers – both direct through feedback on their given reports but also indirectly by something the management wrote in the diary and could be read by all. This behaviour was something that many of the students copied. The possibility to read each other's diaries could be a key factor that creates possibilities for a social community that otherwise could be difficult to reach in a course that is all online.

Another part that can we think have been stimulating a higher activity is the Question of the Week. Here we find comments from the students appreciating the fact that it was voluntary, so they could answer out of knowledge and interest. They also wrote that they recognized that the management had caught some thoughts in the students diaries and guest books and used those as Question of the Week to deepen the aspect or focus and inform on something that the students had expressed thoughts upon.

At LunarStorm there is also a possibility to define and adjust levels for the students. This was used during the fall semester to indicate the level of marks they had in the course. There were 5 different levels, passive, failed, passed, passed+ and passed with honours. We thought that this function would have little, marginal or no impact, but would simple be used as an example of the graduation system that many net communities have. But in spite of this, quite of few students expressed that they got strong and positive feelings when they moved up a grade while some expressed deep dissatisfaction when moved down.

Experiences from the spring semester

Based on experiences from the first semester, quite a few changes were made in the beginning of the spring semester to increase the conditions for learning. An extended and clear students´ guide was written; certain assignments were widened and an experiment started to let the old students "follow along" in the new course. The experiment was to let the old student's functions as student mentors or "minglers" as we have chosen to call them. The purpose was to transfer the feeling of social community that developed during the fall semester into the spring semester. The minglers were there voluntary. They decided themselves how active they would be, they got no payment for this and they can disappear whenever they want or when the management closes them off in case of bad interference in some way.

One conclusion from the previous semester was to try to get the students to write their own diary and read each others diaries, since we experienced that this was a main reason for the good spirit of community between the students in the active group. Therefore it became mandatory in the spring course for students to make diary entries, to get the writing itself going, and also the reading of other's diaries. It was shown that the latter was more difficult than expected, when many students expressed that it felt forbidden to read other's diaries. Here we can see a very obvious change of paradigm between the generations, since the function diary at LunarStorm is used much more openly by the younger generation compared to how the older generation used their analogy, bound book diaries. We in the course management have tried to influence the students to use their diaries in a more flexible way by reading their diaries on a regular basis as well as writing a small comment on the context of their diaries. We have done this also due to the fact that they would get as much feedback as possible, to create closeness between the course management and help the students to experience activity in the course.

In the end, we also changed the use of member's level of belonging to a club. Instead of showing marks, the scale was changed to show only those assignments that were accomplished to a satisfactory level. Here we chose a somewhat informal way of expressing approval of the tasks. These were "Minglers" (that was access status for everyone) "Lunar-journeyman" (which you became when you had made some initial, fundamental assignments for the using of LunarStorm) "Tech- and game expert" (when they were approved on the Technique and game tasks) "ICT-lawyer" (when they were approved on the ICT-judicial assignment) plus "Culture strategist" (when they were approved on the assignment of net community). In order to be transferred to the fourth level "ICT-lawyer", students had to be approved on the assignments for the three first levels.

Conclusions

Our fundamental hypothesis is that strong social contacts between students leads up to a better environment for studies which then leads to deeper learning; something that could be connected to the theory of social constructive theory. Therefore it becomes very interesting to use a platform which primarily is designed and developed to stimulate communication and which stimulates possibilities for this in different ways. Both through observations made by us in the course management and through reading the evaluations from the students, support the hypotheses but here a more research is necessary to be able to describe this area in a closer perspective.

Based upon the experiences from this course, the general issues to consider while designing online courses are:

- Use a course environment that is dominated by informal functions that students can control and that support social community and where the course is located as a sub function. The students should be able to personalize their "spaces" to a large degree.

- Go for diaries/blogs for both teachers and students and let hem be open for everyone and create conditions to comment upon these both open to public and in private.
- Create tasks that stimulate creativity and constructive thinking and create assignments with possibilities for feedback from both teachers and students.
- Check if previous students want to act as mentors for new students.
- The course management should develop a working culture of quick direct and indirect feedback
- Be prepared to change in the course as it goes along.

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Adapting Curriculum and Teacher Pedagogies to Cater for Boys in Primary Years

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Abstract
In 2003, St. Patrick's Catholic Primary School, Australia, began their Multiple Intelligence journey. Starting by collecting data in the final years of primary school, the shift then moved to each grade, Kindergarten through to Year 6. The various ways individual students think and learn were not only identified and celebrated but they were also catered for. As the curriculum and teacher pedagogies adapted, the students attitudes towards school and themselves as learners changed, particularly the male students. Educational results at St. Patrick's have risen over the last four years and students are now analytical, reflective learners who acknowledge and celebrate their differences and achievements.

Keywords: Multiple intelligences, boys, Primary School, thinking

1 Situational Analysis

St. Patrick's Catholic Primary School is a co- educational school with 275 children currently enrolled. In 2006, St. Patrick's was awarded with a National Award for Quality Schooling by Australian Education Minister Hon. Julie Bishop for their successful Boys Education initiatives. St. Patrick's is the lead school for Boys Education in the Diocese of Broken Bay with thirteen schools currently using the Boys Education initiatives and models started by Mrs Suzan Hirsch at St. Patrick's. The Boys Education Initiative focuses on: classroom practice, mentoring, role models, stereotypical attitudes, boys and literacy, IT and self esteem. This paper focuses on the classroom practice aspect of the project, in particular, the use of Howard Gardener's Multiple Intelligence approach in classrooms to maximise student learning outcomes and results.

2 Why did we need to implement a new approach to cater for boys?

Even when putting the proven developmental and brain differences between males and females aside, there is a distinct difference in the way boys and girls think and learn which can be clearly seen in the classroom. Examining the average classroom the difference between the boys and girls engagement and attitude towards school are blatantly obvious. Boys, on the whole, are disinterested and disengaged from the classroom experience compared to their female peers, this difference in engagement is particularly pertinent during Stage 2 and 3 (9-12 year olds) before the boys have even reached high school. This disengagement of many boys has been evident from the data collected in the thirteen schools in the Boys Education Project in the Diocese of Broken Bay.

A Queensland Government Report states that "….As a group, boys are at higher risk of failing to achieve at school than girls as a group. Boys on the whole are less likely to complete high school and more likely to be suspended or excluded. Community concerns about boys' engagement and performance at school link with broader social issues for some young men. These include a worrying suicide rate, significant violence and harassment, and alienation from wider society. ..". As educators of the future generation of men, it is vital that

we focus on adapting the curriculum and pedagogy to cater for boys, to thereby change their attitudes and engagement toward learning and school in order to best prepare and educate them for their future.

Just *one* of many of the approaches undertaken at St. Patrick's Catholic Primary School, Asquith to encourage the boy's engagement and positively change their attitudes towards school was to introduce the Multiple Intelligence Approach to teaching and learning.

2.1.1 How Howard Gardener's Multiple Intelligence Theory was used to benefit the students at St. Patrick's Catholic Primary School?

For many years there has been a strongly held belief that intelligence was a single underlying general ability characteristic. The assumption was that everyone could be grouped according to how much intelligence they had. "…Howard Gardener began to develop a model of intelligence which abandoned the concept of one single characteristic, and proposed that there were seven different and separate kinds of intelligence…" (McGrath, Noble 2003). Gardener's model has had an impact worldwide.

"…Gardener has discovered that all individuals are capable of at least seven different ways of learning- linguistic (Word), logical-mathematical (Logic and Maths), musical (Music), visual/spatial (Space and Vision), bodily-kinaesthetic (Body), intrapersonal (Self), and interpersonal (People) - and their methods for processing information may be identified by specific intelligence profiles…" (Teele 1996). By discovering student's dominant intelligences it was possible to provide them with the opportunities to use these strengths when learning.

The focus has now moved away from asking 'is the student smart?', to asking the question 'how is this student smart?' Educators at St. Patrick's knew and celebrated the different strengths of their students, however, there was no correlation between the identification of differing strengths and teaching strategies prior to this initiative.

McGrath and Noble, 2003, state that Multiple Intelligences help meet the four basic needs which all students have in order to learn in the classroom. Those needs and the ways in which these needs are addressed through Multiple Intelligences are:

Fun- *When the curriculum is adapted to use the multiple intelligence model it becomes more creative, stimulating and fun. Bonds with peers and the teacher are developed and because their strengths are being catered for the boys then are enjoying their lessons and are far less likely to misbehave.*

Sense of Purpose- *Students, especially boys, need to see a reason to what they are doing; they need to understand the importance and relevance of different learning tasks. Identifying their dominant intelligences assists them to see the relevance of those intelligences to their own lives, their hobbies and even to a future career.*

Sense of Freedom-*By providing students with varied activities using all the different intelligences throughout the teaching and learning program allows the students to choose activities that appeal to them as well as having opportunities to try different modes of activities. It is important for students to not only use their strongest intelligences but to also build up and improve on their less confident intelligences.*

Self-esteem- *Multiple Intelligences allows a classroom environment to be created where various strengths as well as differences are valued and celebrated. By recognising that we all have different strengths this encourages peers to develop a mutual respect for each others talents and achievements.*

2.1.2 How did St. Patrick's begin implementing Howard Gardeners Multiple Intelligence Theory?

Prior to 2003 the Stage Three boys at St. Patrick's were clearly less engaged in their learning and had a negative attitude towards school compared to the girls. Our data from Attitudinal Surveys and Interviews as well as the daily body language and dispositions of the boys was a clear indication of this. In 2003, after recognizing that there was a need to adapt curriculum and pedagogy to better cater for the boys at St. Patrick's, professional development in MI was given to all staff as part of the Boys Education initiative. Staff then began by, initially, exposing the Stage Three students to the Multiple Intelligence Theory (MI) and the students (male and female) were introduced to the notion that we all learn differently yet there is not right or wrong way to learn. The metalanguage of each intelligence was used in order to prevent 'dumbing down' the theory for children.

The educators did not immediately 'test' or examine the types of intelligences within their classroom but originally observed, documented and predicted the preferred intelligences of their students. This aspect was critical as it allowed each educator to examine and familiarise themselves with each student in their classroom. This would, however, not be of any use if the children were not exposed to activities of varying intelligences. During the educator observation and prediction stage the students were offered a number of different ways to complete the same task. Below is just one example of how one task was modified for observation of student choice and reasoning.

Personal Development and Health: Water Safety **Same Task, different ways of thinking/approaching it**

Visual/ Spatial	*Body/ kinaesthetic*	*Maths/Logical*	*Musical*	*Interpersonal*	*Intrapersonal*	*Verbal/ Linguistic*
Create a banner which highlights the importance of Water Safety	*Design and perform a Puppet Play which informs your audience about Water Safety*	*Create a logically sequenced comic strip to highlight the importance of Water Safety*	*Create a jingle or rap song about Water Safety*	*In a group create and present a play which highlights the importance of Water Safety*	*Write a diary entry of ways you could make people aware of Water Safety.*	*Write a poem or speech about Water Safety*

Throughout the task the students (girls and boys) refelcted on their thinking and learning in their journals. They reflected on why they chose their selected mode, how did they feel when given a choice and a reflection of the finished product. This documentation and observation process was continued for two months of the first year and has been the starting point each year since.

Once the staff had examined, observed and documented each student's learning preferences the official surveying of the Stage 3 students began. A Multiple Intelligences Checklist for Upper Primary and Secondary (MICUPS) Survey found in McGrath and Noble, 2003, was administered allowing us to discover the dominant intelligence/s of each child. The students also completed an online Multiple Intelligence Survey found at http://www2.bgfl.org/bgfl2/custom/resources_ftp/client_ftp/ks3/ict/multiple_int/index.htm. The decision was made to complete both the pen and paper surveys as well as the on-line survey to ensure that they both revealed the same results and hence to validate the surveys and the results. This allowed us to see each child's intelligences in a preferred order and also allowed us to notice any general patterns between the boys and girls dominant intelligences.

The staff all presented their Multiple Intelligence Graphs to their own class whilst the children shared their own and a lot of discussion was held about the way the teacher teaches the students. They are asked to imagine if the teacher only taught in the way that they

personally learn best. Accepting and celebrating our differences as learners is a mammoth part of the journey but it is also important to have an open mind, to try and learn from peers with different preferred intelligences. This links back to the initial question 'how is the student smart?'. The classrooms have plenty of visual reminders of the MI Theory and the language is very common to the students of St. Patrick's. Students have hence become far more reflective, analytical and accepting students.
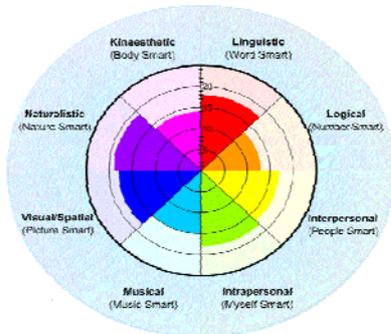
A sample graph the children receive after the survey.   *Children in Year 5 with their Term 2 graph of intelligences*

Rather than labeling students, this process was employed to celebrate and identify the fact that we all think and learn in different ways. It is important to realise that a style is merely a preferred way of using one's abilities. "…It is not in itself an ability but rather a preference. Hence, various styles are not good or bad, only different. We all have a style profile, meaning that we show varying amounts of each style, but we are not locked into any one profile. We can vary our styles to suit different tasks and situations…" (Stenberg1994). It is vital that the students are aware of this to avoid labeling and feeling confined to one intelligence. The Stage 3 students were surveyed three times a year to identify and notice any changes as these intelligence preferences do change, particularly as students are exposed to their weaker intelligences.

In 2004, the St. Patrick's staff then decided to take this one step further and surveyed all the 275 students from Kindergarten through to Year 6 using age appropriate Multiple Intelligence surveys also found in McGrath and Noble, 2003. As part of the Boys Education Project every student in the school also completed an Attitude Survey so that as well as preferred and least preferred intelligences the teachers could also gain information on: the social needs of the boys/girls, the boys/girls views on what it means to be a male/female, the boys/girls views on school life, their self esteem, school justice, role models.

A Student Learning Identity Portfolio (SLIP) was created and given to each staff member at St. Patrick's. The SLIP contains learning information on every child in the school. It includes the Multiple Intelligence Survey results as well as the Attitudinal Results, which are identified, collated, analysed and split into class groups as well as gender. This SLIP is now created three times a year; start, middle and end, so that we can track and monitor changes in relation to the changes in our teaching and learning focuses.

2.1.3 What were the common trends in data?

The different Kindergarten to Year 6 results, emphasise the importance of not labelling the students as preferring to learn through a specific intelligence. This is vital as year to year the results change due to different experiences and opportunities to use different learning styles. It can also not be assumed that if an educator is teaching the same grade two years in a row that he/she can use the same teaching and learning strategies. Each Year group has different results and mixtures of results and therefore they must be catered for accordingly.

Below is an example of gender differences in preferred and least preferred intelligences in just one grade at St. Patrick's.

YEAR 1 BOYS PREFERED INTELLIGENCE
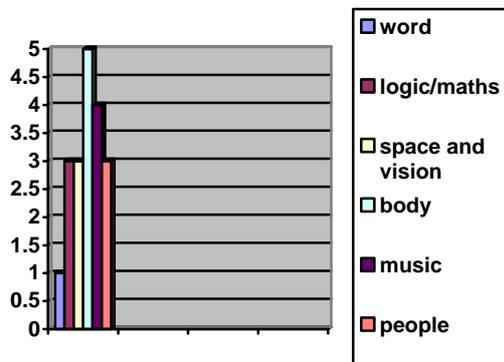
word
logic/maths
space and vision
body
music
people

YEAR 1 GIRLS PREFERED INTELLIGENCES

word
logic and maths
space and vision
body
music
people

BOYS LEAST PREFERRED INTELLIGENCE

word
logic and maths
space and vision
body
music
people
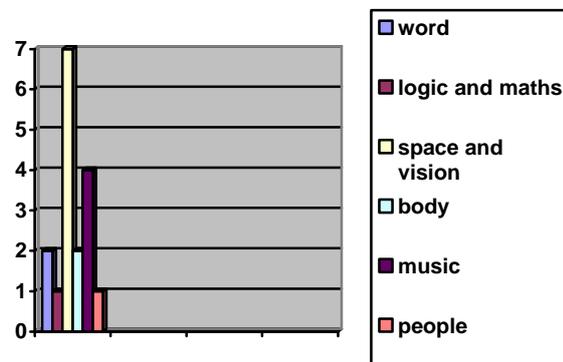
GIRLS LEAST PREFERRED INTELLIGENCE
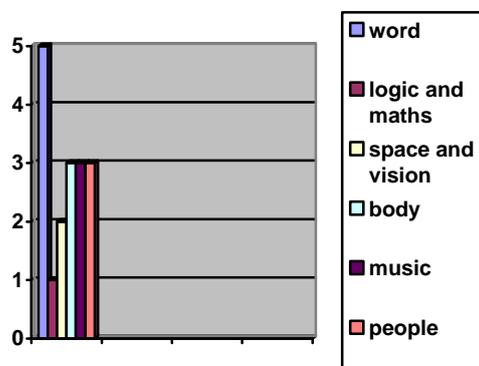
word
logic and maths
space and vision
body
music
people
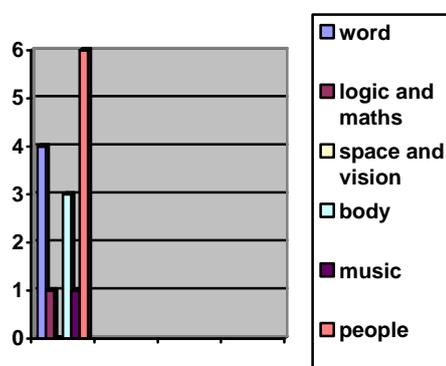
In 2003 at St. Patrick's, ten out of thirteen classes, Body was the highest preferred intelligence for the boys, whereas, Word was the least preferred intelligence for boys, with ten classes scoring Word Intelligence as the least preferred. Although results vary slightly year to year, between 2003 and 2007, the preferred Body Intelligence result has dominated the results of our boys. Overall across the four years the boys in Kindergarten through to Year 6 also preferred using their Visual/Spatial, Mathematical/Logical and Interpersonal (self) intelligence. In almost every class more girls than boys preferred learning through the Interpersonal (people) Intelligence.

2.1.4 How do we use this information to Program for our Key Learning Areas?

After collecting our data from every child and having a greater awareness of how each child in our care thinks and prefers to learn, it was time to put the results and data into action. The MI focus was part of a larger Boys Education Action Research Project run by Mrs Suzan Hirsch. To begin the trial the Stage Three teachers began to program each Key Learning Area (KLA) using the Multiple Intelligence Approach. To begin, time was needed to reshape the format of our programming to incorporate Multiple Intelligences and hence an extra column was created in each of our programs where clear documentation of each dominant intelligence and how and where it was catered for could be easily seen. This documentation occurred next to each of our teaching and learning activities in order to check that each intelligence was represented equally throughout each unit so all children could be exposed to all intelligences, both their dominant and weaker intelligences.

The aim became to not change what was being taught but to change how it was being taught. It was vital to ensure that for every KLA all of the intelligences were used so that

every child's strengths were catered for but it was also important to expose the students to all the intelligences. In every unit of work the children should have the opportunities to learn through every intelligence and also have some menu board situations where they can chose their preferred intelligence for their learning.

The activities are all different and should engage different intellectual domains and different levels of thinking to cater for all the boys and girls in the class. By listening, praising and appreciating the boy's perspective being brought into these activities it gives the boys positive feelings about the strengths they bring from their male identity and their social context.

In order for the benefits of Multiple Intelligences to be successful, it had to underpin all aspects of learning including assessment and homework. We couldn't return to pen and paper testing as the only form of assessment when we were celebrating the differences in the way we think and learn on a daily basis. Multiple Intelligence Homework Task Cards were created on a different unit for each term. Each unit set of cards have at least three choices for each intelligence on that particular theme, they are laminated, brightly coloured and visually appealing. These task cards offer choices and are open-ended so that children have a range of opportunities to meet the objectives. The children present their MI task to the class every second Friday and evaluate their own task as well as their peers. The tasks are displayed around the room with pride, to inspire other children. This evaluation process and presentation focus is vital as it gives the boys a sense of purpose and a chance to gain recognition, feedback and praise from their peers.

By integrating Multiple Intelligence theory into homework this highlights to parents the benefits of this theory and increases awareness of what is being done in the classroom. Several well attended Parent Information Evenings were held to explain the Multiple Intelligence Theory, our actions and results to the parents and they were given an information brochure and surveys to take home.

Conclusion

Over the last four years this Multiple Intelligence approach to programming the curriculum has immensely benefited both the boys and girls in Stage Three and has now been implemented (in differing degrees) in every classroom. The increase in boy's engagement has been remarkable and noticed by the staff, parents and the students themselves. The boys work has increased in standard as has their effort. The girls efforts have also improved, but they were more engaged to begin with compared to the boys. The most common comments from the female students were about the boys. They commented on the lack of misbehaviour and interruptions from the boys, they too noticed that the boy's energy was now directed to their learning. Our yearly compulsory standardised Australian NSW tests, Basic Skills Test is taken in Year 3 and 5. Since the year we started using Multiple Intelligence Approach in our teaching and learning there has been a steady increase in results as shown in one example below:

Writing Plot Trend for ALL in Year 5
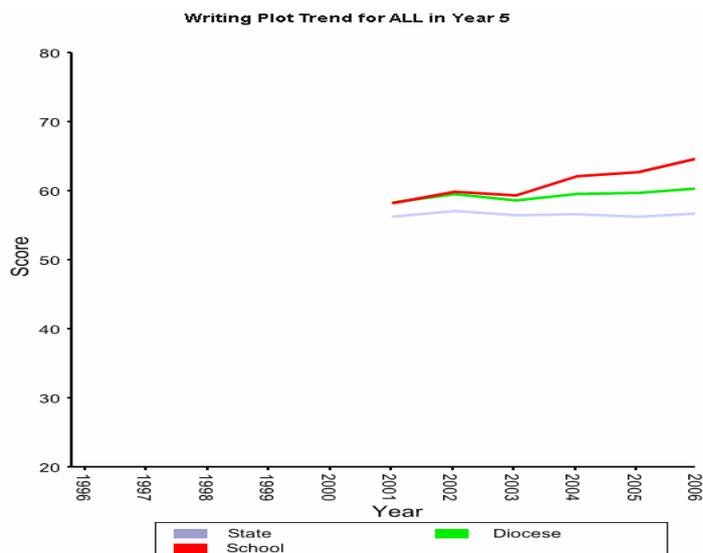
Left: NSW Basic Skills Test Graph from 1996-2006. Our MI focus in teaching and learning from 2003 has had a positive impact on our BST Results in all three tests: Reading, Writing and Numeracy for both our boys and girls.

Attitudes towards school have also changed as a result with the Attitudinal Survey results becoming far more positive for all students. By recognising the differences in our students at St. Patrick's Catholic Primary School, respect is being shown, relationships between teachers and students are strengthened and learning results increase. Although our Multiple Intelligence Approach was part of a Boys Education Initiative, as with all our Boys Education work, our female students also benefited from the approach as did the staff. We are all different, celebrating our differences is one part of the journey, catering to our differences is the critical component. After all, if we all think alike then no one in really thinking!

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Suzan Hirsch has a true passion for making schools a better place for boys. She has completed her Masters in Educational Studies, specialising in Boys' Education through Newcastle University and is currently working on her Phd. As well as being a full time teacher on Stage Three and a co-ordinator, Suzan has undertaken a number of boy's education initiatives at St. Patrick's Catholic Primary School, Sydney, Australia over the last four years. She was asked to lead a Boys Education Committee Project throughout three schools in the Diocese of Broken Bay throughout 2005, this project was extremely successful and won a National Award for Quality Schooling- Excellence in School Improvement. Following the success of the 2005 Project, Suzan is currently implementing Boy's Education Action Research Projects in twelve schools

throughout the Diocese. Suzan has had several journal articles published in the area of Boys Education and has presented her findings at a number of Boys Education Conferences in Australia.

Creative and Critical Thinking in the Context of Problem Finding and Problem Solving: A Research Among Students in Primary School

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Abstract

In the present research we are studying (on a sample of 153 students 6th grade) the relationship between the two forms of thinking: critical and creative, in the context of problem finding and problem solving situations. Our hypothesis is that when there is a change in the context of study (problem solving- problem finding), then the students' creative and critical way of thinking is differentiated, but these differentiations are not independent (statistically) between them. The results of this research reinforce those educational methods where thinking is cultivated holistically and is measured in terms of expression during particular learning experiences and not in terms of constant capacities.

Keywords: Creative thinking, critical thinking, problem finding, problem solving

1   Introduction

The sciences studying thinking in the educational field focus mainly on the development of critical thinking and less on cultivating creative thinking. The fact that scientific research distinguishes between these two levels, leads to the hypothesis that these are two different kinds of thinking or two kinds of thinking which demand different intellectual and therefore brain processes. However, a number of scientists consider that these two kinds of thinking should be studied either as parallel levels, or complementary, or even not distinct fields of thinking (Paul, 1993, Perkins, 2000, Runco, 1994a).

Instructional programmes drafted for the field of education usually aim at one or the other kind of thinking, or, at best, include parallel instructional performances which cultivate both kinds: in any case, the instructional experience which develops critical thinking is differentiated from that which fosters creativity (Hudgins & Edelman, 1986, Kagan, 1988, Nickerson, 1981, Yang & Lin, 2004). This is derived by the distinct methodological theoretical approach for each kind of thinking, where both critical and creative thinking are analyzed in the separate cognitive functions constituting each one of them (Norris & Ennis, 1989, Paul, 1993). The result of this methodological approach is that no common fields seem to exist, on a research and an empirical level, between these two forms of thinking, no matter how they are defined.

These last few years however, it becomes more and more evident that the distinction between the aforementioned forms of thinking is a methodologically artificial distinction (Marzano, 1998, Paul, 1993, Perkins, Jay & Tishman, 1993) rather than a real one on the level of intellectual brain functions. More holistic approaches of thinking pave the way to new educational programmes which do not aim at many different functions of one kind of thinking but exercise students' thinking in a holistic manner in different contexts and different kinds of instructional stimuli and experience (Bleedorn, 1993, Perkins, Tishman, Ritchhart, Donis & Andrade, 2000, Sternberg, 1997). The center of gravity seems to move from the artificial exercise of various intellectual functions to the authentic use of any intellectual functions in

different learning contexts with multiple demands and using multiple dispositions both as regards the content and the tools.

2 Objective – hypothesis and methodology of research

2.1 Objective

The objective of the present research is to study the relationship between the two forms of thinking, that is, critical and creative thinking. It will be conducted according to the different methodological approaches for each category of thinking separately. Both creative and critical thinking are studied in the context of problem finding and problem solving. The questions of the present research, coming from our daily contact with students both as teachers and researchers, are as follows:

We know from literature that the cognitive processes of creative and critical thinking are distinct. However, they present correlations, when the context of thinking demands changes from finding to solving. We wonder therefore whether we are not dealing with only partial functions of thinking which by themselves are not enough to describe the thinking phenomenon.

Thus, the objective of the present research, originating in our research questions, is to confirm of reject the working hypotheses, presented as follows:

A) The various intellectual processes assessed and attributed to each kind of thinking (creative – critical) are distinct processes corresponding to different intellectual functions [faculties] but not independent between them.

B) When there is a change in the context of study of creative and critical thinking – problem finding, problem solving – then the students' performances are differentiated, but these differentiations are not independent (statistically) between them

2.2 Sample

153 students (75 boys and 78 girls) in the 6th grade from 6 different elementary schools participated in the research (3 schools in Athens and 3 schools in the province). The total number of students in the 10 classes participating in the research was 188, but 35 students were not included, either because they were absent (26 of them) at some stage of the research, or because their participation (of the other 9) was deemed by their teachers and the researchers inadequate or not valid in relation to the conditions of the research (these students didn't follow the guidelines). These 35 students were evenly distributed in all 6 schools, so there was no impact on the results.

2.3 Procedure

The students were given a passage from an ancient Greek myth unknown to them, but the beginning and the end of the myth were not given and no one could infer that it was a myth. The plot in this passage was not clear: the problem was missing, as well as its cause, the characters were not clear either and the events were hovering between reality and imagination. And of course, the end, the solution was also missing. The students were asked:

1st PFCreative (problem finding – creative thinking) to formulate any questions they wished in order to understand what was going on in the passage.

2nd PFCritical (problem finding – critical thinking) to write afterwards their own scenario that could precede the passage and explain what was described in the latter.

The following day, the students were given the first part of the myth revealing the original story, without however revealing the end, the solution. Then the students were asked to:

3rd PSCreative (problem solving – creative thinking) to write as many original ideas they could on a possible ending of the story.

4th PSCritical (problem solving – critical thinking) to select and develop in writing their own original ending of the story.

The tasks of the first day incited the students to think about possible eventualities in an unclear situation and to thus identify elements of the problem (problem finding), whereas the tasks of the second day asked the students to provide solutions (problem solving) in the story. Each day's first task was graded based on the dimensions of divergent thinking, fluency, flexibility and originality, whereas the second tasks were graded based on the criteria of critical thinking.

2.4 Data collection means

2.4.1 Grading techniques

The two 'Creative' tasks (1st and 3rd) with the open-ended questions were graded regarding their fluency, flexibility and originality as suggested by Torrance in the Test of Creative Thinking – T.T.C.T. Each different idea received a grade for fluency, each idea from a new category received a grade for flexibility, and finally each idea given by 1 to 6 students received a grade for originality. These three cognitive dimensions of creative thinking have been used extensively in research for assessing creativity, and although they are not identified with creative thinking, they constitute basic indicators of it (Fishkin & Johnson, 1998, Mouchiroud & Lubart, 2001, Puccio & Murdock, 1999, Runco, 1994b). Based on these three dimensions a total creative expression indicator was calculated. .

2.4.2 Categories of critical thinking

The other two 'Critical' tasks (2nd and 4th) were graded based on 8 characteristics of critical thinking as defined by Ennis (1993, 1996), adapted accordingly for the demands of the present research. More specifically, the following characteristics – categories of critical thinking were identified in the students' written texts:

1. To seek a clear statement of the thesis or question. The character's actions (verbs). The actions repeated were recorded once.
2. To seek reasons: Sentences, phrases or statements that justify a person's actions (usually causative clauses or explicative ones with a causative nature).
3. To try to be well informed - Information within the context of reference: The words certifying that the author takes into account the information provided in the text as a reason and uses it to shape either the beginning of the scenario or the solution to it.
4. To try to be well informed - Information outside the context of reference: Words showing that the author uses additional information material (words – phrases) not mentioned in the text, but uses them in a productive manner (either to shape the beginning or the end of the scenario).
5. To use credible sources and mention them: Data pertaining to the shaping of the scenario were identified here (structure).
6. Relevance: Solution oriented to the myth-to the social convention: Total number of meanings referring to the means the problem is formulated or solved.
7. To seek as much precision as the subject permits: (accuracy) Proper exploitation of the information leading to the solution.
8. Open mind: Total number of sentences referring to the means of solving the problem. When this is outside the context of the myth or in general outside commonly accepted conventions it is classified into independent sub-categories.
9. Logical sequence: Search for a logical sequence in the structure of the text.
10. Respect of others: Sentences denoting that the author takes into account his public.

The check for regularity of the distributions showed that three out of these (open mind, logical sequence and respect of others) should have been excluded from the research because their distributions did not satisfy the demands for valid further statistical analysis. There were very few differences between the students' answers according to the histograms of frequencies. This exclusion didn't affect the results because we didn't unify the categories in order to compute a total critical thinking indicator.

3   Results

3.1   Critical and creative thinking.

The correlations (Spearman's rho) between the subjects' performance as regards the dimensions of creative thinking and critical thinking are presented in Table 1.

Table 1. Correlations between **Critical** and **Creative** thinking variables

Spearman's rho		PF Problem Finding				PS Problem Solving			
		Fluency	Flexibility	Originality	Creativity total index	Fluency	Flexibility	Originality	Creativity total index
PF **Problem Finding**	Clear statement	**.002**	**.143**	**-.010**	**.040**	.149	.111	.187*	.212**
	Seeking reasons	**.124**	**.094**	**.078**	**.114**	.210**	.242**	.065	.180*
	Meaningful information within the context	**.188***	**.230****	**.072**	**.189***	.225**	.012	.096	.159*
	Meaningful information outside the context	**.255****	**.351****	**.210****	**.308****	.324**	.240**	.278**	.337**
	Structure	**.183***	**.230****	**.142**	**.220****	.298**	.173*	.184*	.285**
	Relevance	**.203***	**.255****	**.189***	**.256****	.372**	.290**	.235**	.374**
	Accuracy	**.004**	**.116**	**.006**	**.039**	.112	.018	.068	.114
PS **Problem Solving**	Clear statement	.044	.107	.142	.116	**.038**	**.013**	**-.079**	**-.018**
	Seeking reasons	-.028	-.002	-.162*	-.068	**.241****	**.092**	**.104**	**.199***
	Meaningful information within the context	.072	.125	.120	.120	**.336****	**.236****	**.147**	**.273****
	Meaningful information outside the context	.118	.102	.035	.104	**.315****	**.214****	**.123**	**.234****
	Structure	.19*	.258**	.158	.244**	**.306****	**.339****	**.224****	**.342****
	Relevance	.085	.148	-.002	.095	**.185***	**.104**	**.110**	**.188***
	Accuracy	.100	.170*	.089	.131	**.225****	**.181***	**.158**	**.226****

Note: PF = Problem Finding; PS = Problem Solving;
*p < .05 ** p < .001

The statistically significant correlations appearing among the variables of creative thinking and the variables of critical thinking are very moderate, that is, around .20 and .30. Regarding

creative thinking, fluency and flexibility present more correlations with some dimensions of critical thinking, whereas originality has extremely few correlations and only with the information outside the context and the structure in both contexts (PF and PS) and with relevance and clear statement only in the context of PS.

Fluency and flexibility of the subjects' ideas for PF and PS are correlated mainly with variables of critical thinking in PF and PS respectively. The only variable of critical thinking not correlated with creative performance is clear statement. Seeking reasons and accuracy in PF are not correlated to creative performance in PF. However, fluency and flexibility in PS are correlated to critical thinking variables in PF. In other words, the students' performance in critical thinking in both cases, is mainly correlated to their creative performance in the context of problem solving.

3.2 Problem finding – Problem solving

The correlations of indicators of critical thinking between problem finding and problem solving are presented in Table 2, whereas Table 3 presents the correlations among the variables of creative thinking.

Table 2. Correlations between **problem finding** and **problem solving** in **critical** thinking variables

Spearman's rho		Clear statement	Seeking reasons	Meaningful information within the context	Meaningful information outside the context	Structure	Relevance	Accuracy
				PS	**Problem Solving**			
PF **Problem Finding**	Clear statement	**.159**	.108	.138	.072	.147	.189*	.278**
	Seeking reasons	-.025	**.124**	-.068	.091	.116	.031	-.043
	Meaningful information within the context	.071	.026	**.100**	.062	.119	.222**	.115
	Meaningful information outside the context	.174*	.134	.053	**.183***	.203*	.265**	.112
	Structure	.090	.139	.280**	.200*	**.119**	.218**	.222**
	Relevance	.183*	.214**	.132	.134	.150	**.260****	.141
	Accuracy	.206*	.097	.048	.018	.093	.173*	**.160***

Note: PF = Problem Finding; PS = Problem Solving;
*$p < .05$ ** $p < .001$

The students' performances as regards critical thinking variables are quite differentiated between PF and PS. Statistically significant correlations between them are indeed few and low. There are however, variables, which, although they are not correlated between them, have a statistically significant relationship with other variables between PF and PS.

Creative thinking variables have statistically significant correlations between them in PF and PS, varying between .32 and .46.

Table 3. Correlations between **problem finding** and **problem solving** in **creativity** variables

Pearson		**PS**	**Problem Solving**		
		Fluency	Flexibility	Originality	Creativity total index
PF Problem Finding	Fluency	**.319****	.333**	.314**	.385**
	Flexibility	.351**	**.368****	.382**	.445**
	Originality	.287**	.375**	**.397****	.429**
	Creativity total index	.345**	.400**	.405**	**.463****

Note: PF = Problem Finding; PS = Problem Solving;
p < .05 ** *p* < .001

4   Conclusion

The results confirm at large our hypotheses. The cognitive dimensions of creative thinking present certainly correlations with some of the dimensions of critical thinking, but these correlations are quite low; this is especially obvious when the students are thinking in the context of problem solving. Cognitive processes, consequently, have a common basis and elements that influence each other, nevertheless, they do not constitute a predictor for one another. When the students are thinking in a given context, they make use of various thinking processes and it is the interaction among them that yields the result.

The properties of critical thinking seem to be linked more to the creative abilities during problem solving rather than problem finding. The students' performance in the creative task of problem finding seems to be more independent than their performance in critical thinking tasks. Therefore, the context within which the students are thinking activates corresponding intellectual processes of creative and critical thinking, which are not independent from it. We end up with the same conclusion when we correlate the variables both of creative and critical thinking between problem finding and problem solving: low correlations denote that the change of context of reference modifies performance and activates in a different way the intellectual functions.

The conclusions of this research reinforce those educational methods that are not oriented to the exercise of a list of intellectual strategies of creative or critical thinking. Such educational methods, compel the students to face multiple instructional environments and multiple tools, that they are called upon to use in order to exercise their thinking, adapting its various functions to the different demands in a holistic way. Therefore, the research on teaching Thinking should turn from the exercise of isolated forms of thinking to various instructional environments where thinking is cultivated holistically and is measured in terms of expression during particular learning experiences and not in terms of constant capacities.

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Understanding the Creative Mind:
Portfolio Assessment in the Visual Arts

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Abstract
In evaluating creative performances among students in the Swedish compulsory school, the author tested four process criteria: investigative work, inventiveness, the ability to use models, and capacity for self-assessment. What will the correlation between different judges of students' portfolios become, when such criteria are included? Is there any improvement on these criteria from primary school to the lower secondary school? These are some of the questions that the author is attempting to answer.

Keywords: Assessment, visual arts, process criteria, rubrics, portfolios.

Case studies of artists (e.g. Arnheim, 1962; Josephson, 1984; Lindström, 1993a) and of children and young people (Taylor, 1986; Wolf, 1988; Wolf & Pistone, 1991; Lindström, 1993b-c) show that creative work has a number of dimensions, among them the ability to adopt a number of different stances or perspectives, to harness both cultural and social resources, and to pursue ideas for a period of time long enough to allow the sources of problems to be identified, and ways of solving them to be found. These performance or process qualities cannot be measured objectively. Neither can we measure the "beauty" or similar qualities of the finished product. Nevertheless, as John Dewey points out in *Art as Experience* (1934, pp. 298 ff.), this does not prevent us from employing various *criteria* to judge the qualities we appreciate in a painting or, for that matter, in an essay, a scientific experiment or a historical study.

In evaluating creative performances for Sweden's National Agency for Education in 1998 (Lindström, 2007), we tested *seven criteria*. Three of these concern finished products, while four concern the work process. The selection is based on objectives formulated in the national curricula, on qualities that are appreciated in the art world, and on research into the creative process (for a different, inductive method for defining criteria, see Lindström, in press). The *product criteria* comprise: (1) the visibility of the intention behind the picture or pictures (the student's visual work communicates what he or she intended); (2) colour, form, and composition (the student achieves desired effects with the aid of visual elements and principles); (3) craftsmanship (the student masters materials and techniques). *Process criteria* describe: (4) investigative work (the student pursues a problem across several works or experiments, feels challenged rather discouraged by difficulties); (5) inventiveness (the student sets up problems, tries new solutions, is willing to take risks); (6) the ability to use models (the student actively searches out models to emulate); (7) capacity for self-assessment (the student describes and reflects on different qualities in his or her work). In addition, we included (8) an overall judgement in which the teacher takes into account what degree of difficulty the student masters, his or her capacity to work independently and other factors of significance.

For each criterion the assessors had to choose between *four rubrics*, each with "plus," "medium" and "minus" (that is, a twelve-grade scale), presented in a teacher's manual. These rubrics describe levels of performance on an ascending scale. They correspond to the development from *novice* to *expert* outlined by the Dreyfus brothers (1986) and thoughts

about rubrics design put forward by Goodrich (1996), Wiggins (1998, pp. 153 ff.), and others. The development proceeds from solving simple tasks with assistance to tackling complicated problems in an independent and confident way.

Table 1. Process criteria with rubrics

Process criteria	Expert ← - Novice			
Investigative Work	Takes considerable pains, approaches themes and problems in several different ways and uses drafts, sketches or test work to develop the work.	The student does not give up in the face of difficulties, preferring to concentrate on a particular approach that she begins to develop and refine.	Demonstrates a degree of patience, tries out her own solutions and approaches, but does not develop them.	Gives up easily, does not follow her own ideas to completion, and only does what the teacher requires of her.
Inventiveness	Often sets up problems or reformulates the problems set by the teacher. Makes consistent progress and experiments regularly, is willing to take risks and often finds unexpected solutions to problems.	The student sometimes sets herself problems. She develops her knowledge, experiments fairly often and sometimes finds unexpected solutions to problems.	Can take a problem the teacher has set and change it slightly. Shows tendencies to experiment and play with colour, form and composition, or materials and techniques.	Does not set herself any problems, shows no sign of experimenting with colour, form and composition or materials and techniques.
Ability to Use Models	Actively searches out models to emulate and can use them in her work in a multifaceted, independent and well-integrated way.	Makes active efforts to find pictures for her own work. Demonstrates an ability to select images that suit her intentions.	The student shows an interest in other people's pictures that she or the teacher has found, but she confines herself to copying them.	Shows no interest in other people's pictures and cannot benefit from them even when the teacher has helped find them.
Capacity for Self-Assessment	Clearly identifies merits and shortcomings in her own work and can select sketches, drafts and works that illustrate her progress. Can justify opinions and explain why a particular result was obtained. Can produce qualified judgements of peers' work and contribute constructive criticism.	As a rule, manages to see for herself the merits and short-comings in her work, and can select sketches, drafts and works that illustrate her progress. Is beginning to produce qualified judgements of peers' work.	With some assistance, can identify her strengths and weaknesses and differentiate between good and less successful work. Her views about her peers' work are limited to subjective preferences (good/bad, like/dislike).	Cannot identify strengths and weaknesses in her own work or differentiate between good and less successful work. Has no views about the work of her peers.

The progression on our process criteria (Table 1) corresponds particularly well to the development from novice to expert described by the Dreyfus brothers (1986) and others. The elementary level (*novice*) is characterized by expressions such as, e.g., the student "does only

what the teacher requires." Descriptors at the next level include that the student can assess his or her work "with some help" and "take a problem the teacher has set and change it slightly." At the advanced level (*expert*), students develop the work on their own, set themselves problems to solve, actively search out models, can justify their preferences, and so on.

All student portfolios in our study were assessed independently by both the student's own teacher (the class teacher) and by a teacher who taught students of the same age at a different school (the co-assessor). The assessors used a teacher's manual containing our descriptions of the seven qualities characterising the creative mind and the four levels of performance for each of these criteria (Lindström, 2007, Chap. 5). They also judged, at each level on a criterion, whether the portfolio demonstrated a performance that was slightly below, on a par with, or slightly above the average described in the manual. As a result, the level on each criterion was assessed on a twelve-grade scale.

We compared the assessments of the class teachers and the co-assessors, applying all criteria on 458 portfolios, from the second, through the fifth and ninth grades (8, 11, and 15-year-olds) of the compulsory comprehensive nine-year school, to the final year (19-year-olds) or concluding courses in the arts programme of the upper secondary school.

The material studied consisted of *portfolios* whose contents, in addition to a final product, included sketches and drafts, reflections in logbooks, models used as sources of inspiration and a 10-15 minute videotape interview with each student. The portfolios documented the students' work over a period of 10 hours (nine-year comprehensive school) or 30 hours (upper secondary school). During this time, the students worked within a visual arts theme of a divergent nature, that is, a theme that could be approached in a variety of ways, which was selected by the teacher.

One of the methods we used to study the reliability of assessments was to calculate the frequency with which the judgements of the class teacher and the co-assessor differed by two steps or less. We considered a difference of two steps on a twelve-grade scale to be acceptable, particularly as the teacher's manual contained verbal descriptions of only four levels of performance. Even in cases where a difference of two gives a different standard, we regard this outcome as fully acceptable. After all, judgements contain a subjective element that defies precise verbal description; they presuppose that the teacher uses his professional judgement in interpreting criteria, levels and the content of portfolios.

We found a high agreement between class teachers and co-assessors in ratings of both the students' visual results (product criteria) and their approach to work (process criteria). In almost 3,100 comparisons between class teachers and the co-assessors from another school, there is 78 per cent agreement ($\leq$ 2 steps on a twelve-grade scale). Given that other discrepancies between the two assessors were small and indicate an approximately normal distribution, this may be regarded as a satisfactory result. Were we to consider a difference of three steps or less as negligible, which had not been unreasonable, then the level of inter-rater agreement would be as high as 90 per cent.

Thus, the study effectively refutes the idea that only superficial knowledge and skills can be assessed and evaluated. By using criteria related to visual design and students' work habits, we managed to evade the assessor's Scylla and Charybdis, that is, a tendency to place undue emphasis on students' skills in the use of materials and techniques on the one hand, and a judgement based solely on arbitrary preferences on the other.

The results of our study are in conflict with the view that process criteria are intrinsically difficult or impossible to assess. Extracts lasting about five minutes each, from 46 videotaped interviews, were converted to digital format. Together with the students' portfolios, these were put as illustrations on a CD-ROM that Leif Ulriksson produced as an appendix to the final report (Lindström, 2007). These interviews illustrate various dimensions of performance and demonstrate the kind of evidence on which students' portfolios were assessed.

A high correlation between independent judges is a necessary but not sufficient condition for assessment outcomes to be accepted as valid. Another condition is that the ratings on different criteria are independent. Everyday experience, as well as empirical evidence from a few similar studies (Hargreaves *et al.* 1996; Kárpáti *et al.* 1997), directed our attention to the risk that both the class teacher and the co-assessor form a general impression of a student's work, which then influences their assessment on each individual criterion. It is still interesting that the class teacher and the co-assessor often had a similar general impression of a portfolio. However, a tendency to over-generalise would make ratings on individual criteria less valid.

To examine this source of error, we recruited 30 students who were close to completing their training as art teachers. Each of them was asked to assess a large number of portfolios, including videotapes, using a single criterion. They were to ignore other aspects of the portfolios than those defined by that criterion. Thus a student art teacher judging pupils' "inventiveness" had to examine all portfolios from that viewpoint alone, and ignore, for example, how successful the final product is. The portfolios were anonymous, and were sorted in random order to make it more difficult to estimate the sex and age of the pupils.

Although this procedure took several days, it proved to be a good investment. A factor analysis (i.e., a statistical technique that allows for the reduction of variables representing a particular construct) supported the assumption that teachers' judgements were strongly influenced by their overall impression of a portfolio. However, with the more independent judgements that the student art teachers made, we obtained two main factors: "product criteria" and "process criteria". All the process criteria were loaded on a common factor, as were the product criteria. None of the seven process and product criteria appeared to be multidimensional, that is, to be a manifestation of qualities in both process and product.

This outcome supports the hypothesis, on which the present study was based, that creativity in the visual arts contains two main dimensions that must be considered separately when assessing students' work. At the same time, the results show that teachers need training in applying one criterion at a time, if they are to evaluate various qualities in their own teaching and give useful feedback to their students.

The outcome of the student art teachers' assessment indicates that pupils in the comprehensive school improve their visual design and artistic skills. That is, they make progress on two of the product criteria, one which describes elements and principles of design, such as colour, form and composition, and the other the use of materials and techniques (craftsmanship). However, with regard to process criteria, referring to their capacity to work independently, evaluate their work etc., students in ordinary comprehensive school classes appeared to stagnate or show only insignificant improvement (Table 2).

Table 2. Median values on criteria for creative skills in the visual arts in comprehensive school. Assessors: student art teachers (individual criteria) and class teachers (overall judgement).

	Visibility of the intention	Colour, form, and compo-sition	Crafts-manship	Investi-gative work	Inventive ness	Ability to use models	Capacity for self-assess-ment	Overall judgement
Grade 9	7	7	8	7	6	6	5	8
Grade 5	7	5	5	5	5	5	5	6
Grade 2	7	3	5	6	6	5	4.5	6

The process criteria show how well the school has achieved one of its overall goals: the development of students' creative skills from solving simple tasks with support to tackling

complicated problems in an independent and confident way. This is the very core of the development from apprentice to master, from novice to expert in a domain.

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The Multiple Intelligences Questionnaire (MIQ)
A Useful Tool in School Research?

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Abstract
The aim of the present study is to articulate implicit criteria used by teacher educators and professional artisans to assess expertise in craft & design. Two teacher educators and one artisan were asked to assess portfolios in metalwork consisting of finished products, sketches, and interviews about the working procedure. The paper shows how expertise, as construed by the interviewees, is related to a particular culture of learning and practice, including a disposition to use experience, knowledge and skills in specific ways.

Keywords: Assessment, craft & design, metal work, expertise, repertory grids

Introduction

IQ tests predict school performance with considerable accuracy. However, they have several shortcomings. First, they restrict the notion of intelligence to the capacities used in solving logical and linguistic problems. Secondly, they result in a single test score, but they do not provide useful feedback in terms of each individual's strengths and weaknesses. Thirdly, they are developed to predict SAT scores, grades, etc. but they are not useful for predicting students' experience of different subjects matters, although such experience have been shown to predict choice of further studies.

Howard Gardner defined intelligence as the ability to solve problems or fashion products that are of consequence in a particular cultural setting or community. Consulting evidence from several different sources, such as brain research, human development, evolution and cross-cultural comparisons, he finally came up with a list of eight intelligences: Musical intelligence, Bodily-kinesthetic intelligence, Logical mathematical intelligence, Linguistic intelligence, Visual-spatial intelligence, Interpersonal intelligence, Intrapersonal intelligence, and Naturalistic intelligence.

Gardner argued that these multiple human faculties are to a significant extent independent. This characteristic contrasts sharply with traditional measures of IQ that find high correlations among test scores. Inasmuch as nearly every cultural role requires several intelligences, it becomes important to consider individual profiles rather than focusing on a singular problem-solving faculty. Such profiles can be achieved by asking the individual to solve problems or create products using the materials of the intellectual medium. But equally important, Gardner contends, is the determination of which intelligence is favoured when an individual has a choice.

Gardner is a severe critic of pencil-and-paper short-answer tests, which he thinks reward a certain kind of decontextualized facility rather than the ability to solve problems in a contextually appropriate way. The Multiple Intelligences Questionnaire (MIQ), developed by the first author of the present study, is a pencil-and-paper inventory adapted for large scale use in situations where contextually appropriate ways of measuring would be too complicated and time-consuming. It is supposed to measure a combination of perceived talent, habits and interest within the eight domains described by Gardner in *Frames of Mind* (1983) and *Intelligence Reframed* (1999).

The purpose of this study is to find out whether MIQ would be a useful instrument in school research. We are studying reliability of the eight scales, i.e. the extent to which the scales are homogenous. Furthermore, we investigate the predictive validity of the instrument through studying the relationships between scale values and grades in various school subjects. Finally, we test whether the instrument would be useful in studying the relationship between Gardner's intelligences and 15-year old pupils experience of school and leisure activities.

Method

Sample
The study group was a random sample of about 200 students (the number of students vary over variables due to internal drop out) at year nine of the compulsory Swedish school, 15 years old, equally distributed on sex, taken from a municipality in central Sweden, including both a city and country areas. The students took part in an Experience Sampling study. They also answered questionnaires and tests, and information on background and school issues were collected from their parents.

Design
In the Experience Sampling Method (ESM) study hand computers were used to give questions at random times both at school time and at leisure time for about one week to the students. The Experience Sampling Forms (ESF) contained questions on activities/situations and how these were experienced. About 10.000 observations were answered, about 8.200 are used in the analysis in this report. Questionnaires and tests were given to students, and questionnaires to parents. Furthermore, register data (grades) were collected.

Variables

Independent variables
Gender: Female given score 1, Male score 0.
Foreign background: One or both parents with a non-Swedish background resulting in score 1, otherwise score 0.
Family education: A progressive scale from low to high education.
Family social status: A progressive scale, from low via middle to high social status. Note that some families could not be given a meaningful score, thus the number of internal missing values is high.

Raven's matrices: A non verbal general intelligence test that is considered relatively independent of cultural influence, scored from 1 to 9 according to stanine procedure.

Multiple Intelligence Questionnaire (MIQ) with eight subscales aimed at capturing various talents, attitudes and habits, each item scored from 1 to 5.

Psychometric properties, including Cronbach's alpha for the MIQ scales were satisfactory, with all alphas above .70, a cut off value often used for deciding if to judge a scale to be reliable, and thus to be used in further analysis. The lowest alpha was for Kinaesthetic (.71) and the highest for Naturalistic (.88).

Dependent variables
Engagement: Engagement is an index based on theory and research by Csikszentmihalyi and colleagues. It is constructed by taking the mean for three

experience variables in the Experience Sampling Form, namely Interesting, Concentrated and Enjoyed. Reliability measured with Cronbach's alpha was .78.

Engagement per subject and per lesson in total and leisure time in total: Engagement for a certain student and a certain discipline was calculated by aggregating the Experience Sampling Forms over the individual and discipline. The mean for all disciplines, and for all Experience Sampling Forms at leisure time, respectively, was also calculated. Note that the random sampling design meant that a varying number of students, for some disciplines a high number, did not answer any Experience Method Forms for a certain discipline. The number of observations (individuals) thus varies for these variables. However, for those students that do have data on Engagement for a certain discipline, the Mean could be based on one or several Experience Sampling Forms, giving the variable a high degree of information.

Grades per discipline and the sum for the 16 best disciplines were collected and calculated, respectively, from register data.

Statistical analysis

The objective of the analysis was to explore whether the Multiple Intelligence Questionnaire scales, under control for relevant background variables, predicted Engagement per subject and in total for School time and Leisure time, as well as Grades per subject and in total in a way that validated the Multiple Intelligence Questionnaire scales.

Multivariate regression with LISREL 8.7 was used, with background variables and Multiple Intelligence Questionnaire scales as independent variables and Engagement per subject and grades per subject, respectively, as dependent variables. All regression coefficients were estimated simultaneously (that is with control for the other variables in the analysis). Independent variables were assumed to be correlated, dependent variables were assumed to be uncorrelated in the model (an assumption of correlated variables would be meaningful and indeed essential in other contexts, but would here unnecessarily complicate the analysis).

Standardised regression coefficients are reported from the analysis, varying from -1.0 to + 1.0. Squared coefficients give the proportion explained variance of the dependent variable by the independent variable.

Results

Relationships between background variables and MIQ scales
In the following multivariate analysis, correlations between independent variables, for example between background variables and MIQ scales, are assumed, and estimated. They are not reported here.

Relationships between Background variables, MIQ scales and Grades
The standardised regression coefficients for MIQ scales and background variables predicting Grades per discipline were estimated simultaneously for all variables. The results were quite straightforward and tended to validate the content of the MIQ scales. MIQ Music was positively associated with Grades in Art and Music, respectively. MIQ Kinaesthetic predicted grades in Sports positively. MIQ Verbal was positively associated to grades in English, Mathematics and Swedish, respectively. The regression coefficient for MIQ Verbal to grades in Swedish was .58, indicating that about 33 % of the variance in grades in Swedish was explained by MIQ Verbal,

controlling for all other variables. This is to be considered a strong predictive relationship, taking into account that all other independent variables were used as control. MIQ Mathematical/Logical predicted grades in Mathematics positively.

Table 1. Relationships between MIQ scales and Grades per discipline, controlled for other background variables. Standardised regression coefficients. The column heads give the independent variables, the rows the dependent variables. Maximum number of observations is 200. Note: *) 5 % significant
**) 1 % significance.

Grades	Music	Kinaesthetic	Verbal
ENGLISH	0.06	0.04	0.43**
ART	0.17*	0.09	-0.01
SPORTS	-0.07	0.25**	0.02
MATHEMATICS	-0.07	0.03	0.18*
MUSIC	0.27**	0.07	0.21*
SWEDISH	-0.05	0.02	0.58**

Grades	Math./Logical	Visual/Spat.	Interrel.	Intrarel.	Nature
ENGLISH	0.12	-0.09	-0.21**	-0.06	-0.10
ART	0.05	0.07	-0.09	0.08	0.00
SPORTS	0.00	-0.09	0.00	0.09	0.05
MATHEMATICS	0.34**	0.00	-0.16*	-0.05	-0.06
MUSIC	-0.04	-0.04	-0.11	-0.04	0.03
SWEDISH	0.09	-0.05	-0.11	-0.05	-0.02

Relationships between MIQ scales and Engagement
The standardised regression coefficients for MIQ scales were estimated simultaneously for all variables, controlling for background variables, in predicting Engagement per discipline, and Engagement at school activities and at Leisure time, respectively.

Since the Engagement per discipline variables are based on means for each individual and each discipline, and the observations were done by random sampling, not all individuals did take part in each discipline when asked to answer the ESF during the study. Less than 100 students had experiences of Art, Sports or Music lessons during the study. We therefore refrain from interpreting the predictive associations from MIQ scales to Engagement in these disciplines.

For the remaining disciplines, English, Mathematics and Swedish, it was noted that Music predicted Engagement in the subjects English and Swedish negatively and significantly. Verbal significantly predicted Engagement in English, explaining about 25% of the variance in Engagement in that discipline.

There were no strong relationships between MIQ scales and School activities or Leisure activities.

In sum, the relationships between MIQ scales and Engagement seemed more complex than the more straightforward relationships between MIQ scales and grades.

Table 2. Relationships between MIQ scales and Engagement per discipline, controlled for other background variables. Standardised regression coefficients. The column heads give the independent variables, the rows the dependent variables. Maximum number of observations = 200. Note: *) 5 % significant **) 1 % significance. Disciplines with few observations are marked by *italic*.

	Number of valid Individuals for the discipline	Music	Kinaesthetic	Verbal
English_Engagement	129	-0.25**	0.10	0.48**
Art_ Engagement	*44*	*-0.12*	*0.20**	*0.10*
Sports_ Engagement	*76*	*-0.31***	*0.17**	*0.28***
Mathematics_ Engagement	141	-0.04	0.22**	0.07
Music_ Engagement	*49*	*-0.28***	*0.01*	*0.13*
Swedish_ Engagement	123	-0.28**	0.22**	0.11

	Mathematical Logical	Visual/ Spatial	Interrela-tionships	Intrarela-tionships	Naturalistic
English_ Engagement	-0.20*	0.04	0.11	-0.06	0.10
Art_ Engagement	*-0.02*	*0.13*	*0.09*	*-0.10*	*-0.07*
Sports_ Engagement	*-0.27***	*0.08*	*-0.06*	*0.23***	*0.19**
Mathematics_ Engagement	-0.03	-0.03	-0.05	0.11	0.13
Music_ Engagement	*-0.25**	*-0.02*	*0.17**	*-0.02*	*-0.06*
Swedish_ Engagement	0.07	-0.27**	0.12	0.07	0.04

Discussion

The main purpose of this research was to investigate the generalisability, namely reliability and validity of the MIQ scales. Cronbach's alphas for the eight scales indicated satisfactory reliability. A multivariate regression gave straightforward associations between MIQ scales and grades in different disciplines, controlling for background variables that could confound the relationships. The findings were in agreement with educational theory, thus verifying the validity of the scales. The associations between MIQ scales and Engagement in different disciplines, controlling for background variables, were more complex. Since there is no theory readily available for assessing the last results, it must be an aim for further research to develop such a theory and evaluate the validity of MIQ scales accordingly in relation to experiences of school and leisure activities.

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Appendix
Two MIQ scales

The Linguistic Scale

Books mean a lot to me.
I easily find the words when I am talking and writing.
I easily imitate other people's way of talking.
I am good at doing crosswords, solving puzzles and playing word games.
I appreciate puns, nonsense rhymes and jokes.
When I encounter a new word, I try to find out what it means.
I like using colourful words and expressions.
I find it easy to write letters.
I regularly read newspapers, magazines or other journals.
When talking to others, I often bring up things that I have heard of or read about.
People enjoy listening to me when I tell them something.
I often make notes or write down lists of things that I should do.

The Naturalistic Scale

I enjoy being outdoors in nature.
I notice weather changes and feel instinctively when they are going to happen.
I recognize and know the difference between common sorts of birds by looking and listening to them.
I like and am interested in both pets and other animals.
I am taking good care of animals and like being together with them.
I have "green fingers", i.e. I am good at cultivating things and get them to grow.
When I notice a plant or an animal species, I often try to find out what it is.
I recognize several constellations of stars in the heaven.
I enjoy finding patterns and relationships in nature.
I like to collect, sort and classify (group) objects.
I am good at finding mushrooms/berries in the wood and I recognize different sorts.
I have an engagement in environmental issues, which is based on experience and observation.

A Generic Model of Common Sense Applicable to Problem Solving or Product Development – Ideas as Precursors to Actions

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Abstract
In this paper we argue that common sense, documented in reflective proverbs and sayings, gives useful qualitative tools for problem solving or product development processes. The proverbs are chosen in a process analogous to the way a knowledgeable carpenter is choosing appropriate tools in his "problem solving" enterprise. Underlying the choices is the presumption of the wisdom extracted from the work of Jean-Paul Sartre and Martin Buber in five basic assumptions presented in the paper.

Keywords: Proverbs, problem solving, product development

1 Introduction

The simple and general idea presented in this paper is that all human endeavours, e.g. problem solving or product development, are driven by an interplay between ideas and actions. To start a resource-demanding endeavour you must have an idea of what to get out of it – you must have a goal or a purpose for your actions. This is the precursor to what will happen in practise in your attempts to reach the goals namely trials – and now and then mistakes! This paper will show that common sense knowledge documented from human history in proverbs and sayings are applicable ideas for implementing practical tools in a strategy to reach goals in general and in particular goals applied to product development processes.

2 Theory and basic assumptions

The notion of being an animal which has a mind is characteristic to human beings. Human beings have the ability to reflect upon strategies, ways of reaching goals and thereby the freedom of choice. This freedom, albeit confined to situational constraints, for choosing among alternative ways to reach a goal is comprehensively advocated by the philosopher Jean-Paul Sartre (Sartre, 2002, 1946; Börjeson, 2001; Lübeck, 1991; Østerberg, 1995) and his followers in the philosophy of existentialism. We may imagine alternative future scenarios from our standpoint in the present situation. We have a choice!

A1: Thus the first basic assumption for our discussion is that we have a choice.

The way we choose depends on what we think is best, from some point of view, and what is possible to accomplish depending on available resources – in essence people, tools and time. An important notion is that we do not comprehend, for obvious reasons (our senses, as well as our ability to process signals in our consciousness are limited), all the inherent complexity of hidden circumstances and possibilities characterising the situation we are facing.

A2: Thus the appreciation of hidden possibilities in the present unique situation and the nearby future is the second basic assumption to bear in mind when we seek solutions to problems – especially looking for innovative solutions!

Another aspect of human endeavours is that I interact with other human beings as well as with everything else in my world. Buber (Buber, 2002) has put explicit emphasis on those relations by forming the dyads I-You and I-It respectively. You interact with me in a way I cannot foresee and it is You who actively may determine "the force of that interaction"! As a human being I am acted upon by an active force or agent –You – whenever we recognize each other. The relation I-You in every meeting between people starts an interaction the result of which we cannot foresee in every detail. Likewise I interact with everything else in my world which according to Buber is an I-It relation which is a more passive interaction, where I actively can influence how much information or knowledge I may extract. The I-It-relation is a relation between I and an object and Buber makes us aware of the fact that we may treat our fellow human beings as objects too! Thus our relation to a fellow human being can be both an I-You-relation and an I-It-relation!

A3: Thus awareness of the significance of our interaction with other human beings and the world around us is the third basic assumption for this discussion.

A4: The forth assumption is the possibility that a relation to another human being can be either I-You, where I and You interact as human beings, or I-It, where You are an object to me. According to Buber it is You, as an active agent, who invites me to a relation I-You.

How do we act consciously? The basic assumption in this paper is that we can act consciously when we have embraced the situation at hand with intelligible thoughts occupied by words, symbols, sentences, assertions and conclusions following accepted rules of inference in our minds. Thus ideas, intelligible thoughts, of reachable goals and strategies, which we believe may lead to the goals are the precursors of the practical actions we pursue. When we do not consciously "think about" why we are performing certain actions we imitate what we already have learned or are ordered to do. Many actions in our daily life are pursued just out of habit, what we are used to do in similar situations, whether they are actions of unconsciously competent experts or by "followers" of learned behaviour from role models, masters or "leaders". The quality and inherent diversity of possible actions opens up for the conscious mind, whereas the unconscious mind probably acts like a machine according to learned habits or pre-programmed behaviour or forced by external agents. In both cases the outcome may be unpredicted results, but the conscious mind will probably be much more able to reach the perceived goal. The living creature versus a robot. If we can foresee the coming sequence of actions a robot (optimized!) will probably do the better job. But if we have to adapt to unforeseen actions and circumstances the human being will, we believe, be more successful (after all we have programmed the robots in the first place).

A5: Thus the fifth basic assumption in this paper is that ideas, conscious thoughts, are the precursors to conscious actions – the result of reflections of why we are acting as we do.

What is the general message of these assumptions? It is that every situation along the arrow of time is unique, experienced by people and in circumstances interacting in a way we cannot foresee in detail. As is said "The truth is in the detail", so details are important – they make the difference. People's conscious actions are guided by ideas, ideas of a problem, ideas about possible solutions, about potential tools to use, ideas of how to use a tool, ideas about other persons etcetera. And in every situation we have a choice, although not every choice is possible to realize at all times or at all. The message is also the importance of the interpersonal dialog – a dialog which in fact defines our view of the world, including our view of the current problem situation. These are all basic general assumptions applicable to all

human enterprise. Thus, they are underlying a wise problem solving procedure, as they are basic to the thoughts and the arguments in this paper.

3 A generic problem story

Let us imagine the following generic problem: A problem is posed to a group of people. A solution to the problem is the goal. We have restricted resources of people, tools and time. We are confined to pass certain gates (gates represent major decision points and are used in numerous models for product development processes by sholars and by companies in their practical work) on our journey to a solution. Let these gates; for the sake of argument be defined by the following questions:

G1: Show us the problem solving team.
G2: Show us a strategy for the problem solving
G3: Show us the tools you are intending to use
G4: Show us plausible solutions
G5: Show us a solution to the problem

Intelligible answers to a gate question are accepted passwords letting us pass to the next gate. The gate guards will examine the passwords with regard to their general wisdom – assembled through years of experience – in problem solving or product development. Of course a generic problem solving strategy only shows plausible ways to act. Explicit results are found using explicit problems and an actual problem solving process. The purpose of this paper is only to show the applicability of common sense ideas to the creation of practical tools for whatever problem. Now, let us look into the library of human proverbs and sayings to find reasonable passwords to pass the gates of our imagined generic problem. The reference for proverbs used is Martinsson (Martinsson, 1996).

3.1 Diggings from the library of human proverbs and sayings

The procedure pursued will be to show examples of proverbs that may be used as qualitative guides on our journey to solving a problem. Here, proverbs are used in an analogous way much as tools are employed by, for example, a competent carpenter. The gate guards comment on our answers and decide whether we may pass the gate or not.

3.1.1 G1: Show us the problem solving team

How should we choose a problem solving team? *Friends may meet, but mountains never greet* so certainly the team should by able to meet – as team friends. Of course *Every man has his faults* but *Evil communications corrupt good manners* and threaten to disintegrate good team work. In general team members should be wise because *A wise man esteems every place to be his own country* and, of course, *Union is strength* and *Good company on the road is the shortest cut* or otherwise *A house divided against itself cannot stand*. Diversity in the team opens up more opportunities. Thus, *It takes all sorts to make a world* and, of course, *He who has an art has everywhere a part* and *The workman is known by his work*. It is important to be aware of the fact that *Empty vessels (barrels) make the most noise (sound)* and *One rotten apple can spoil the whole barrel*, but also that hearsay may be a bad adviser, so *First try and then trust*. Generally we know that *Where there is a will there is a way* so *A living dog is better than a dead lion*. Also important to know is that *He gives twice who gives quickly* and *Wisdom is an age* – a mixture of ages is preferred. In general **willingness** – *Hunger is the teacher of the arts* or *It is easy to do what one's own self wills*, **curiosity** – *He that nothing questions, nothing learns*, **courage** – *He that fears leaves let him not go into the wood* or *He*

that will conquer must fight and **persistence** – *He that can stay, obtains* are important qualities of the team members chosen. ***Gate guards' comments:*** Your arguments are compelling. We find no reason to stop your efforts at this first gate. Please proceed to the next gate.

3.1.2   G2: Show us a strategy for the problem solving

It is important to try to establish milestones and deadlines because our time is limited and *One of these days is none of these days* and, of course, *Time and tide wait for no man*. But because *The unexpected always happens* it is important to show due respect to unforeseen problems. Also as *One hour today is worth two tomorrow* and *Time is money* and *The early bird catches the worm* we have to make the project duration as brief as possible. In planning for activities we must remember that *A chain is no stronger than its weakest link*; *Good works take long in doing*; *Seek mickle and get something. Seek little, and get nothing*; *Opportunity seldom knocks twice*; *You must not put all your eggs in one basket*; *You must sow ere you reap*; *You never know what you can do till you try* but also that *Circumstances alter cases* and *The tide must be taken when it comes*. In planning for individual work we have to consider that *He who begins many things finishes but few* and *What is a workman without his tools* so we have to plan for the application of appropriate tools and divide the work between team members wisely. In planning for milestones, deadlines and the decision making we must be aware of the fact that *Procrastination is the thief of time* and, of course, *Time is money*.

Well, these arguments are rules of wisdom that will guide our time planning and strategy in our problem solving process. ***Gate guards' comments:*** Your arguments are still compelling. We find no reason to stop your efforts at this second gate. Please proceed to the next gate.

3.1.3   G3: Show us the tools you are intending to use

It is important in the problem definition (product specification) to realize that *Old habits die hard* and *Like question, like answer* as to open our eyes to new possibilities in the problem definition and problem understanding phase. We have to be aware of that *Where we least think, there goes the hare away* but *You can have too much of a good thing* and *Not every change is for the better* so *Let sleeping dogs lie*; *Things are not always what they seem* and *A full belly does not understand an empty one* so *Hear all parties* and remember that *He that nothing questions, nothing learns* and *He that will eat the kernel must crack the nut*. In coming up with plausible solutions (product concepts) we understand that *Abundance is welcome* but solutions must be chosen according to specifications so *When in Rome do as Romans do* although *Appearances are deceptive* we know that form (design) is important because *The coat makes the man* and E*veryone after his fashion*. In choosing solutions we know that *The afterthought is good for naught* and *Facts speak louder than words (opinions)* so *A good example is the best sermon* but *The best cart may overthrow* but *The anvil fears no blows* (are the solutions robust designs?) and *Seeing is believing* (the tools should help showing working solutions); *Good cheap is dear* (the tools should help finding cost effective solutions) and *Good wine praises itself* (quality of the solutions are self-marketing). In general, of course, *Honesty is the best policy* in applying our tools and examining the results.

Well, these arguments are rules of wisdom that will guide us in choosing appropriate tools in our problem solving process. ***Gate guards' comments:*** Your arguments are still compelling, discussing a generic problem solving process, so we find no reason to stop your efforts at this third gate. Please proceed to the next gate.

3.1.4 G4: Show us plausible solutions

When showing plausible solutions to a problem (or introducing concepts in a product development process), it is important to be aware of the fact that *Truth will come to light* sooner or later … so *Gut no fish till you get them* and because *A chain is no stronger than its weakest link* you have to prove the ability of all links in your solutions. But in that process we must make sure that you *Do not kill the goose that lays golden eggs*. But your plausible solutions should be appropriate and wise *Do not cast your pearls before swine* and, of course, *The cowl does not make the monk*. But don't be too afraid as *Fortune favours the bold* and, of course, it is important to deliver in time because *First come, first served*. In general, *Do well and have well* and *A clear conscience fears no accusations*. In showing the strength of your plausible solutions to your employer, client or steering group you know that *Seeing is believing* (show the working solutions!) and *Afterwit is everybody's wit*!

Well, these arguments are rules of wisdom that will guide us in showing plausible solutions to our problem. ***Gate guards' comments:*** Your arguments are still compelling, discussing a generic problem solving process, so we find no reason to stop your efforts at this fourth gate. Please proceed to the final gate.

3.1.5 G5: Show us a solution to the problem

All rules of wisdom presented in the previous gate (G4) are, of course, appropriate but in demonstrating a solution to a problem (or embodied concept in a product development process) you must be absolutely aware that *All things come to an end*; *Want is the mother of industry*; *Better a small fish than an empty dish*; *Provision in season makes a rich house*; *Other times, other manners* and remember *Cheapest is dearest*.

Well, these arguments are rules of wisdom that will guide us in showing a solution to our problem. This gate also finishes our generic problem story. After the final comments from the gate guards, we will discuss the whole process and reflect on the results arrived at.
Gate guards' comments: Your arguments are still compelling, discussing a generic problem solving process, so we find that you have been able to pass also the fifth gate. Congratulations, you have proved, according to our wisdom and experience in problem solving, that the wisdom inherent in proverbs and sayings provide good general rules to follow in a wise problem solving process.

4 Discussion and conclusions

We have argued that generic principles or guidelines for problem solving are to be found in the well of reflective proverbs assembled from human experiences in a variety of human enterprises. These guidelines have, of course, no meaning – are useless – for humans without prior knowledge. Principles should be judged and applied as relevant to the problem situation at hand. There are, of course, contradicting proverbs. But that does not reduce the value of the proverb tools, because different circumstances may demand different tools. Because the hammer (but not the saw) is an inappropriate tool for a carpenter to cut a piece of wood doesn't make it (but the saw) useless for assembling wood pieces with nails. Because water is essential for the human body doesn't mean that drinking water always is the right "tool" – it may kill you. Looking at guiding principles from the knowledge domain of product development you might find conclusive (from empirical findings) propositions like: "1. New Product Success is highly situational. 2. No one factor can be clearly defined for New Product Success." (Owens & Cooper, 2001). You don't need much understanding of the complexity of product development and volatile markets to agree with those generic statements. And analogous proverbs "confirm" the common sense nature of such statements. E.g. for

conclusion #1: *Circumstances alter cases; There is nothing permanent except change; The unexpected always happens; No pains, no gains; Nothing is certain but the unforeseen; What may be done at any time is done at no time; Time will tell; In doing we learn; If at first you don't succeed, try, try, try again; He that would have the fruit must climb the tree; Failure teaches success!* E.g. for conclusion #2: *You must not put all your eggs in one basket; Half the truth is often a great lie; All good things go in threes; All roads lead to Rome!* As a matter of fact many scientific papers on product development are sprinkled with conclusive guidelines of the "common sense" type easily found in proverbs. What might that infer? A plausible hypothesis (which is the idea behind this paper) is that human enterprises like problem solving or product development infer similar types of "common sense" guidelines, which already have been collected in reflective proverbs from the history of human experiences. And, common sense, documented in proverbs and sayings, consists of wise thoughts often born out of hard individual experiences, which adult human beings easily can adhere to and appreciate. Those tools are at our disposal for adult human beings, if we are conscious of the generic structure of the problem situation we are facing – if, indeed, we *Can see the wood for the trees*!

But deep simple truths are seldom self-evident in practice. They seem to be buried so deep in our behaviour as human beings, that we are not consciously aware of them. That's an example of the important difference between passive and active knowledge.

In this paper Jean-Paul Sartre, Martin Buber and the reflective thoughts collected in proverbs are messengers of such deep simple truths, which when they are made active in our minds may make an important difference in the quality of our human behaviour. This consciousness may give extra quality to all our endeavours in general and to problem solving or product development in particular. We have argued that common sense, documented in reflective proverbs and sayings, with the underlying presumption of the wisdom extracted from the work of Jean-Paul Sartre and Martin Buber in our five basic assumptions, give us useful qualitative tools for problem solving or product development processes.

As a consequence the discussion and the conclusions in this paper are very simple and straight-forward. Or as a proverb tells us: *There's no disputing a proverb, a fool, and the truth*.

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Building Thinking Skills in Thinking Classrooms:
ACTS in Northern Ireland

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Abstract
A longitudinal evaluation of the effects of a metacognitively-rich pedagogy on children's thinking skills in primary classrooms in Northern Ireland is reported (ACTS – Activating Children's Thinking Skills). Participating in ACTS produced positive changes in children's self-evaluations of their learning and thinking strategies. However, the changes took time to build and were not even across all learners. The implications for classroom practices for teaching thinking, and for school reform, are noted.

Keywords: Metacognition, thinking skills, pedagogy, primary school, evaluation

1   Introduction

The purpose of the paper is to present some of the findings from the ACTS (Activating Children's Thinking Skills) project in Northern Ireland. This project was designed to create and develop teaching methods to improve learning in primary schools, through enhancing children's thinking skills across the curriculum. Three strands of investigation were pursued. The first strand comprised the main study: it evaluated an intervention process to enhance 8-11 year old children's thinking and learning, and the effects on both pupils' and teachers' learning were appraised. In a second study, thinking lessons were video recorded to identify features of classroom dialogue likely to mediate the development of metacognition. The final strand aimed to design a professional development programme for teachers, to write curriculum materials, and to create longer term strategies for sustaining thinking classrooms. This paper presents the outcomes for children's learning only (the first strand).

The project was funded by the United Kingdom's ESRC Teaching and Learning Research Programme (TLRP), with additional funding from the Department of Education in Northern Ireland, from the Educational and Library Boards, and from the Curriculum Council (CCEA).

Further details of the project are available from:
www.sustainablethinkingclassrooms.qub.ac.uk

2   The Framework

It is generally agreed that children cannot become better thinkers – able to give reasons for their conclusions, to think flexibly and creatively, to solve problems and make good decisions – solely by learning a content-based curriculum. We must make clear what we mean by these different forms of thinking and set out to teach them more explicitly than we normally do in classrooms.

Various models of thinking can be used to guide such teaching. A core distinction is between 'enrichment' and 'infusion' approaches. Enrichment approaches generally draw on a

specific cognitive theory. Lessons are pre-designed and are taught in parallel with existing ones. Examples include Cognitive Acceleration programmes (Adey & Shayer, 1994; Shayer & Adey, 2002) and Instrumental Enrichment. In contrast, infusion approaches place thinking in the context of normal curricular topics so that topic understanding and thinking can be taught simultaneously. Infusion can be subject-specific (science, mathematics, history) or may be developed on a wider scale across the curriculum (see McGuinness, 2005 for a further elaboration)

It has been argued that infusion across the curriculum is a good strategy for developing 'intelligent' novices who can recognise and use common patterns of thinking, deepen their understanding of curriculum topics, make connections between them, and thus be a position to capitalise on new learning opportunities (Bruer, 1993). ACTS (Activating Children's Thinking Skills) adopted an infusion approach and built on the work of Swartz & Parks (1994) and Tishman, Perkins & Jay (1995) in the US.

Figure 1 shows the ACTS thinking framework. It includes a range of different types of thinking. For example, they include pattern-making through analysing wholes and parts, noting similarities and differences (Searching for Meaning); making predictions and justifying conclusions, reasoning about cause and effect (Critical Thinking); generating ideas and possibilities, seeing multiple perspectives (Creative Thinking); solving problems and evaluating solutions (Problem-Solving); weighing up pros and cons, and making decisions (Decision-Making). The types of thinking identified in the framework formed the basis for designing infusion lessons. At the heart of the framework is a different type of thinking – metacognition. Metacognition refers to learners' capacity not only to engage in these explicit forms of thinking but also to use their emergent knowledge about thinking to plan, monitor and adjust their future learning and thinking. Thus metacognition has potential to facilitate the transfer of learning.

Several different theoretical meanings of metacognition, related to both individual and social learning, were drawn upon in the project. The ACTS Thinking Framework was derived from a cognitive perspective and acknowledged the importance of metacognition for cognitive development - not only as a *product* of development but also as potential means for fostering development. Within the cognitive developmental tradition, Kuhn (1999) has most recently articulated that position but it can be traced back to Flavell's original writings.

How can the ACTS Thinking Framework be harnessed pedagogically? In our work this required two theoretical shifts. The first shift was from considering metacognition as 'revealing' cognitive development, to a more constructivist perspective on metacognition as fostering or 'creating' development. The second shift acknowledged the power of social learning as a mediator for metacognition and the perspective shifted to social-constructivism, particularly to the role of classroom dialogue (e.g., Mercer, 2000; Wells, 1999). Hence language and dialogue were of primary interest in the video study. Finally, as our ultimate goal was that the ACTS intervention should have an impact on children's capacity to manage their own thinking – to think independently - we linked the concept of metacognition within a broader cognitive-motivational framework of self-regulation (e.g., Boekaerts, 1997). The concern with fostering self-regulation represents a convergence of many different theoretical perspectives (Piagetian, information-processing, Vygotskyan, motivational and self theorists). Thus, the research findings reported in this paper relate to the impact of the ACTS pedagogy on cognitive and motivational indicators of children's learning and thinking.

Figure 1. ACTS Framework for Thinking

Searching for meaning

Sequencing, ordering, ranking Sorting, grouping, classifying Analysing, identifying parts and wholes. Noting similarities and differences. Finding patterns and relationships. Comparing and contrasting.

Critical thinking

Making predictions and formulating hypotheses. Drawing conclusions, giving reasons. Distinguishing fact from opinion. Determining bias, reliability of evidence. Relating causes and effects, designing a fair test.

Metacognition

*Planning
Monitoring
Redirecting
Evaluating*

Creative thinking

Generating ideas and possibilities. Building and combining ideas. Formulating own points of view. Taking multiple perspectives and seeing other points of view.

Decision making

Identifying why a decision is necessary. Generating options. Predicting the likely consequences. Weighing up the pros and cons. Deciding on a course of action. Reviewing the consequences.

Problem solving

Identifying and clarifying situations. Generating alternative solutions. Selecting and implementing a solution strategy. Evaluating and checking how well a solution solves a problem.

3   Working with Teachers

134 teachers of different ages and years of teaching experience participated in **five** ACTS professional development days sustained over the school year (September- June). During that time they learned about the ACTS framework, how to design infusion lessons, and how to adopt more metacognitive approaches to their teaching.   The professional development which they received was based on the notion of teacher collaboration. Teachers planned, designed and taught infusion thinking lessons to 8-11 year old children (Key Stage 2 in Northern Ireland) from a variety of social backgrounds. Infusion lessons were taught across all areas of the curriculum and integrated into schemes of work.

4   Methods

4.1   Design and Sample

In the main intervention study, comparisons were made between three groups of children. Two groups of children participated in ACTS for different lengths of time: one group for three years (N=292, 12 classes) and another group for one or two years (N=412, 17 classes). Children from these ACTS classes were compared with a third group of similar children from **different** schools who were not taught using the ACTS pedagogy (N=548, 25 classes). The children's learning from all groups was tracked longitudinally over three years.

4.2 Measures

In terms of evaluating the impact of the ACTS intervention on children's learning, we positioned our analyses within a more learner-centered framework that included both cognitive and motivational constructs. We used a suite of self-assessment inventories, Assessment of Learner-Centered Practices, ALCPs (McCombs, 1997) developed from the American Psychological Association's learner-centered principles (www.apa.org/ed/lcp.html). Seven scales enabled pupils to evaluate their learning (rated on a four-point likert scale) with regard to a range of cognitive and motivational constructs called - *Active Learning Strategies (cognitive and metacognitive), Knowledge Seeking Curiosity, Task Mastery, Performance-Oriented Goals, Effort Avoidance Strategies, Work Avoidance Goals, and Self-Efficacy*. Subsequent psychometric evaluation showed that the scales had good internal reliabilities for the Northern Ireland sample at all ages (ranging from .57-.86, with the vast majority being over .75).

4.3 Statistical Analyses

Latent growth analyses were carried out on the longitudinal data at four time points. The predictor variables in all analyses of outcome variables were Intervention (ACTS 3-Years, ACTS1/2 Years, No intervention), gender (girls/boys); age in class (varied by 12 months) and percent free schools meals (measured at the level of the class). Exploratory graphical and statistical analysis indicated that developed ability, had a potent and potentially non-linear effect on many of the pupil outcome variables. For this reason, separate analyses were carried out on Low, Moderate and High Ability groups. All analyses take the clustering of the data at the level of class into account.

5 Results and Discussion

One of the most important findings relates to the pattern of change over three years in **children's self-ratings** on three ALCPS scales – *Active Learning Strategies*, *Effort Avoidance Strategies*, and *Work Avoidance Goals* – identified through latent growth modeling. Participating in ACTS had a statistically significant positive effect on how children rated themselves with regard to their use of cognitive and metacognitive strategies, their willingness to work harder and to put in more effort. For example, ACTS children rated themselves higher than control children on items such as "I ask myself questions when I do my work to make sure I understand", "I spend some time thinking about how to do my work before I begin it", and they rated themselves lower on items such as "When I do work I just want to get it done as quickly as possible". **We have identified this pattern of change as a 'pro-active' learning effect.** Overall, girls rated themselves more positively than boys on the learning scales, but the pro-active learning effect was similar for both groups

There are important qualifications to this general conclusion. The pattern of change took time to build and those children who participated in ACTS for three years benefited most – there were few effects for those who participated for one or two years. In addition, the positive benefits were not even across all learners. Moderate to high ability children (who represented 80% of the sample) benefited most. No positive outcomes were identified for lower ability children, at least on these self-rating measures. However, when poorer children were given problems to solve, they did show positive changes in their strategies compared to control children, but these specific achievement did not translate into how the children rated themselves more generally.

While all of the self-rating measures were significantly correlated with measures of attainment in reading and mathematics, the effects were small when compared to the impact of other variables such as prior ability. Consequently, the positive *changes* in children's self-

ratings had only weak effects on attainment, although they were statistically significant in some cases.

A final word about the images of active learning that underpinned this project and how they contrasted with more passive images of learning that can dominate a content-based curriculum. Learners were viewed as potential agents in their own learning and expectations were set for high quality thinking and learning. Learners were considered as capable of being both mindful and resourceful about their learning and were encouraged to participate in joint meaning making. In terms of the findings, the image was not fully realised in all the children's experiences, yet it did prove possible to 'turn around' a large number of children to be more proactive about their learning and thinking. We also found that teachers experienced important changes in their images of themselves as teachers. They described an increased awareness of the importance and value of teaching thinking, of being more open to alternative approaches and allowing children to be more independent in their learning.

National curriculum planners across the UK and elsewhere are now engaged in revising and redesigning their curricula and writing guidance materials to help schools move in the direction of developing children's thinking. The methodology and findings from the ACTS project are informing their policies and practices. The biggest challenge will be to find ways of making long-lasting changes to classroom pedagogy so that children's capacity to become independent and self-regulated learners can be promoted and sustained. The research findings from ACTS give some direction with regard to a theoretical approach, curriculum planning and classroom pedagogy but they also show that there are no quick fixes.

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From Passive Consumers to Active Producers: Students as Co-Teachers in a Popular Music Program

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Abstract

This paper considers one example of the new roles that are emerging in schools and universities as a result of shifts that are taking place in the nature of pedagogical work. It examines ways in which both learners and educational leaders are working pro-actively as players not pawns in the educational game. Implications of this for thinking about the nature and purposes of formal education are discussed.

Keywords: Student engagement, self-directed learning, reflection, peer assessment.

1 The problem

The paper below responds to the problem of how to set up a learning environment that is more appropriate to the pedagogy of a popular music degree program than a master-apprentice model. It documents a study conducted by one Conservatorium music teacher into his experimental model with students as 'co-teachers' in a popular music program currently being offered at the Queensland Conservatorium of Music (QCM). It is program that in many ways exemplifies the shift from students as musical apprentices receiving wisdom from expert teachers to students as co-producers, assessors and users of the cultural products that are learning outcomes of the pedagogical work. For Don Lebler, coordinator of the program and a co-author of this paper, the idea that students should look to him for mastery of what is in essence their own cultural field of play, is patently absurd.

2 Background

Shifting from student-as-passive-consumer to student as-active-co-teacher has not been easily achieved, despite all the reasons why it is so appropriate in this case (Lebler 2006). It is not simply that the QCM, with its long-term investment in time-honoured traditions of master-apprentice pedagogy, militates against such 'democratisation' of their programs. It is also that in-coming students themselves anticipate, understandably, that they will be actively taught and assessed by an expert musical educator. One of the most difficult issues for contemporary education is to overcome the deeply embedded notion that teachers ought to know more about their subject matter than their students. It is not just that those outside the profession have this

expectation; teachers themselves expect to know enough to provide considered answers to student questions. Whether or not we view teachers as the sage on the stage or the guide on the side (or a bit of both), teachers are still generally expected – and expect themselves – to earn their keep by being 'ahead' of their students in terms of their overall knowledge base.

A corollary of the idea that teachers ought to know more than students is the idea that teachers should provide the starting point for learning activities, and that students should engage in the tasks set by the teacher – ie, that students should follow where teachers lead. In light of shifts in the social nature of knowledge exchange itself, we argue that it is time to re-think this idea (see McWilliam, 2004). Public policy analyst Gregory Hearn's (2005) points to "an emerging fundamental shift in the way that value creation is thought about in business" (p.1), and the conceptual architecture he provides in his analysis is very helpful for re-thinking the teacher as 'out in front' and the student as 'following'.

Central to Hearn's thesis are a number of specific shifts that he describes as characteristic of "value ecology thinking" (p1). Among these shifts he includes the shift from consumers to co-creators of value, and the related shift from value chain to network. Hearn makes the point that consumption is no longer essentially passive in character – that after a generation or more of 'couch potato' inactivity at the end of a supply chain where the product to be consumed arrives as a final product, we are now seeing patterns of distribution and consumption being developed that allow consumers to add value or finalise and so value-add to the product. In Lawrence Lessig's (2001) terms, the user becomes the producer.

Research literature claims benefits for more active student engagement, including an enhanced ability in students to monitor their own progress more effectively (see, for example, Blom & Poole, 2004; Boud, Cohen, & Sampson, 1999; Daniel, 2004; Gijbelsa, Wateringb, & Dochy, 2005; Hanrahan & Isaacs, 2001; Liu, Lin, & Yuan, 2002; McLaughlin & Simpson, 2004; Sadler, 2005; Struyven, Dochy, & Janssens, 2005). This is easier said than done, however. Whether or not it was achieved it in this popular music program of learning is the object of the study set out below.

3   Method/Findings

To track the means by which students moved from passive consumer to active co-teacher (ie, "prod-user") in the program under study, the team collected data at the three stages John Biggs (1999) has identified as crucial to the learning process: the Presage (or antecedents), the Process (or Pedagogical work) and the Product (both creative works and identity formation).

3.1 Presage

Sixty-five students who were enrolled in the program at the start of 2005 were surveyed about the ways they had learned music before coming to university. They were asked about the activities they had engaged with, how much (if any) private tuition had been taken and what sorts of feedback they had relied on to guide their development.

The fact that the program in question focuses on popular rather than classical music does make for a somewhat different cohort of students in terms of their prior learning. As Figure 1 shows, the capacities that are already so well developed in these students have not come, in the main, from 'master teachers' – a majority enrolled in 2005 had taken fewer than 50 private lessons and more than a quarter had taken fewer than ten.

Moreover, the cohort was characterised by the breadth of their musical experiences – more than three quarters of students having been singers and almost as many having played guitar, while other common popular music instruments (including

Figure 1

Number of lessons

116
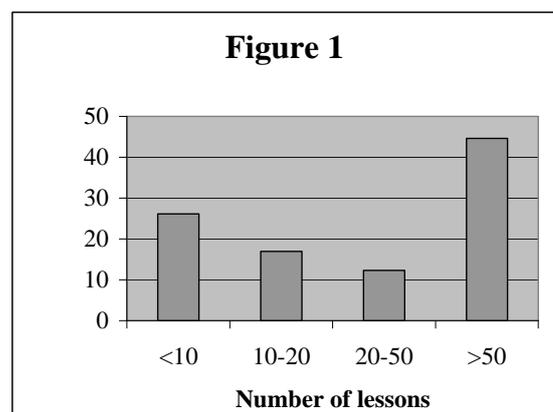
music-making using computers) were also well represented. Indeed, less than one tenth of students reported being active in only one of the categories of music making activities listed in the survey, and almost three quarters were active in three or more areas.

As evidenced in Figure 2, almost all students indicated that their own opinions were the most often used source of feedback prior to entering the program. By comparison, feedback from bandmates, audiences, friends and audio recording all outranked teacher feedback as something students relied on. Over three quarters of the cohort reported that being in bands outside school had played a part in their musical development.

Figure 2
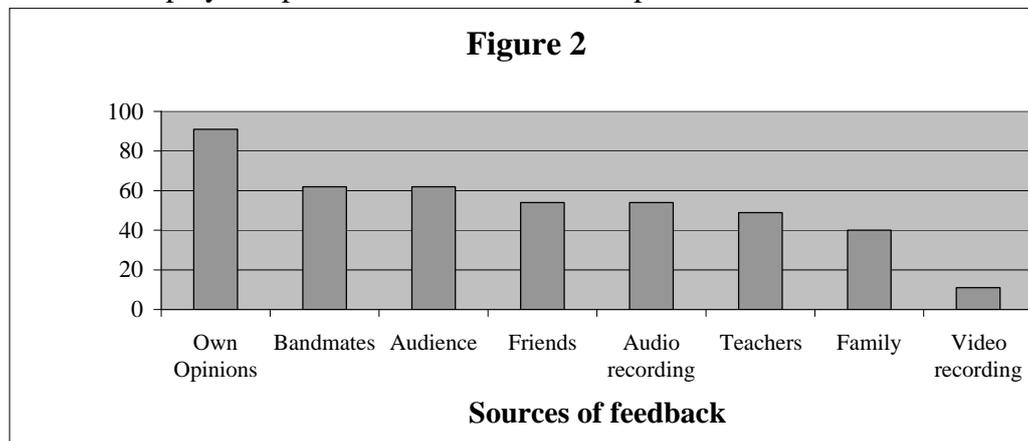
The breadth and informality of their prior learning experiences might well be regarded in more traditional contexts as impediments to excellence – too much diffusion, too little discipline. The approach taken in this case, however, in contrast with perhaps a more predictable 'reining in' or formalising of the learning, was to insist on the importance of these same pedagogical processes – those that had framed their learning experiences before entering the QCM – and to seek to duplicate these in the program itself. In simple terms, this meant preparedness to put self- and peer- teaching and evaluation at the centre of the pedagogical culture. The students would be respected for what they knew and at the same time challenged to grow in terms of their musical understanding and productivity. The challenges would come in large measure from the students' individual and collective ability to critique their music making and to engage closely and constructively with the work of their peers.

3.2 Process

The invitation to self-and peer evaluation should not be understood as welcomed by all students on first meeting for its more 'democratic' orientation to the learning process. Disappointment was expressed at times by those who felt that legitimation of their work could only really come from the Master teacher. Nevertheless, the gentle but firm refusal of the teacher to teach as Master, when combined with the rich technological resources of the studio, combined in the short or medium term to counter such resistance. Many students who had been sceptical in the initial stages went on to engage pro-actively in a rigorous process of self- and peer-assessment. Evidence of the level of engagement was captured in a study of the efficacy of the peer feedback program conducted in semester 2 2006 over a three-week period from week 6 to week 8, the normal class time being devoted to the playing of recorded works-in-progress so that students could provide feedback through the on-line course discussion board. As shown in Figure 3, a total of 49 songs were presented, with 58 students engaged in providing collaborative feedback out of a total enrolment of 75.

Figure 3
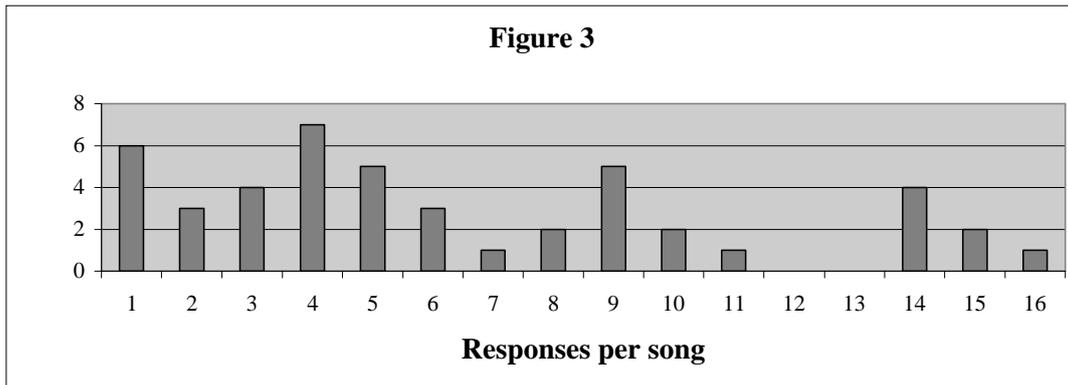
Responses per song

This process generated informal verbal feedback, and although that is valuable, the more formal process of the discussion board was of more interest to the study. There were nearly three hundred responses posted, an average of six per song. Three or more responses were posted for more than 80% of the songs presented, clear evidence of the preparedness of many in the cohort to 'buy in' to the collaborative evaluation process. Overall, nearly seventeen thousand words of feedback were provided by 42 students, 29 of whom responded with five or more postings, the requested level of participation for all students (see Figure 4).

Figure 4

Responses per student
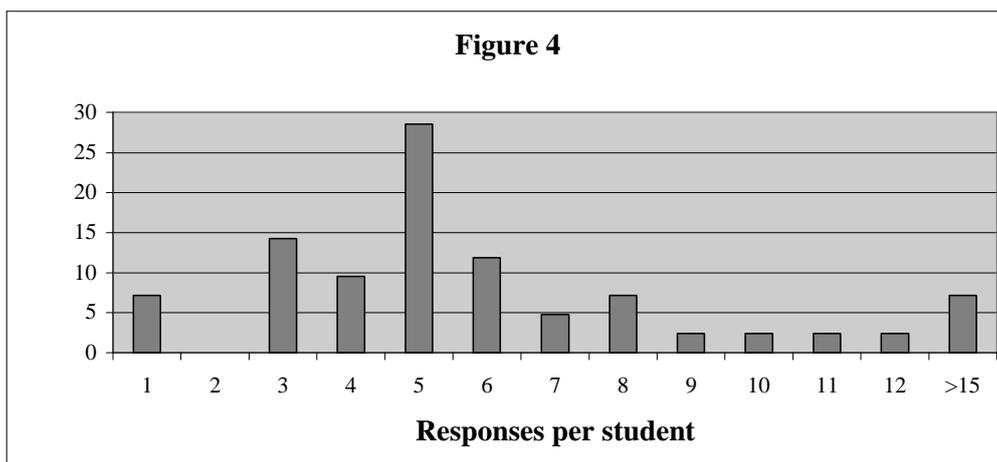
The overwhelming majority of this feedback was well presented, framed with positive comments at the start, making observations on possible areas for further attention, and finishing on a positive or encouraging note, always with benefits for the receiver being the objective. There were a few instances of very brief comments and occasional use of 'Master' tone, but almost all the feedback was encouraging. The length of responses is represented in Figure 5 below.

Figure 5
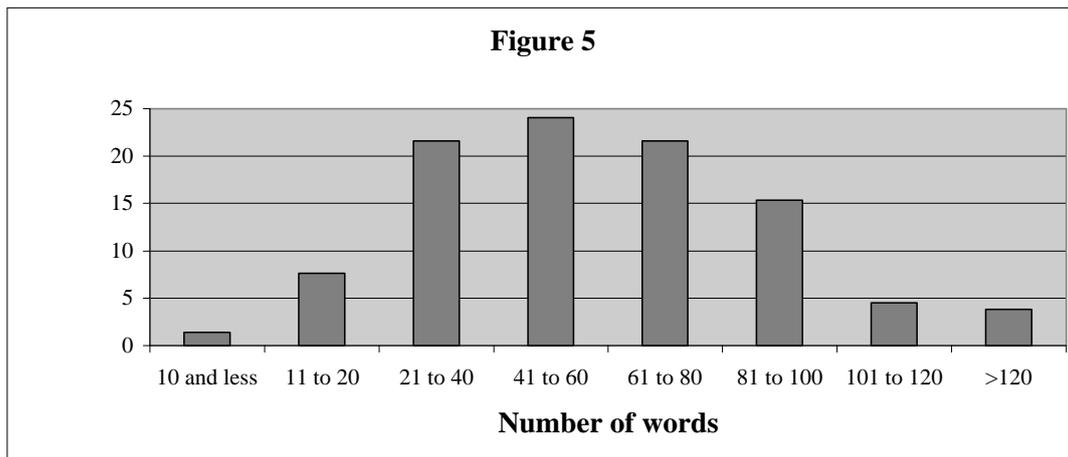
Insisting on student-led processes of evaluation was shown to be worthwhile on a number of levels.

1. It provided useful feedback to a majority of the students who presented work.
2. It increased awareness of the range of music that is currently being developed by students, and who does what.
3. It provided experience of the electronic communication through the course web site that is so necessary at the end of semester for major study submissions.
4. Most importantly, it provided the experience of giving feedback and exemplars of such feedback with the discussion board being used is a resource that students could access to see what kind of feedback others regarded as acceptable.
5.

It is worth noting that, in purely quantitative terms, the volume of feedback available to each student in the formal assessment process conducted at the end of the semester was impressive – indeed, individual teachers would find it difficult to match this quantity of assessment output. Seventy-three students presented 292 recorded tracks that were assessed by 11 panels consisting of six or seven students and one teacher, as described in Lebler (2006). Feedback generated by this process amounted to 182,025 words averaging 623 words per track. In addition, teachers provided an average of 197 words of feedback to each student on their performance as assessors.

3.3 Product

The essential difference between this approach and that employed in most conservatorium practices is that both the prior learning of students and their expertise are explicitly factored into the structures of a learning environment, relieving the teacher of the sole responsibility for the provision of feedback and expertise. Instead, the teacher becomes a co-producer of learning, assuming responsibility for the design and maintenance of the structures that support the learning community, providing training in the learning functions rather than instructing in the learned product. If the structures are not well maintained, then such activities could well descend into chaos or an 'anything goes' free-for all. The pedagogical work is therefore intense and on-going, though not as instructional pedagogy. Modelling careful, rigorous and deep engagement with the cultural products of others is a crucial part of this work – this is the antithesis of patronising or preaching.

Certainly students become enculturated in the assessment practices employed in the course, and the gap between self-assessed marks and those awarded by the assessment panels narrows with experience as illustrated in Figure 6. But perhaps most importantly, student experience an authentication of their prior learning as well as a shift from 'couch potato'

Figure 6
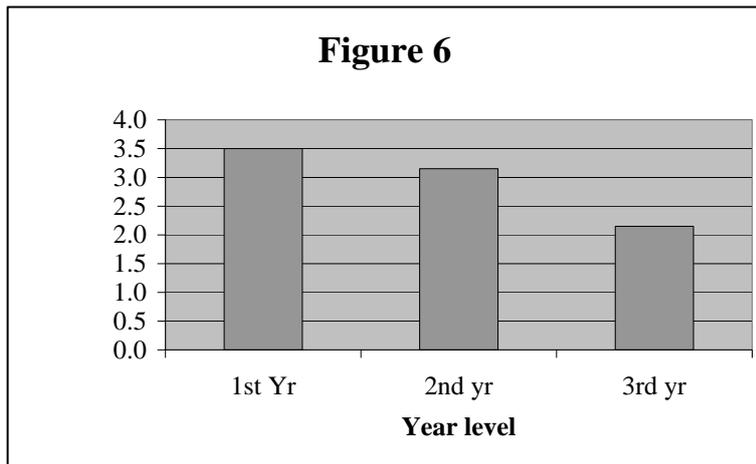
consumption of the expertise of knowledgeable others to an active engagement in the pleasures and challenges of 'prod-using' music. If Lessig (2001), McWilliam (2004) and others are right, then it is just this sort of capacity to add value through collaborative and productive engagement, not just in the creation of music in digitally enhanced environments but in work and leisure more generally, that will be the hallmark of the post-millennial global citizen.

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She has utilised cutting edge ideas from all these disciplinary fields to investigate how best to prepare young people for creative work futures at a time of social flux. Her recent scholarship on what she terms the Yuk/Wow Generation, presented at the recent *Creativity or Conformity?* Conference in Wales, builds on her long-term research into pedagogical processes and the impact of social change. Because of Erica's international reputation as an educational scholar and her outstanding ability as a public speaker, she was chosen by the Australian Council of Educators to deliver the prestigious biennial Bassett Oration, *Schooling the Yuk/Wow Generation,* in August, 2005.

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Learning or Performance:
What Should Educational Leaders Pay Attention To?

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Abstract

This paper addresses the important question of how educational leaders think about how they spend their working time in the context of significant changes to the nature and purposes of their daily work. The report focuses on a dilemma that is confronting many educational leaders – why is it that I seem to get so little time to engage with the things that I value most? Put another way, why am I spending so much time responding to external accountability requirements and so little, in relative terms, on the learning culture of my school community? If our core business is learning, then surely the promotion of a culture of learning should be occupying most of my time. If not, why not, and what can I do about it?

To explore these questions we take on four main tasks in this paper. First, we explore the context in which measuring performance has become the main game for educational funding, and thus for educational institutions. Then, drawing on Carol Dweck's (1999) research, we set out a case for understanding *learning* and *performance* as different sorts of goals, rather than seeing them as inextricably linked to each other. Having outlined this distinction, we then ask about how both of these goals are pursued in the 'attentional economy' (Taylor, 2005) of educational leaders - that is, how such leaders divide their attention across these two sets of goals and with what effect. Finally, we present empirical data on one school principal's 'attentional economy' for comment and self-reflection.

Keywords: Attention, school leadership, risk management

1   Why performance measures now?

As part of their retreat from the funding of public education and health in general, Western governments are increasingly tying funding for schools to 'learning outcomes' as measured against government determined "standards". These standards are generally linked to government approved national priorities such as better employability skills, and improvements in literacy, numeracy and citizenship, as defined within state-sanctioned policy. According to Corson (2002), this imperative shows itself in the drive towards standardised testing regimes linked to notions of accountability that are presumed to measure improvements in learning:

> [G]overnments across the world are saddling schooling systems with an extravagant array of tests and assessments, so much so that some warn against the arrival of the 'evaluative state' that will be tied in all respects to a doctrine of competition, measurable results, and efficiency. (p.7)

In broad terms, the funders of education, both government and non-government, have come to fix almost exclusively on performance data that can be standardised in order to allow for intra-state, national and international comparisons. Despite the often questionable nature of these data as a basis for evaluating and comparing educational performance, educators at all levels are under pressure to support teaching and learning strategies which maximize student results in the assessment tasks which form the basis of the league table data.

Schools and universities that have the resources and reputational clout to sit at the top of a league table can advantage students who are similarly aspirational. This means that a significant minority of institutions with the cultural and financial capital to resource their activities well are unlikely to complain about public league tables. Indeed, some educators welcome them as useful indicators of where they are and/or where they aspire to be in years to come. Others are less sanguine. David Mulcahy, for example, argues that this aspiration is not to a high standard of education but to "a high standard of standardness" (in Brenneis, Shore and Wright, 2003, p.7). Studies by Gewirtz (1999) in the United Kingdom and Lingard et al (2002) in Australia, point to a trend to value critical, autonomous and creative thinking skills only if and when they can be seen to contribute to productivity as measured by the school's aggregate examination performance. In simple terms, performance is no longer "merely an important instrument or component within the [schooling] system", but has come to "constitute the system itself" (Ranson, 2003: p.459).

Whether by choice or not, educators know that performance matters – it drives funding, and is a marker of reputation. The higher up the league table, the greater the expertise of the staff and the more likely it is therefore that the students are working optimally as learners.

2   Performance *or* learning?

Or are they? Carol Dweck's (1999) distinction between performance goals and learning goals allow us to think again about this proposition. For Dweck, an individual's performance goals are "about winning positive judgment of your competence and avoiding negative ones", while an individual's learning goals are characterised by a desire to acquire "new skills, master new tasks or understand new things" (p.15). While these two goals are "normal and universal", they are often in conflict. Dweck (1999) notes that, when there is an overemphasis on performance goals, individuals are less likely to risk moving out of their zones of competence, and more likely to blame their own innate ability if things go wrong. They are more likely to worry too much about their ability and not enough about strategy. When the pressure is on, if they can't look smart, nothing matters more than avoiding looking dumb, and this can consume a great deal of time and energy, while at the same time creating a downward spiral of self-recrimination, vulnerability and victim-hood (Dweck, pp.16-19).

In Dweck's research, performance goals and learning goals were found to be present in most young people in about a 50/50 ratio (p.16). They could however, be manipulated by an external 'other' (eg, a parent or teacher). When this occurred, it was clear that those students for whom learning goals were paramount continued to seek new strategies while those who were performance-driven were more likely to give up on the task set, blaming themselves for their inability to complete it.

While we need to be cautious about extrapolating from the 'self-theories' of the individual to the climate of a school, there is nevertheless much of what Dweck is saying that might be usefully brought to an analysis of the performance culture of educational institutions as

outlined above. It raises at least the possibility that educational leaders, students and parents who are abnormally focused on winning positive judgment of their performance from external others might actually be putting their students in jeopardy whereas leaders who seek to foster a healthy balance of learning goals and performance goals may well be more likely to be producing robust learners.

If, as Dweck points out, the tasks that are best for learning are those which risk confusion and error (p.16), then the aim of 'facilitating learning' would be to create obstacles that need to be overcome. Error would be welcome and explanation minimised. However, where error results in painful condemnation from external others who are marking, grading and measuring each move, then it is more likely that a student will avoid uncertainty at all costs, not embrace it for what it might conceivably offer to fresh understanding. So too an institution's performance, dependent as it is on the judgment of external others, is vulnerable if and when its 'mistakes' (ie, a less than dignified place on league tables) are out in the open. When the price of failure is a lack of enrolments, diminished reputation, and/or a funding cut, it is to be anticipated that 'best foot forward' can become not simply an important imperative but the dominant imperative that renders all others to marginal status.

3   Paying attention

Once an imperative is relegated to the margins, we are, naturally enough, less likely to pay attention to it. Put another way, it is less likely to be identifiable when we map our "attentional economy" (Taylor, 2005). We want to explore this term briefly before indicating what this might look like in an actual study of what a principal does during the working day.

What we give attention to, and how that attention is given, are in the main products of our learning. That attention is controlled by the mental models that are activated in our mind. Our mind operates at a number of levels. In terms of the issues we are exploring here, two levels are of great importance – sub-conscious operations, and conscious operations. The latter are activated as 'working memory'. The former operate outside of conscious control. And unlike the limited capacity of working memory, the subconscious has no limitations on its processing capacity. The irony here is that our most creative thinking is done without conscious control. Mindful thinking is the tip of the iceberg, irrespective of whether the focus is on learning or performance.

The essential point is that our attention, and our thinking, are based on mental models and schema that represent 'reality' in simplified ways. Some of those models and/or schema will be brought into our conscious attention, while others will be activated sub-consciously. In fact the vast majority of our mental activity is at the sub-conscious level. The iceberg is very large.

The mind works to make available to us the mental models that it anticipates we will need in a given context. This automatic 'downloading' from long term memory makes routine behaviour possible, whether that behaviour be at the level of a novice or expert. In fact, to interrupt routine behaviour is to interrupt any high level of performance – experts ought not think and act at the same time. So discussion of reflection-in-action is misleading, unless the action is relatively non-routine.

In terms of attention, the downloaded mental models serve as attentional filters. They indicate what we should give attention to, and the attention is given in ways that tend to confirm the particular model, or to allow minor adjustments through its operationalisation in the particular setting. Thus, the mental models also determine the factors within our sensory field to which we give attention. Put differently, our mental models are also our perceptual lenses, or blinkers, depending on your preference.

Because we are social animals, our mental models tend to be shared, rather than individualistic. Most school based learning attempts to achieve such shared outcomes, while basic social interaction requires shared expectations in relation to how others will behave.

What is more, social relationships depend on the sharing of understandings, or ways of interacting, and cultures are based on these shared and largely subconscious outcomes. All require mental models that are at least aligned. Leaders in school settings are likely to have invested considerable effort to ensure that certain understandings are shared by all staff. In many senses, leadership involves the achievement of such shared mental models.

What all this means, simply put, is that what educational leaders give their attention to is both conscious and sub-conscious, both individual and social. New expectations of schools and universities mean that adjustments are constantly being made around what is now important and what sorts of routine behaviour are most useful. In a culture increasingly focused on meeting external accountability demands by means of measuring the performance of educational institutions, educators' new mental models are likely to filter out much that once went without saying as important. It is not that this is done cynically or with ideological intent, but that the mental models that come with the 'performative' territory' are providing our lenses, our blinkers.

4   The tale of one principal

Below we provide some empirical data from a doctoral study in which all the authors have recently played a role. The data was gathered by a high school principal who studied her 'attentional economy' in action over a period of three working weeks.
The analysis of the data recorded over the weeks led to the formulation of a number of different categories. These are presented in the two pie charts below:

Figure 1: Work Chart 1
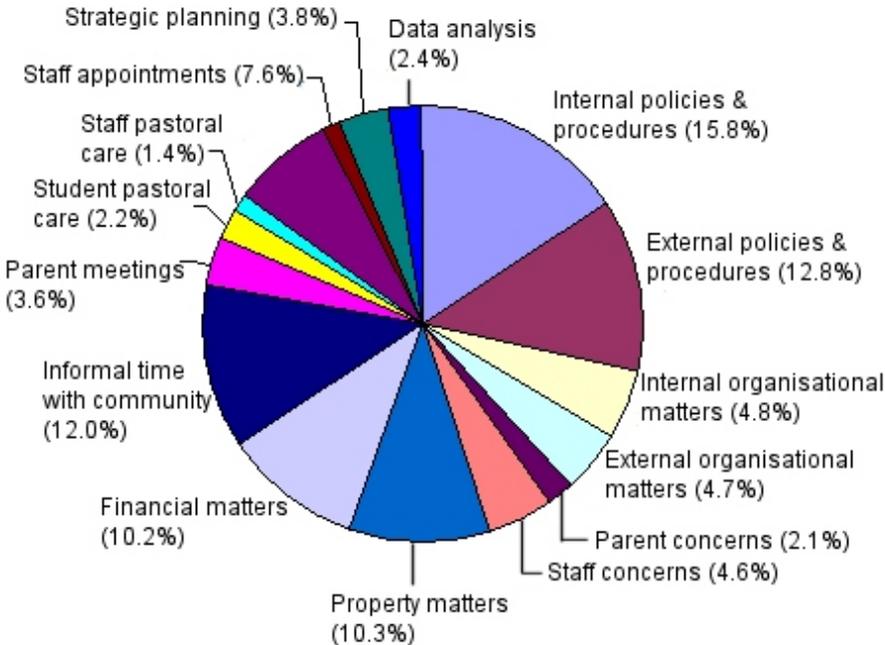
Figure 2: Work Chart 2
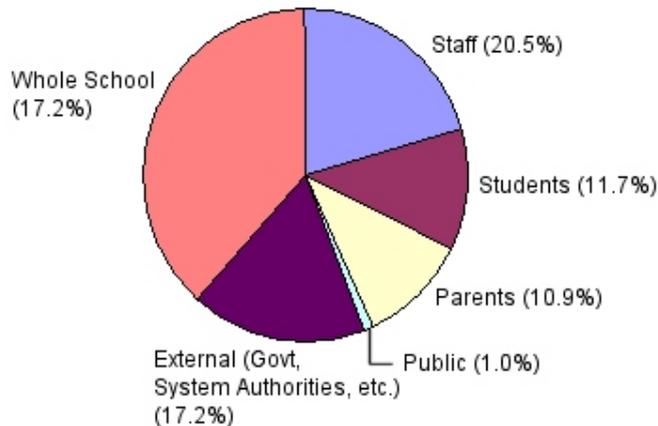
She then analysed the data recorded during the week to discern key categories of activity. Next she asked a number of colleague principals to review these data in light of the questions:

- How well does this recorded pattern of activity match your perception of how you spend their time?
- Are there any significant differences in this pattern when compared to your pattern of activity?

Following the feedback received after yet another phase of colleague feedback, she finally re-presented her 'attentional economy' in Figure 3 as follows:

Figure 3:
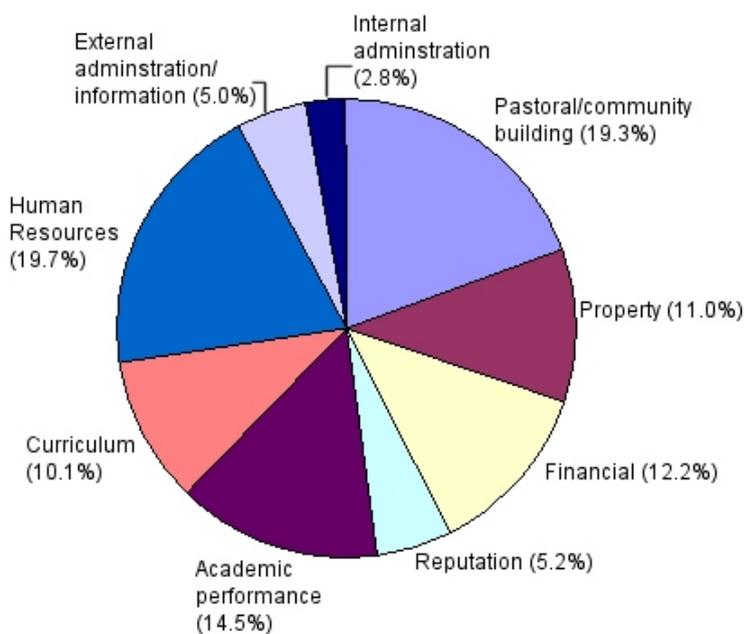
The re-examination of the items from each of these categories revealed that a large proportion related to curriculum and academic performance issues (from the previous strategic and internal administration categories) plus human resources (from the external matters). Overall, this principal assessed her time as approximately two thirds (63%) focused on externally driven performance matters and only a little over one third (37%) taken up with internal matters to do with the educational and social life of the school. In addition to this overall picture, the data also revealed the differential emphasis given to the two types of goals within particular categories of activities. Performance goals dominated almost all categories. For example, human resource activities during this week included the summative performance review of a person in a promoted position. The person was being reviewed against established duties and performance goals were a clear focus. A number of interviews for appointments to short-term acting promoted positions were also held during this week. Finalising the appointments was a clearly identified outcome at this time. In the category of pastoral and community, a large proportion of the time was spent on informal interactions with members of the community – attendance at sporting carnivals, playground interactions, parent social events, tuckshop visits and the like. These activities, by definition, were in many cases more directed at outcomes rather than strategies for improvement and thus were shaped by performance rather than learning goals. However, the nature of some of these activities, for example, discussing with

tuckshop helpers new strategies for generating increased parent volunteers, were quite clearly underpinned by learning goals.

This tends to suggest, following Dweck, that, in this principal's balance of attention, there is a tendency to spend more time on attending to externally driven requirements rather than internal strategies around learning, and this is so despite the very strong commitment of this principal to learning as of paramount value in her school. It might well be argued that, as a secondary principal, this individual is under greater external pressure than her colleagues in primary or special schools. But it could equally be argued that education in the early years has even greater challenges, with increased parental anxiety about the safety and future success of their young children having such a big impact on this area.

Concluding remarks

While we could continue to debate the matter of which schools are under most pressure, it seems more useful to turn to the feedback this principal received from her principal colleagues in similar schools. The categories she developed were certainly recognisable to other principals; schools nevertheless did vary in terms of the sources of the pressure for their leader's attention. One colleague noted that a major strategic issue in his school was pastoral (in line with a review of their current horizontal pastoral structure) and that this consequently occupied more time than curriculum or academic performance matters. Another noted that the major strategic issue in her school was a review of the positions of added responsibility structure and thus human resources were currently occupying a bigger proportion of the principal's time. Two further colleagues felt that academic performance was not given the amount of specific attention in their schools in comparison with this principal's analysis as depicted in her work chart. The focus in their schools was on broad curriculum issues.

Yet while schools differed in certain respects, all school leaders shared a profound sense of the uncertainty and instability of the environment both within and outside schools, and their frustrations with a rising number of externally-driven demands to measure the performance of the schools, at times in ways that are suspect in terms of their value for learning. With all that we now know about the importance of experiment, risk-taking, contestation and unresolvedness in producing knowledge, it becomes crucial that we protect spaces that allow such modes of engagement. To do so, we need to pay attention to the learning goals of those within all educational institutions, not just their performance goals. And this needs to be re-asserted across the entire spectrum of education, even despite and contrary to, the desire to be awarded the maximum available number of gold stars.

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She has utilised cutting edge ideas from all these disciplinary fields to investigate how best to prepare young people for creative work futures at a time of social flux. Her recent scholarship on what she terms the Yuk/Wow Generation, presented at the recent *Creativity or Conformity?* Conference in Wales, builds on her long-term research into pedagogical processes and the impact of social change. Because of Erica's international reputation as an educational scholar and her outstanding ability as a public speaker, she was chosen by the Australian Council of Educators to deliver the prestigious biennial Bassett Oration, *Schooling the Yuk/Wow Generation,* in August, 2005.

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A Model for Systematic Thinking and Decision Making

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Abstract
In order to improve the situation of Iranian families in Sweden, I initiated a two-year program aimed at educating and supporting these people. A model for problem-solving and decision making was developed and used both in the educative radio programs and especially in the help-line conversations. After showing its effectiveness, the model has been taught to university students and to social workers in Sweden and Iran since 2000.

Keywords: Model, systematic thinking, decision-making, problem-solving, educating.

Introduction and goal of the paper

I conducted an intervention research involving Iranian families, one of the largest immigrant groups in Sweden. The objective was to construct a family pedagogy based on the opinions/narratives of members of these families and subsequently put this teaching into practice. I initiated a two-year program aimed at educating and supporting these people. From 1998 to 2000, as many as 13,000 Iranians listened to a total of 83 live radio broadcasts and 525 telephone calls lasting a total of 22,507 minutes were made by Iranians for private family counseling. A model for decision making was developed and used both in the educative radio programs and especially in the help-line conversations. After showing its effectiveness, the decision making/problem-solving model has been taught to university students and to social workers in Sweden and Iran since 2000. The goal of this paper is to introduce this model and show how it was developed during practice.

A Model for Systematic Thinking and Decision-Making

1. Defining the general and the concrete situations and the problem. According to the humanist or the empowerment perspective each individual is the expert of her/his own situation. The practitioner who comes into contact with a help-seeking individual is the expert of using one or more models, concepts or ideas. Both experts through dialogue define the general and the concrete situations. The discussion starts with the general situation and the conversation goes on toward constructing a clearer picture of the situation. Often, help-seeking individuals have an idea of what their problems are. Through the dialogue the definition of a problem or problems may also emerge.
2. Defining the desirable situation. Through dialogue the two experts construct a map of the help-seeking individual's desired situation and how he/she can ameliorate his/her situation.
3. Possible alternatives. Through dialogue the two experts imagine possible alternatives. At this stage they do not think about what is possible or not, what is good or bad. All imaginable alternatives should be considered. They then pay attention to A. The consequences of the imagined alternatives B. The resources available for realizing each alternative C. The barriers preventing the realization of each alternative
4. Choosing the best possible alternative and planning for action. Many times help-seeking individuals put pressure on the practitioners to say which alternative is the best. This means that the help-seeking individual is not ready to take control over her/his life and needs more time. In such situations practitioners should continue the dialogue and avoid choosing alternatives for people. When the help-seeking individual chooses an alternative the dialogue continues to plan, in some detail, for action.
5. Evaluation: Looking back and consider steps 1 to 4. After a while the practitioner and the help-seeking individual review the situation and considering the consequences of the chosen alternative they can have a better picture of the situation. Usually there is the possibility of changing the course of action and choosing a new alternative.

Describing the Steps of the Model

Step 1 Thomas and Thomas (1928) wrote that if men define their situations as real they are real in their consequences. This known theorem connects people's understanding of the situations to actions and to their consequences and justifies the three first steps of the model. Practitioner and the help-seeking individual, through dialogue, construct a picture of the general and concrete situations. The help-seeking individual is regarded as the expert of his or her own life. The practitioner can with patience and curiosity proceed from what and Andersson and Goolishian (1988) and Anderson (1997) called "not knowing position" and helps the individual to define situation. We can compare the dialogue-process with a funnel and how a discussion becomes more and more specific. The beginning moment of the dialogue is like the top of the funnel, it is wide and open and allow considering many relationships and experiences. Somewhere in the middle we have a definition of the concrete situation, a picture about a few relationships and experiences. Somewhere near the bottom of the funnel we may have definition of a problem.

Step 2 Dialogue continues and the individual tries to imagine the desirable situation. The desirable situation is connected to present situation and the problem as defined in step 1. It is possible that the dialogue (in step 1) cannot lead to definition of the problem, but when the individual talks about the desirable situation and what she/he wants, then, it becomes clearer what she/he *does not* want. The practitioner should not regard steps very strictly and be flexible enough to let the dialogue go up and down the steps when necessary. It is also possible that the help-seeking individual thinks of several desirable situations. Then, the next step would help us to find out which desirable situation is more possible from a practical point of view.

Step 3 Watzlawick has said the best help that we can give someone is to find a new alternative for her/him (in Engquist, 1996). At first all possible alternatives should be founded without any attempt to rank them. Later, we should try to consider barriers and resources in front of each alternative. And finally *the consequences of each alternative should be looked at very carefully*. Only at this stage the help-seeking individual can rank the alternatives. Sometimes we have 3 or 4 alternatives and for each alternative we have to look at barriers, resources and consequences. This is the step of the model that demands much thinking and patience. According to my experience (in almost 1000 cases I have used this model) many people use this step of the model in their daily life. The main difference, however, between how a practitioner applies it and how people use it is the systematic approach of the practitioner in looking carefully at each alternative and its barriers, resources and consequences. *And it is this systematic approach that makes the great difference.*

Step 4 Many times it is not easy for help-seeking individuals to choose an alternative. They may put pressure on the practitioner to recommend one. The practitioner should encourage the help-seeking individual to study the alternatives and choose one. After the individual selected an alternative together with the practitioner they plan for action.

Step 5 The help-seeking individual and practitioner can look back and try to find out whether the individual is satisfied with the course of action.

Discussion: Advantages of this Model

1. The strength of the model is the marriage of two ideas: stress on the social constructionist idea about the role of language and communication in our lives (Gergen, 1994 and 1999) and the pragmatist philosophical idea which maintains that individuals attempt to

adapt themselves to their environment. The first idea pays attention to the creative role that dialogue plays in defining the situation and constructing alternatives for action. The second idea is about how individuals confront the challenges of their social environment. The first step of the model maps the hard realities of life, the sad moments and problems that individuals confront. The second step is an attempt to imagine the desirable situation, a "journey" to the domains of dreams and visions. The third step is an attempt to find a way between the present situation and the desirable one and creates a bridge between "what is" and "what could be". The dialogical journey of practitioner and help-seeking individual between these three steps of the model is in line with the ideas of Cooley (1918) who concludes that human life in every aspect, is essentially tentative, that we work it out as we go along, and always must, "that it is a process rather than an attainment" (p. 408). In this third step of the model the key term is "best possible" alternative. This pragmatist model is built on the realistic assumption of moving from the real situation as it is mapped through the dialogue. At the same time it maintains that life can always be improved with reference to our dreams and wishes (Dewey and Mead about ameliorism, see Forte, 2001, 2002, 2003).

2. It is a humanistic model that raises the status of the help-seeking individual to be the expert of her/his own life. It is an effective kind of "help to self-help" and does not create dependency on experts. Many social work perspectives share this humanistic principle. Saleebey (1992) means that the greatest good you can do for another is not just to share your own riches to people but to reveal people's own strength to them.

3. Dewey (1938) writes that we are told that it is impossible for human beings to direct their life intelligently. According to these claims the complexity of human relations and the fact that human beings are too emotional make it almost impossible to plan their lives by using their intelligence. Dewey rejects this idea; he believes that nothing prevents us from using our intelligence in our daily life activities. For Dewey intelligence has to do with remaking of the old through union with the new. This model is an intelligent decision-making/problem-solving model for two reasons: (a) connecting past and present to future and (b) comparing different alternatives. Such a connection and comparison increases the reflective capacity of help-seeking individuals and practitioners. Many times there is no quick solution. The model raises the consciousness of all about the complexity of life and situations.

Emotions' roles in decision-making processes and development of the model

Ratey (2001) writes that emotion is "messy, complicated, primitive, and undefined because it's all over the place, interwined with cognition and physiology" (p. 223). He hopes that with the help of science our knowledge of how emotions function increases and we learn how we can more effectively manage our everyday emotions (p. 224). Ratey states that cases of some of the patients' indicate that "lack of emotion leads to poor reasoning and ultimately to poor social judgement, even when factual intelligence is still intact" (p. 292). As Neurosociologist Franks (2003a) observes

> "One can know cognitively that others regard killing as a serious crime, but without empathetic emotions, the private compulsion making such behavior automatically undesirable to the individual is lacking… Mastery of any culture's right and wrong must contain an emotional component. Socialization is not just a process of stuffing heads with shared and disembodied symbols; it involves the body as well as our thoughts. Without physiologically grounded constraint of emotions, role taking would just as well produce a society whose 'understanding' of others would be used only for their manipulation" (p. 789)

Damasio (2003) notes that "emotional signal is not a substitute for proper reasoning. It has an auxiliary role, increasing the efficiency of the reasoning process and make it speedier" (p. 148). In an earlier book, Damasio (1999) talks about different "levels of life regulation". He describes emotions as complex, stereotyped patterns of responses. Feelings too are described as sensory patterns signalling pain or pleasure. Emotions and feeling are under the line of consciousness and high reason above the line of consciousness. Reasoning is described as complex, flexible, and customized plans of response that are formulated in conscious images and can be executed as behavior. (p. 55). Franks (2003b) with reference to the studies of Damasio and others states that "most rational business choices are laced with emotions" and "the anticipation of regret, patience in making well thought out decisions, and expectations of long-term success involve emotions" (p. 625). Franks criticises ideas of "pure logic determinancy" and means that rational decision making and social control depend on their own supportive embodied emotions (p. 626). Emotions accompany previous experiences. However, coming situations may be like previous ones or may not. An individual once beaten by a dog may feel frightened as soon as he/she sees a dog. The reasoning may indicate that indeed the majority of dogs do not beat and the individual may overcome the fear. Or a driver who has survived a very ugly car crash may dare not to drive again. However, he/she can overcome this fear by reasoning and of course training to start to drive again. Therefore the reasoning strategy should consider the point that previous experiences accompanied with strong feelings may make one more wise and cautious but should not work as a barrier for further acts that are important for the future of individuals. It is quite possible that an individual is in a situation that he/she has no time or motivation to apply a reasoning strategy for making a decision. Then one trusts one's feelings because they accompany similar previous experiences. What is proper is that, whenever emotions "come up", the individual tries to reflect on them. The person can apply the reasoning strategies to what one's emotions "demand" and carefully think about what one wants to do. In the final stage the individual may make decision on the basis of awareness of consequences of different alternatives or as Damasio (2003) writes "the emotion signal can operate entirely under the radar of consciousness" (p. 148). I use Damasio's ideas to develop the model in a way that it explicitly covers the role of emotions in decision-making/problem solving activity. First I present Damasio's model:
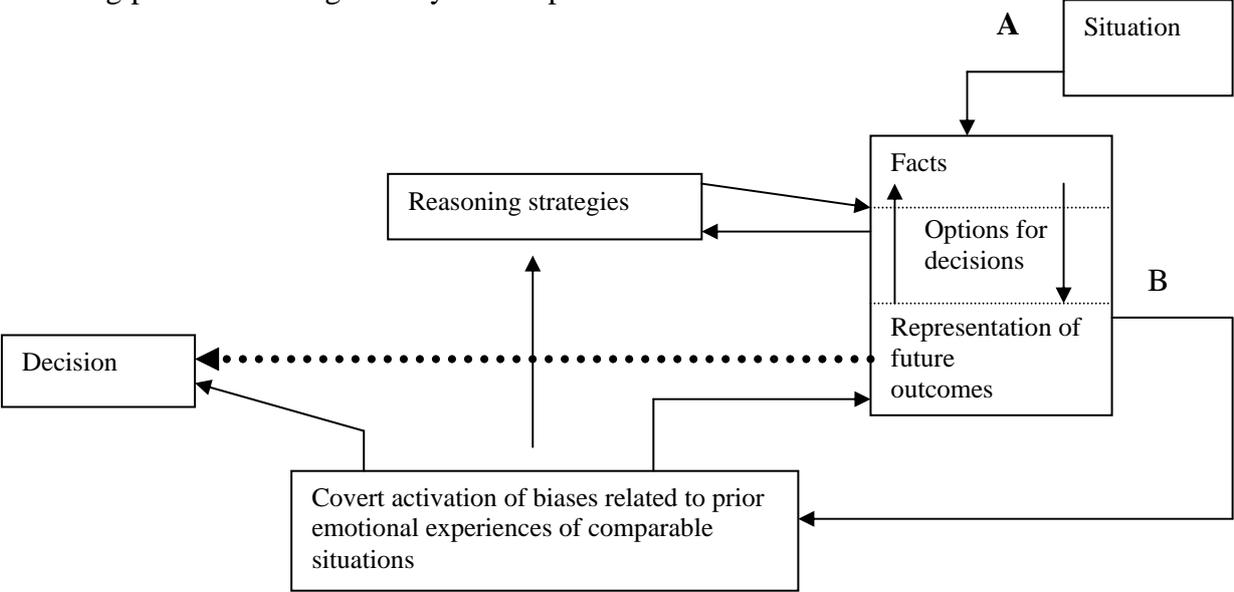
Figure 1. Normal decision making uses two complementary paths. Confronted with a situation that requires a response, path A promotes images related to the situations, the options for action, and the anticipation of future outcomes. Reasoning strategies can operate on that knowledge to produce a decision. Path B operates in parallel and promotes activation of prior emotional experiences in comparable situations. In turn, the recall of the emo-

tionally related material, be it covert or overt, influences the decision-making process by forcing attention on the representation of future outcomes or interfering with reasoning strategies. On occasion, path B can lead to a decision directly, as when a gut feeling impels an immediate response. The degree to which each path is used alone or in combination depends on a person's individual development, the nature of situation, and circumstances (Damasio, 2003, p. 149).

As we see in Damasio's model, the part he names path A is very similar to my model; What he calls "facts" is the same as definition of situation in my model, what he calls "options for decision" and "representation of future outcomes" is like step three in my model. On the basis of learning from Damasio's model I complete the model by illustrating and discussing the role of emotions in the process of how individuals make decisions. The complete model is shown in the figure below:

A Model for Systematic Thinking and Decision Making

1. Defining the general and the concrete situations and the problem. According to the humanist or the empowerment perspective each individual is the expert of her/his own situation. The practitioner who comes into contact with a help-seeking individual is the expert of using one or more models, concepts or ideas. Both experts through dialogue define the general and the concrete situations. The discussion starts with the general situation and the conversation goes on toward constructing a clearer picture of the situation. Often, help-seeking individuals have an idea of what their problems are. Through the dialogue the definition of a problem or problems may also emerge.   *****   *Consider and openly discus individual's emotions attached to previous experiences*
2. Defining the desirable situation. Through dialogue the two experts construct a map of the help-seeking individual's desired situation and how he/she can ameliorate his/her situation.   *****   Consider and discuss how previous experiences and emotions attached to them influence future desires.

3. Possible alternatives. Through dialogue the two experts imagine possible alternatives. At this stage they do not think about what is possible or not, what is good or bad. All imaginable alternatives should be considered. They then pay attention to
     A. The consequences of imagined alternatives
     B. The resources available for realizing each alternative
     C. The barriers in front of each alternative
 	
 *****
 Consider and discuss how different alternatives are related to previous experiences and attached emotions.

4. Choosing the best possible alternative and Plan for action. Many times help-seeking individuals put pressure on the practitioners to say which alternative is the best. This means that the help-seeking individual is not ready to take control over her/his life and needs more time. In such situations practitioners should continue the dialogue and avoid choosing alternatives for people. When the individual chooses an alternative the dialogue continues to plan, in some detail, for action.   *****   Consider and discuss if a previous experience and attached emotions function as a barrier or resource to choosing the desired alternative.
5. Looking back and consider steps 1 to 4. After a while the practitioner and the help-seeking individual review the situation and with the consequences of the chosen alternative can have a better picture of the situation. There is always the possibility of changing the course of action and choosing a new alternative.

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The 'V' Factor: Thinking About Values as The Epicentre of Leadership, Learning and Life

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Abstract

This paper places the 'V' factor at the epicentre of meaningful and productive living, learning and leadership endeavour. It explores the authors' reflections upon their own professional experiences, research studies and review of the literature as they work towards establishing '*working with*' leadership practices appropriate for a knowledge era. This paper also reports on Nanschild's preliminary PhD research findings of "*A Values-Based Approach to Leadership Development: Implications for Organisational Change*".

Keywords: values; leadership; leadership development; golden capital; knowledge economy

1. Introduction

> I've never seen anyone derailed from positions for lack of technical competence. But I've seen lots of people derailed for lack of judgment and character… I see a real connection between what it takes to be a leader and the process of character growth…(Bennis, 1988, p 144).

When we reflect on a systems approach to human relations we can see that our subliminal value sets are at the very epicentre of human endeavour. Our values—and what we value—as individuals and groups, have the capacity to impact positively or negatively on our leadership, learning and day to day living. The art of productive living, learning and leadership is in fact intertwined and our values, espoused or otherwise, are deeply embedded in this trinity. The focus of this paper will be on the symbiotic relationship between values and leadership; but at the same time acknowledge that the concepts discussed here are also applicable to the trinity of leadership, learning and life as a whole.

There are two notions conveyed in this paper that require explanation. The first is '*working with*' leadership practices which is borne from the concatenation of theories and practices which encourage, support and value humane work practices. These theories can be traced back to the 1920's work of Mary Parker Follett (Graham, 1995) through the 1990's and the learning organization movement (Senge, 1990, for example) to the present day. The second is '*golden capital*' which succinctly encapsulates the worth of our own and our organisations' human, social and intellectual capital (Davis, 2006).

The authors accept the rationale behind '*working with*' leadership practices as described in the literature (see for example, Senge, 1990; Drucker, 1993, 1999; and Bennis, 1988). '*Working with*' leadership practices are indeed appropriate for a knowledge-based economy because such an economy is increasingly reliant on *golden capital*—the human, social and intellectual capital of its people as a central means to economic prosperity.

A statement widely attributed to William Gibson that "the future is here, it's just unevenly distributed" holds true here as the uptake and enactment of '*working with*' leadership practices are not as widespread or evenly distributed—across the globe, industry or even within organisations—as proponents may have expected by now. The impetus of this paper comes from our concern that there are still barriers today in establishing '*working with*' leadership practices over the hegemonic command and control '*working for*' management and leadership norms established for the machine-age industrial era. Our thinking, discussions, reading and research have led us to a critical consideration of the intangible barriers to transformational change in organisations and people with a focus on values as being chief amongst these.

2. The 'V' Factor

Values are deeply held beliefs that guide our everyday actions and behaviours. They are usually tacit and unexamined yet they lie at the foundation of the decisions we make and the actions we take based on those decisions. The literature tells us that our values rest in all conscious and unconscious decisions or choices we make and such choices are ordered via our unique set of value priorities (Hall et al., McCann, 2002; 1992; Schwartz, 1992) as described by Argyris as our 'ladder of inference' (2004).

People view the world through the lens of their personal values and expend high levels of energy to defend these values (McCann, 2002), whether aware of these actions or not. Whilst shared mutual values can lead to harmony, understanding and shared vision; a clash in values can and does cause conflict between people. Indeed, the clashing of values is often the root cause of failed change management initiatives and a reason for the slow take up of '*working with*' leadership practices which are much more suited to the knowledge era.

An understanding of value priorities and how we come to hold these leads us to greater self-knowledge about ourselves and our own defensive patterns. Importantly, through this reflection brings an understanding that the 'other' will have deeply held belief systems too. It is upon this reflexive practice that we can engage in deep impact learning and effective '*working with*' leadership practices for ourselves and our organisations. We call this acknowledgement of values as integral to ourselves and to our relationships with others as acknowledging the 'V' factor at work in our lives.

2.1 Foundation, Focus and Future Values

Thinking about the 'V' factor and other knowledge-based intangibles is one approach to interrogate clashing paradigmatic views because values serve as a bridge between the past, present and future. It has been acknowledged in the literature that the intangible cultural shifts necessary to move agendas forward, be they organisational or societal, have historically been shown to be the hardest shifts to make.

> Anthropologists use social data and models from the past to provide a frame or a context for the future. The details of millions of years of history and hundreds of societies reveal patterns. When you understand these patterns of the past, culture is often the last system to adapt. Vestiges of old beliefs hang on long after the technological, economic and demographic systems have changed (James, 1996 p 22).

In Nanschild's ongoing doctoral research to be reported here, the Hall-Tonna Values Framework (Hall et al., 1986) research instrument was chosen because it offered a way to measure a values continuum made up of interrelated sets of three types of values: *foundation* values, *focus* or day-to-day operational values, and the *future* values that exert a pull towards the future.

Foundation values lie in the history of people and organisations. Management futurists like Drucker (1999) and James (1996) employ pattern recognition—looking back to history—as a way of predicting the patterns of the future. History tells us that when significant shifts occur affecting the social fabric of society—the invention of the printing press, the industrial or information revolutions, for example—we as a society initially carry on with established ways of doing things. It took 58 years, for example, after the invention of the printing press for a non-biblical text to be printed.

Whilst history is a salient indicator of change, our *focus values* influence our day-to-day operations. *Foundation values* that have not been fully developed or matured will distort our *focus values* lens, such that we cannot move beyond the day-to-day operations to 'see' a possible vision of the future. Even today we see examples of the cultural lag described above by James (1996) in the proliferation of command and control mechanisms of the industrial era. Increasing reliance on compliance and surveillance, for example, are attempts to control order in an increasingly complex global, networked and information rich world. The

machine-age, scientific worldview of '*if it can't be measured it can't be managed*' is still prevalent but it is no longer appropriate because this view does not acknowledge that the real key performance indicators required for success in the new millennium are likely to be intangible. We argue that the overuse of such control mechanisms and economic rationalist single bottom line practices are actually part of the problem, not a solution. This behaviour is an example of regression under pressure to outmoded *foundation values*, diverting energy from thinking about the true purpose of governments, learning institutions, organisations and individuals for the future. '*Working with*' practices, based ostensibly on values, are an appropriate vehicle for moving this agenda forward.

Future values provide the motivation for developing new skills because they reflect the future aspirations of individuals, groups, organisations and communities. *Future values* clarify vision and have the potential to pull us into the future because they represent a vision worth aspiring to. This point is summarised succinctly by Hall and Joiner (1992) where they state that "leadership development begins with visioning. Each time we rethink our view of the world, new value priorities emerge" (p 23). An example of future values-in-action can be seen in the trend towards the triple bottom line approach of financial, social and environmental responsibility, where values and profits sit comfortably together. Bragdon (2006) makes a case for this approach where "companies that affirm life in their mission, vision, values and management practices attract the most loyal employees, strategic partners, customers, and investors—and produce exceptional financial results" (p 55). Bragdon provides empirical evidence that his research subjects—companies operating under a triple bottom line ethos—surpassed those of their peers in terms of average credit ratings, longevity and growth rates.

As Figure 1 below illustrates, the underlying 'V' factor at work in our lives is a dynamic entity. As values mature and fully develop they move along a values cycle. *Focus* values lead to the realignment of *foundation* values and the interplay between *focus* and *future* values produces value shifts; the process then begins again. *Foundation, focus* and *future* values then represent a set of conscious and unconscious priorities that drive behaviour (Hall et al., 1992). In organisations they drive organisational outcomes; in individuals they are a catalyst for change and drive learning.
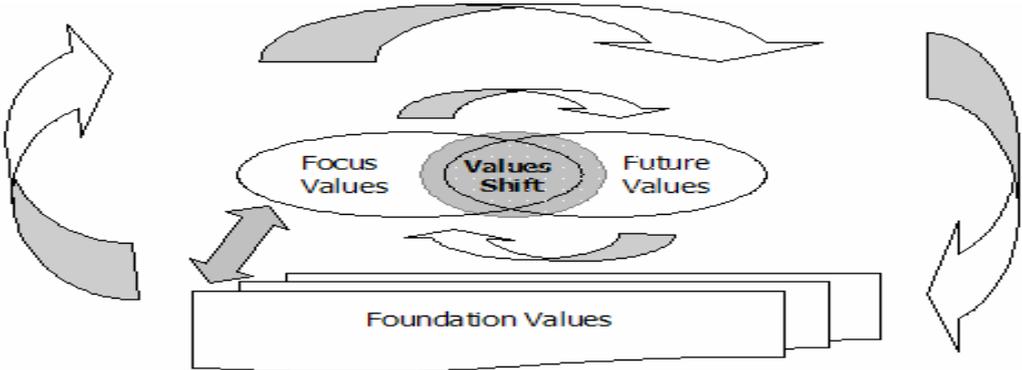
Figure 1: The 'V' Factor Dynamic

For organisations to fully leverage knowledge work and knowledge workers, an organisational change of mindset is imperative. The lag in changing the machine age worldview and practices is an example of James's (1996) "vestiges of old beliefs" and urgently needs to be addressed in order to move to the more salient '*working with*' leadership practices for contemporary times. To gain competitive advantage in a knowledge-based economy the *golden capital* of workers needs to be acknowledged, harnessed and leveraged and acknowledging the 'V' factor is a way forward.

3. The Research

As a Management and Education Consultant interested in developing the attributes of effective management, leadership and personal mastery, Nanschild is investigating whether knowledge of personal values has an impact on an executive's leadership style and performance and eventual effect on an organisation's ability to change. In an era of the rise of the gold collar worker (Wonacott, 2002) and the changing demographics of Australian society and its workforce, Nanschild further enquires into the notion that values-based approaches to management and leadership might play a significant role towards retaining and nurturing the workforce of the future in an environment of ongoing, rapid, chaotic, ambiguous and complex organisational change.

The research subjects were senior executives in the Australian Public Service. In equal gender ratio, their ages range from 32 – 65 years with one new to the senior executive service, one recently retired and the remainder with significant years of experience at this level. The research methodology utilised pre and post online testing of the Hall-Tonna Values Framework (Hall et al, 1986) and focus group interviews to collect qualitative data between the online surveys. Research subjects identified their personal values through an online questionnaire. Each subject received several aspects in their profile including their values priorities and subsequent values track result, and a narrative report on skills development required for adjusting their values track to achieve the *vision* values they desired. Subjects met as a focus group over a six month period and reported on their progress. They redid the values questionnaire at the end of the research period to indicate if any values shift had taken place as a result of their involvement in the research.

An analysis of the values of each organisation represented by the research subjects was also conducted, using software that processed content within the Hall-Tonna Values Framework. This was useful for comparative purposes. Research literature (Henderson et al., 2003; Hall, 1995, for example) suggests that individuals will be happier and more productive if their values strongly align with those of the organisation in which they work.

3.1 Key Findings

The overarching motivation for research subjects to be involved was their commitment to participate in a values journey, moving from an implicit values ('values silent') or unaligned values position to values-led leadership practice. Amongst the many discoveries that emerged, there are four key findings to report here.

3.1.1. Values-based leadership

Leader values are the guiding principles that determine leader behaviour, which in turn motivates and inspires follower behaviour. The connection between leader values and associated behaviours that foster high performance in themselves and others whom they lead is a central alignment to successful organisations of the future. Even when organisational values are articulated, they often do not lead to aligned behaviours. If followers don't see values-in-action, they become cynical of the process. What is needed is a meaningful way to identify values to create shared vision.

3.1.2 Management by core values

Other research has shown that the most successful, productive and enduring organisations are strongly values-based (Blanchard et al., 1997; Bragdon, 2006; Henderson et al., 2003; Kaplan et al., 2004). Such organisations recognise that values are the building blocks of workplace culture and therefore recognise the importance of an unswerving adherence to core values that drive performance, unify staff and result in effective decision making. The research subjects found that core values were indeed fundamental to their management effectiveness. Each created a personal vision statement that synthesised their chosen values to key words with explanations (core values) against which they purposefully developed their managerial skills

through action planning. They found this process led to an effective re-alignment of their management behaviours with their desired values. They recommended keeping organisational values to four key 'concepts' for simplicity and resonance for everyone in the organisation; for values-based management to work, values need to be woven deeply into the fabric of the organisation. Managing professionals, or indeed any knowledge worker, is of course famously difficult ("herding cats" is the usual metaphor) but if a value has been deeply embedded in the culture, any worker will be confident, for instance, when faced with a dilemma to "act in the best interests of the core value" (Henderson et al., 2003).

3.1.3 Language and interpretation around values

The research subjects found that using the term 'values' was itself value-laden because values are interpreted in different ways that can cause people to become confused and misunderstood. Research subjects reported that they had difficulties in engaging their staff in conversations about values because staff felt uncomfortable. Many of the research subjects reported that their staff had assumed they would be lectured about family values, religious values or some other value domain, when in fact the research subjects were trying to identify a common language to discuss the importance of having one's highest value priorities fulfilled in the workplace. In order to engage their staff in meaningful discussions about motivation, goals and purpose, research subjects found themselves rephrasing their language. For example, in conversations about values, they found that asking questions similar to "what do you like about working here?" was more effective than "what do you value about working here?" A common value statement this enquiry elicited was "collegiality…working with people who are dedicated and supportive and I enjoy working with". Nanschild's professional practice and research has led to her understanding of the importance of holding 'values conversations' as a crucial step towards gaining commitment and understanding in the workplace.

3.1.4 Personal values shifted, therefore behaviour shifted

Value shifts are cyclical in nature as deep learning is taking place. Real change doesn't happen until it happens inside people (Blanchard et al., 1997), such as through the adjustment of their personal value lens; that is, changing what they 'see with' not just changing what they saw. Awareness and understanding of one's personal values is an important first step in the process of self-improvement and behaviour change. All of the research subjects shifted in their personal values as a result of working on their value priorities. The majority shifted towards increasing consciousness about their actions and behaviours whilst two subjects shifted instead to focus on maturing and strengthening their foundational values.

4. Where To From Here?

Values-based leadership can have a significant impact on an organisation. Nanschild's research shows how leaders can examine the role of values and how leaders can develop their personal behaviour system. The research findings indicate that those in leadership positions need to be aware of and decide upon the value priorities that will drive their behaviour. True leaders create vision through articulating future values, then motivate, coach, inspire and align individuals to that vision (Bennis, 1988; Drucker, 2000; Kets de Vries, 2003; Senge, 1990). In the new workforce, inspiring people is a critical leadership challenge that requires highly developed interpersonal skills and emotional intelligence. In new times where professional and technical staff shortages are becoming an increasing concern, the establishment of '*working with*' leadership practices will be one way to counter this trend, and may well be the difference between attracting and retaining the right people in the numbers required to move an enterprise forward.

The emerging research findings confirm the literature around '*working with*' leadership practices. For example, a deeper understanding of ourselves, our strengths, weaknesses, value

sets and defensive patterns, is a clearly recognised requirement of the first two of Senge's (1990) five learning organisation disciplines—that of personal mastery and mental models which then enables the third discipline, shared vision—and impacts on the remaining two disciplines of team learning and systems thinking (pp 7-11).

5. Conclusion

A values-based approach to leadership, learning and life has the capacity to generate momentum and high performance if led and managed purposefully. Sound values systems give individuals a notion of deeper meaning for the organisation and in turn, a notion of deeper meaning for their role within the organisation. The end result is an organisation better equipped to achieve competitive advantage and future success. When used consciously the 'V' factor becomes a powerful driver to propel our leadership, learning and lives into the future.

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Academic Achievement of Groups Formed Based on Creativity and Intelligence

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Abstract

The relationship between creativity and academic achievement is investigated in this study to understand the nature of these relationships in the intelligence continuum among 497 Form Four Malaysian students. Intelligence was measured using Cattel's Culture Fair Intelligence Tests and Creativity was measured using Torrance Tests of Creative Thinking. Four groups were formed based on creativity and intelligence scores, namely, High IQ – High Creative, High IQ – Low Creative, Low IQ – High Creative and Low IQ – Low Creative. The mean academic achievement scores of these four groups were compared. One-way ANOVA indicate that there are significant differences in the mean academic achievement scores among the four groups. There were significant differences between High IQ – Low Creative and Low IQ – Low Creative groups as well as between High IQ – High Creative and Low IQ – Low Creative groups. These findings are only to be expected as the difference in IQ between these pairs of groups are 48 and 50 points respectively. However, there are no significant differences in academic achievement between the High IQ - Low Creative and Low IQ - High Creative groups. This supports the findings reported by Getzels and Jackson (1962), Torrance (1959) and Yamamoto (1964a) of equivalent academic achievement among the highly intelligent and highly creative groups. Although the Low IQ – High Creative group had a mean IQ 46 points lower than the High IQ – Low Creative group, the former appears to be able to compensate for this with their higher level of creativity. Another significant finding is the equivalent academic achievement levels of the High IQ – High Creativity and the Low IQ – High Creativity groups although the latter has a mean IQ 50 points lower than the former group. This further accentuates previous findings that creativity may help compensate the lack of intelligence in enhancing academic achievement. These findings have important implications in curriculum design and instruction aimed at infusing creative thinking and enhancing academic achievement among students of varying level of intelligence.

Keywords: Academic Achievement, Creativity, Intelligence, Intelligence Threshold

Introduction

Intelligence thresholds in the relationships between creativity and intelligence have been investigated ever since Torrance (1962) and Yamamoto (1964ab) reported differences in these correlations in the intelligence continuum. Some studies (Preckel, Holling & Wiese, 2006, Kim, 2005 and Runco & Albert, 1986) have indicated an absence of these variations across the intelligence continuum. Studies have also investigated intelligence thresholds in the relationships involving creativity, intelligence and academic achievement (Torrance, 1959, 1960; Getzels and Jackson, 1962, and Yamamoto, 1964ab). While the majority of these studies indicate positive correlations between creativity and academic achievement, some did not. These studies were mainly based on American samples. This study reports findings on investigations into these relationships among Malaysian Form Four (US Grade 10) students; thus exploring cultural influences in these relationships.

Past Research

The study which had a great impact on psychologists in the field of education and which had set off a boom in research into the area of creativity was the study of 449 high school children in Chicago, published by J. W. Getzels and P. W. Jackson in 1962. They compared a group of middle-class adolescent pupils who had scored well on intelligence tests with pupils who scored well on creativity tests designed by Guilford. They found that highly creative children were superior in scholastic achievement to pupils with high I.Q., although the high creatives had 20 I.Q. points lower than the high I.Q. students - indicating a positive relationship between creativity and academic ability. The high creatives, although having an average I.Q. 5 points less than their school population taken as a whole performed better in school achievement.

Getzels and Jackson's (1962) study drew criticisms as to its design and the sampling procedures employed. But the educational implications of Getzels and Jackson's study were undeniable. Several research studies replicated the study on other samples. Torrance (1962), for example, undertook eight replications of this famous study. Five of these studies were on elementary school students, one at high-school level and two at graduate level. It was found that six of these studies supported the findings of Getzels and Jackson that creativity is related to academic achievement. The two discrepant studies showed that creativity may be dependent on other factors such as the range of intelligence of the sample studied and the type of school the students attended.

Yamamoto (1964a) replicated Getzels and Jackson's (1962) study on 272 ninth through twelfth grade students of the University of Minnesota High School. The students in each grade were grouped into three groups based on their level of creativity and intelligence scores. The groups were the high intelligence group (comprising students in the upper 20% on IQ but not in the upper 20% on creativity scores), the high creative group (comprising students in the upper 20% on creativity scores but not in the upper 20% on IQ) and the high intelligent-high creative group which comprised students in the upper 20% on both the I.Q. and creativity measures. On analyzing the academic achievement scores of these groups, Yamamoto (1964a) found no difference in academic achievement between the high creatives and the high I.Q. groups although there was a mean difference of twenty I.Q. points. The creatives seem to be able to "compensate" for what they lack in intelligence by their creative ability to attain similar level of academic achievement.

Other researchers like Ahrens (1962), Jacobson (1966), Lucht (1963), Feldhusen, Treffinger and Elias (1970) have come out in support of the Getzels and Jackson phenomenon. Researchers who used the Grade Point Average as a measure of academic achievement, namely, Taylor (1958), Nuss (1961), Parker (1979), Wilson (1968) and Cline, Richards and Needham (1963) have also reported results consistent with the findings of Getzels and Jackson.

However, there are studies that did not support the Getzels and Jackson phenomenon of equivalent achievement of the high creative and the high I.Q groups. Among the earliest were the discrepant studies reported by Torrance (1962) based on his replications of the Getzels and Jackson's study. Many reasons were put forward to explain this. Among them were the lower level of intelligence among the subjects studied, the different kinds of academic ability measured and to the presence of an I.Q. threshold in the relationship between creativity and academic achievement.

This study intends to further investigate this phenomenon using Form Four (US Grade 10) Malaysian students to explore if this phenomena is prevalent in other cultures.

Procedure

Subjects totaling 467 Form Four students were drawn from three secondary schools in the township of Kuantan, in the state of Pahang in Malaysia. Their average age was 13.3 years and the students had undergone six years of primary and three years of secondary school

education. The students were divided into 4 subgroups: high IQ – low creativity or HI-LC group (subjects in the upper 20% on IQ scores but not in the upper 20% on Creativity scores), low IQ - high Creativity or LI-HC group (subjects in the upper 20% on Creativity scores but not in the upper 20% on IQ scores), high IQ – high Creativity or HI-HC group (subjects in the upper 20% on both Creativity and IQ scores) and the low IQ – low Creativity or LI-LC group (subjects not in the upper 20% on both Creativity and IQ scores).

Three instruments were administered to assess intelligence, creativity and academic achievement. Measures of intelligence were obtained using Form B of the Cattel Culture Fair Intelligence Test Scale 2 (Cattel & Cattel, 1960).

The Torrance Tests of Creative Thinking (TTCT), both the Figural and Verbal Forms A were used to obtain the various measures of creativity. The Figural Form A yields four components of Figural Creativity, namely, Figural Fluency, Figural Flexibility, Figural Originality and Figural Elaboration while Verbal Form A yields three components of Verbal Creativity, namely, Verbal Fluency, Verbal Flexibility and Verbal Originality. The standard scores of the various components were summed to derive the composite creativity scores.

Academic Achievement was the aggregate of the grade points and marks obtained by the students. The marks were those that were obtained in two monthly examinations prior to this study and grades were those obtained in the standardized examination, Lower Certificate of Education or *Sijil Rendah Pelajaran*.

Table 1 shows the composition of the students in this study. It can be seen that although there are 57 High IQ and 62 High Creative students, there are only 31 students in the High IQ and High Creative group. This indicates that if students were identified or selected for programs based on intelligence scores alone, 62 out of 93 highly creative students (about 67%) will be excluded, while if students were selected based on creativity scores alone, it will eliminate about 57 out of 88 (about 65%) highly intelligent students.

Table 1. Composition of Subjects Based on Sex and Groups formed Based on IQ and Creativity

Groups	Frequency			Percentage
	Male	Female	Subtotal	
HI-LC	37	20	57	12.2
LI-HC	39	23	62	13.3
HI-HC	23	8	31	6.6
LI-LC	145	172	317	67.9
Total	244	223	467	100.0

Results

Table 2 shows the means and standard deviations of IQ, creativity and academic achievement of the four groups. These four groups were then compared on their academic achievement

scores using One-way Analyses of Variance. The level of significance was set at $p < .05$. The results are shown in Tables 3 and 4.

Table 2. Means and Standard Deviations of Academic Achievement Scores of Subgroups Formed Based on IQ and Creativity Scores and the Total Sample

Groups		IQ	Creativity	Academic Achievement
HI-LC	Mean	152.00	390.81	159.58
	Std. Dev.	11.00	39.16	21.43
LI-HC	Mean	106.00	481.12	151.31
	Std. Dev.	15.00	26.88	25.60
HI-HC	Mean	156.00	481.81	160.34
	Std. Dev.	15.00	22.56	20.55
LI-LC	Mean	106.00	378.97	147.01
	Std. Dev.	6.00	41.60	23.91
Total Sample	Mean	114.67	400.80	150.00
	Std. Dev.	24.29	55.82	24.09

Table 3. One-way Analyses of Variance of Academic Achievement Scores of the Four Subgroups

		Sum of Squares	df	Mean Squares	F
Academic Achievement	Between Groups	11486.22	3	3828.74	6.85*

* Significant at $p < .05$

Table 4. Mean Academic Achievement Differences of Intelligence – Creativity Groups

	LI-HC	HI-HC	LI-LC
HI-LC	8.27	-.76	12.57*
LI-HC		-9.03	4.30
HI-HC			13.33*

* Significant at $p < .05$

Table 3 indicates that there are significant differences in the mean academic achievement scores among the four groups. Table 4 shows significant differences in academic achievement for comparisons between HI-LC and LI-LC groups as well as between HI-HC and LI-LC groups. These findings are only to be expected as the difference in IQ between these pairs of groups are 48 and 50 points respectively.

There are no significant differences in academic achievement between the HI-LC and LI-HC groups. This supports the findings reported by Getzels and Jackson (1962), Torrance (1959) and Yamamoto (1964a) of equivalent academic achievement among the highly intelligent and highly creative groups. Although the LI-HC group had a mean IQ 46 points lower than the HI-LC group, the former appears to be able to compensate for this with their higher level of creativity.

A very important finding in this study is the equivalent academic achievement levels of the HI-HC (Mean academic achievement = 160.34, SD = 20.55) and the LI-HC (Mean $_{academic}$ achievement = 151.31, SD = 25.60) groups although the latter has a mean IQ 50 points lower than the former group. This further accentuates previous findings that creativity may help compensate the lack of intelligence in enhancing academic achievement.

Another important finding is that although the LI-HC (Mean academic achievement = 151.31; SD = 25.60) group had a mean IQ 9 points lower than the general population (Mean academic achievement = 150.00; SD = 24.09), there were no significant differences in their academic achievement scores. Again, it may be deduced that creativity may be able to compensate for intelligence in enhancing academic achievement.

The HI-HC (Mean academic achievement = 160.34, SD = 20.55) and the HI-LC (Mean academic achievement = 159.58, SD = 21.43) groups also obtained similar academic achievement scores. This finding indicates that at very high IQ levels (in this study, at IQ 140 and above), an increase in creativity may not result in higher academic achievement. This suggests that there may be an intelligence threshold which delineates the nature of the relationship between creativity and academic achievement.

Discussion

The equivalent academic achievement scores obtained by the HI-LC and LI-HC groups support the findings reported by Getzels and Jackson (1962), Torrance (1959) and Yamamoto (1964a). The fact that similar findings are obtained in another culture with a different education system after a lapse of about 40 years adds to the generalizability of this phenomenon of positive correlation between creativity and academic achievement across culture and time.

The similarity in achievement scores among the HI-HC and LI-HC groups further supports the contribution of creativity to academic achievement. The fact that students not in the top 20% in IQ are able to achieve just as well as students in the top 20% in IQ possibly due to their elevated creativity, may be considered a significant finding in this research. This finding also provides empirical evidence and support for the advocacy of creativity enhancing curricula and programs in Malaysia.

At very high IQ levels, the strength of the relationship between creativity and academic achievement appears to diminish. This finding appears to support the threshold concept in this relationship. It appears that above an intelligence threshold of about 140, creativity may not enhance academic achievement. However, this finding appears to contradict Yamamoto's (1964b) study which found that above the IQ level of 120, creativity would enhance academic achievement. It may be concluded that while the intelligence threshold concept appears to hold true, the nature of the relationship between creativity and academic achievement both above and below the threshold appears to differ in this Malaysian sample. Further research involving different samples and different measures of creativity, intelligence and academic achievement will throw more light on these relationships and the concept of intelligence threshold.

Conclusion

This paper provides empirical support for the positive relationship between creativity and academic achievement and the finding that this relationship appears to differ across the intelligence continuum. This relationship appears to be positive until an intelligence threshold of around 140 above which it appears to diminish. Further studies need to be carried out to confirm the nature of this relationship for other measures academic achievement and across other cultures to establish the generalizability of this finding.

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On Teaching Critical Thinking to Engineering Students

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Abstract
This paper describes the first attempt at teaching critical thinking skills in a Portuguese engineering undergraduate curriculum, at the Faculdade de Ciências e Tecnologia of Universdade Nova de Lisboa, for Informatics Engineering students. It addresses the motivation and curricular reforms that made this course desirable and possible to implement, the structure and objectives of the course, and the results obtained, both as reported by the student's personal evaluation of the course and by the academic results. After this successful experimental instalment, this course is likely to become available to other undergraduate programs in Faculdade de Ciências e Tecnologia.

Keywords: Critical thinking, teaching, engineering.

1   Introduction

1.1   Critical thinking in the Portuguese curricula

The teaching of critical thinking skills in Portugal is rare in science and engineering programmes. To our knowledge, there is no specific "Critical Thinking" (CT) course in Portugal in Higher Education, in any field, the one reported here being first of the kind. We have been its promoters and lecturers.

The course takes place at Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa, and began, for the first time, from mid September 2006 to end of January 2007 (14 weeks teaching plus exam study period). Detailed information on the course sessions (including slides and other documentation in English) can be found on its web site at http://ssdi.di.fct.unl.pt/lei/pc/. There were 97 students enrolled.

CT was introduced as a compulsory course in Informatics Engineering, formatted according to a 3-year Bologna cycle. We expect enrolment of students across the board from a number of other science and technology courses at the FCT/UNL campus, as part of the Bologna recommendations for more soft skills in higher education.

This CT soft skills course for Informatics Engineering is preceded by a generalist and compulsory "Expression and Communication" course in their 1st year, and followed, in the 2nd cycle (for those who continue) by an obligatory course on "Scientific and Technical Communication".

1.1.1   *The relevance of Critical Thinking for engineering education*

Although our CT course follows a fairly standard approach to the teaching of these skills, it is nevertheless innovative in the context of scientific and technological higher education, in that it emphasizes the stance of the specialized producer of scientific and technical information, not just that of the lay information consumer. Indeed, critical thinking skills are essential for good and apt decision making and for the understanding of problematic issues, this being especially important for engineering professionals who are expected to make important

decisions, solve technical problems, face ethical balances, employ best practices, and report and document their findings and products, as well as act in a consultant capacity.

A deeper understanding of the epistemological, philosophical, and methodological foundations of science is also a case in point, and not just for those who intend to pursue a research or teaching career, for a better appreciation and intervention in regard of the deeper context.

Most ironically, engineering and science training can discourage critical thinking by presenting the student with only well established theories and best practices during the student's training, not requiring a critical attitude from the students. This is indispensable for teaching students the correct methods and techniques, but may leave them unprepared to face real life situations, where uncertain, unreliable, or even misleading information can affect the decision process.

Even though students are prepared in their scientific field, they are hesitant and have difficulty criticizing non scientific claims in their daily lives. In practical sessions of this CT course, students have been asked to discuss subjects such as astrology, miracles, or spirit communication. Many students initially argue in favour of these beliefs based on the absence of negative evidence. While no engineering student would argue in favour of a technical claim in their field based on such weak reasons, they seem unaware of the importance of positive evidence to support a claim outside their area of expertise. This may be because technical courses always provide positive evidence, training the student to expect such evidence in technical problems. But this evidence is presented authoritatively, is not uncovered by the student through critical analysis, and it may well be this reason that leads students to underestimate the importance of positive evidence for any claim

Furthermore, critical thinking is essential for effective scientific and technical communication. In addition to the skills to assess claims and data, it is important for engineering students to develop the skills to criticise their own assumptions and inferences, as well as the way they communicate and argue for their knowledge. Again, these are important skills for the engineering professional, but ones rarely partaking of the regular technical courses, where the students are graded rather by their performance in standard examinations that focus on the application of technical knowledge and not on its actual communication.

Thus our focus on the two aspects of critical thinking, both as consumers of information, requiring the skills to assess claims and inferences critically, and as producers of technical information, with specific training to question assumptions, put checks on their own reasoning and avoid fallacies.

1.1.2   *The Bologna process*

This CT course was implemented as part of the curricular reforms motivated by the Bologna declaration on European education. Specifically, to better serve the objectives of improved mobility and lifelong education. Critical thinking is a transversal skill that can help the student in any field, thus helping those wishing to pursue a broad education spanning several areas of expertise. It is also a skill which, once acquired, will always remain of use, improving with practice, and not be replaced by new information, thus especially suited for a project geared towards long term education.

1.2   **The course**

1.2.1   *Goals*

We designed the CT course with two major goals in mind: to improve the student's ability to analyse claims and information critically, and to teach the students to present results and technical information in a correct manner.

1.2.2 Format

The course is taught by alternating two-hour lectures presenting the subject matter to all students, with two-hour practical sessions where a smaller number of students (approximately 30) have the opportunity to discuss the subjects and practice with exercises. This gives a total of four hours per week divided into two sessions for each student. The students are also expected to work an additional six hours per week on individual study and practical exercises. All sessions are recorded into digital audio files made available at the course web site, so students can review the sessions and also hear their own contributions to the discussions.

Evaluation is divided into a theoretical and a practical component. The practical component consists of four exercises and two essays, all individual. The exercises are up to one thousand characters long, and each focuses on a specific aspect of the subject matter, such as building an argument, analysing a scientific theory, or making a decision under uncertainty.

The larger essays are at most five thousand characters long, and each covers a broader part of the course. The first essay is on an objective issue, requiring the students to build an argument, analyse competing hypotheses, and assess the reliability of sources. In this semester the first essay is an analysis of conspiracy theories about the fall of the Twin Towers in New York.

The final essay is on decisions involving both objective data and subjective values. The students can choose the theme for the second essay, with recommended subjects like environmental policies, immigration, abortion, copyright laws, and such. The goal of this essay is to have the student make a policy decision in the face of uncertainty, distinguish the objective aspects from the value judgements, and adequately present and defend such decision in a structured argument.

The students have approximately one week to complete the smaller exercises, and three weeks for the larger essays. Active participation in the practical sessions is also taken into account for evaluation purposes. The practical component accounts for 40% of the overall grade.

The theoretical component of the evaluation is a two-hour exam, requiring a broad view of the subject matter, whence each student will choose two out of four provided topics, form an opinion and present it as a written argument. It accounts for 60% of the overall grade.

1.2.3 The curriculum

The course curriculum can be divided into two stages, with the first focusing on the analysis of objective issues, and the second addressing matters involving decision and value judgements.

The first stage covers, in order, the structure and logic of arguments, abduction and the formulation of explanations, properties of good explanations, designing experiments to test alternatives, the analysis of scientific models and epistemological problems.

The second stage of the curriculum covers the assessment of statistical data, decision as satisfaction and optimisation, the consideration of consequences, alternatives and opportunity costs, and finding omitted information. There is also be a brief introduction to ethical concepts, as they play an important role in decision making, but the focus is mainly on the objective aspects of decision.

Theory and practice are brought together in this course throughout, by the emphasis on discussion in the weekly two hour practical sessions, and on a strong practice component of the student's evaluation, demanding from each one regular work distributed over four exercises and two essays along the semester. The total workload for each student is approximately ten hours per week, with a large part of this time dedicated to the practical application of the subject matter.

1.2.4 Material

The main reference book recommended to our students is Fisher's (2004) "Critical Thinking: An Introduction". This textbook was chosen for providing a clear and accessible presentation of the main aspects of our course: argumentation, evaluating reasons and sources, assessing causal explanations and deciding.

As complementary sources we also use expository material from Browne and Keeley (2004), resort to Schick and Vaughn (2004) for many examples in the discussion sessions, Giere (1997) for the analysis of scientific models, and Baron (2000) for its solid discussion of decisions, utility, and risk.

For the discussion sessions students are also required to read a diversity of material, from paranormal claims to scientific experiments, most of which available on the internet. Two examples used this semester were the Viking probes' experiments to detect life on Mars (Caplinger 1995), and possible explanations for near death experiences (Blackmore 1991; Newport 2005). Some exercises were based on examples presented in Browne and Keeley (2004) and in Thompson (2002).

2 Results and Discussion

This course edition showed that students start poorly prepared for creating sound arguments, with most resorting to rhetorical tricks and arguments from personal opinion instead of correctly identifying the important aspects of the problem. However, our experience so far indicates that students quickly grasp the important aspects, the importance of critical thinking, and there has been a noticeable improvement in the students' capacity to analyse different subjects along this semester.

Currently we are still exploring the best ways of fitting together diverse aspects covered by the curriculum, and we expect some changes in the order of the subjects for the next edition of this CT course. But overall the course progressed quite well, and we feel that we are being successful at giving the students the necessary skills to properly analyse a diverse range of subjects.

Student reaction has also been positive, with most students showing they are interested in the subject and many participating in discussions. Also, a few students for whom this course is not available have been coming to the discussion classes, even though they are not enrolled, which suggests a potential for the expansion of this course to students outside Informatics Engineering.

Students scored in the course on a scale of 1 (bad) to 5 (good). The overall score was moderately positive (3.5), with a marked preference for the discussion classes (3.8) over the more theoretical lectures (3.1). Figure 1 shows the results of the student questionnaire for overall evaluation of classes, during the exam period.

Figure 1. Student evaluation of the discussion and lecture classes. Scores from 1 (bad) to 5 (good).
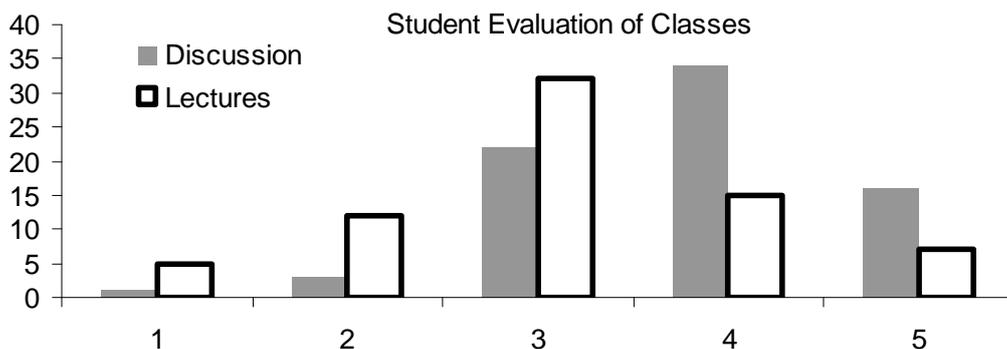
The results are for samples of 76 and 71 respondents (discussion and lecture classes respectively), making up most of the 97 students that were still enrolled at the end of the semester. The chi-square test comparison of the two distributions, normalising the lecture class responses to account for the difference in respondents, was very significant, with a p value well below 0.001.

This was an expected result, as critical thinking skills are much more adequately taught by practice and interactive sessions such as those in the discussion classes. Purely theoretical lectures are not the ideal means to convey critical thinking skills. In fact, our initial plan for this course consisted solely of tutorial sessions for 20 to 30 students where the theoretical concepts would be taught along with practical exercises and discussion. This plan had to be changed due to the unexpected popularity of the course. With more than twice the expected number of students enrolled we were forced to split the classes into lectures and discussion sessions. For the next instalment the situation will be corrected by allocating more teacher hours to this course.

There was a 62% approval rate for the 85 students that submitted to examination (12 enrolled students turned out to be absentee students by the end of the semester). The average grade was 60%, with a standard deviation of 10%, and the top grade was 85%, which is in line with a moderately demanding course, especially for a first instalment, where students have no access to exams or evaluation papers from previous editions.

3   Conclusion and future work

We feel that this was a successful first attempt at teaching critical thinking skills to Portuguese engineering students. Ironically, the biggest problem was the unexpected number of enrolments that forced us to structure the lessons in a way that was not ideal. However, this problem can be solved in the next edition of the course. A greater emphasis on discussion sessions and with the material now available from the first instalment to help students know what to expect should improve the academic results and student satisfaction.

Overall, it seems we met the goals of giving engineering students better skills at evaluating claims, supporting and assessing their own positions, and making decisions, al extremely useful skills that are seldom explicitly exercised in engineering curricula.

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The Features of Socratic Seminars

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Abstract
In this paper a model of what is intended in Socratic seminars is presented. It is based on a literature summary of analogous traditions in Sweden, USA and Germany. The Socratic seminar is a group activity intended to increase critical thinking, self responsibility and self-reliance- all seen as necessary qualities in a democracy. A fairly simple methodology is utilized to improve the complex interplay of dialogical and intellectual skills.

Keywords: Critical thinking, democracy, dialogue, interaction, Socratic, virtue

> *"The main thing would not be to win, not even to be right; the main thing would be to reach clarity as far as possible. This was what we should help each other with, and we would of course be sure to reach this goal closer by listening to each other rather than through endlessly listening to ourselves."*
> *Oscar Olsson (1921) p. 181 (my translation)*

1.   Introduction

Plato's three analogies of the Socratic educator: gadfly, midwife, and stingray are essential to understand the Socratic idea of education (Matthews, 1999). The Socratic gadfly stings the Athenian State to awaken it: the educator is given a societal mission to improve the community by educating all how to discover knowledge by investigation. The midwife helps deliver others' ideas: The analogy tells us that there is no use in trying to teach "true" propositions to another person. The educator should promote learning by *elenctic*[1] questioning, interactive cooperation, and teach ways to improve as human beings. The self stinging stingray stings the student AND the educator to perplexity by asking questions with no definite answer: There are always new things to learn in a life long quest of curiosity, both to the student and the teacher. Perplexity, *aporia*[2], teaches a thinking disposition rather than a methodology.

In the tradition of Swedish Popular Education, *Folkbildning*, a method using the Socratic dialogue in education was promoted by the early 20th century educators Hans Larsson, Oscar Olsson, Ellen Key and Alf Ahlberg. The tradition combined personal *bildning*[3] with intellectual and scientific studies, carried out as a group activity (Gustavsson, 1991). The ultimate purpose was enhance necessary qualities in a functioning democracy: critical thinking, self responsibility and self-reliance. The method is practiced with students as "Sokratiska samtal" (Lindström, 2000, Pihlgren, 2006). Almost identical methods are found in American education: "The Paideia Seminar" (Adler, 1984, Roberts & Billings, 1999), "Great Books" (Junior Great Books, 1992); and in Germany: "Das Sokratische Gespräch" (Nelson, 1965).

2.   Intention and method

In this paper a model of what is intended in Socratic seminars is presented. This model is based on a summary of literature in three analogous traditions: Swedish Popular education and "Sokratiska samtal;, "The Paideia Seminar", "Great Books"; and "Das Sokratische Gespräch". The traditions, although almost identical in their methods, goals and theoretical assumptions,

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1 Elenchus", ελεγχος, to examine, refute, or put to shame, Socrates' dialogic method of questioning.
2 *Aporia*, puzzle, problem, difficulty, perplexity.
3 The Swedish *bildning* is equivalent to *Bildung* in German, *dannelse* in Danish, *obrazjenie* in Russian and *Paideia* in Greek. English texts use either general or liberal education or culture. *Bildning* is used in this text.

have had no (or little) knowledge of each other. An overall description has not been attempted before. After comparing the literature from the three traditions, the elements of each were merged into a general description of the Socratic seminar, resulting in a model (figure 2). Practitioners of the traditions were invited to discuss the results of this merger and revisions were made accordingly. The work is done to prepare for a study of video-taped seminars with students 4-16 years old.

3.   Results of the literature review

One major goal of staging Socratic dialogues is to secure and enhance democracy. Not primarily to secure the parliamentarian system, but to prepare all citizens to participate in open, negotiating dialogues. There are positive effects for the individual, such as attaining *bildning* (in itself regarded as something making life worthwhile). *Bildning* will also result in assuming the responsibility as a citizen. It is a process of socialisation becoming an active part of the continuous human history, to have a chance to participate in "the Great Conversation" of mankind (Hutchins 1952). This "conversation" includes the ideas, problems and mysteries that have puzzled and occupied human beings since the beginning of human time. The ideas are seen as recurrent, but the mission is not to "teach" a right set of values. It is to foster virtues to access "practical wisdom", a concept inherited from Aristotle: finding ways to act, when confronted with a multiplicity of ideas and incongruent values.

3.1.   Learning to think in the Socratic seminar

To all traditions, learning is interactive, achieved through communication and learning from role models. With practice, habits of mind such as thinking and intellectual/dialogical virtues are formed and internalized. The habits of mind are steps, training to attain virtues. The outcome of habits of mind and virtues is intellectual and moral character/practical wisdom. Learning is considered contextual, a continuous flow of experiences exchanged between individual and context. On the other hand, there is an ongoing internal cognitive process, where the individual investigates and tests the findings made interactively. The interactive process is considered to be triggered by the subjective, personal experience (with the personal pre-judgement as an interpretive background) and then tested and elaborated on in cooperative interaction. Inquiry and learning are seen as a natural, ongoing process, a way of life, both cooperatively and individually. There do not seem to be any predestined (biological) levels in the development of thinking implied.

3.1.1.   Intellectual character

To fostering intellectual character two areas are targeted. One is the understanding of ideas of the different areas of human knowledge such as history, physics, mathematics, art etc. and the other is ability to analyze the underlying values of these ideas, critical thinking skills. In some ways, the intellectual virtues overlap the critical thinking skills, but virtues go beyond the skills. Learning critical thinking skills is learning to use instruments or techniques, but virtue is attained as a habit of mind, a way of living "intellectually", having intellectual character. The habits anticipated are similar to Karl Popper's critical problem posing strategy (Magee 1997, Popper 1971). By posing questions and problems, trying to solve these and sorting out less effective or wrong assumptions or pre-judgements, one will get closer to the better solution. The critical problem posing strategy is carried out both within the individual and within the group interplay. It is, however, not an entirely logical and "objective" process. There is an irrational and emotional element in the process where creative intuition plays an active part (Key 1906, Larsson 1904, Lindström, 2000). Since all problems are relative to the individual and to the context in the specific situation there has to be an innovative moment when looking for solutions.

3.1.2. Moral character

Moral character cannot be taught, because of its context bound complexity. It's not possible to teach someone how to act in all situations when choices confront a multiplicity of ideas and incongruent values. Particular habits of mind are required, presented as seminar ground rules:
- *Shared inquiry through thoughtful dialogue.* The group cooperates in "group thinking", to come to some understanding (as opposed to debate, where one argument/participant "wins")
- *Listen attentively to what others say*
- *Many answers.* Productive seminars will end in a variety of (logically supported) ideas
- *Be open to reconsider and maybe change your opinion*

The ground-rules are addressed to the individual participant, but concern the cooperative interaction. There is hence a "process" dimension stressing how dialogue is carried out, a set of "dialogical" virtues that can be taught as opposed to moral virtues. The "product" dimension, concerned with how to choose wisely, is not possible to teach. Seminar teaching is focused on promoting what is considered productive conduct in seminar by stressing the "rules", dialogical virtues and by controlling the process from beginning to end, using the steps in the seminar plan. The teacher is urged not to control the "product" dimension, to refer from stating opinions, favouring ideas or manipulating or controlling thoughts raised in seminar.

3.1.3. Methodological steps

Preparation starts with individual interpretation of the "text" (except in Sokratische Gespräch). Written texts as well as art work, music, graphs etc are used. A "text" should be rich in ideas, but not moral or edifying. Pre-and post-seminar discussions highlight the dialogic process by setting and evaluating personal and group goals. The seminar normally has three steps:
1. Opening question, eliciting ideas (in "text"), relating them to the participant's understanding
2. Interpretive questioning promoting ("text") analysis, examining the ideas
3. Questions of evaluation where ideas are related to participants' own experience.

4. Analysis

The seminar abilities are seen as internalized individually and in the group culture over time, practicing at the same time as learning. The ideas of the dialogical/intellectual relations anticipated are complex:
- The contextual construction presupposes a group- and an individual process going on at the same time and these are considered interdependent.
- There is a twofold cognitive focus, one on promoting dialogical habits of mind and one on promoting intellectual habits of mind, both considered interdependent.
- There is a "process" dimension of the seminar stressing how dialogue is carried out and a "product" dimension, stressing choices and these dimensions are considered interdependent.
- To acquire knowledge both the rational critical problem posing strategy and the intuitive element of creativity are equally important and considered interdependent.

4.1. Abilities trained in seminar

The intellectual process seems to presuppose two ways of coping with interpretation in seminar: interpreting cumulatively (cp. Gadamer 1994, Piaget 1971) or interpreting as adjusting thoughts to a new idea, insight or understanding (cp. Vygotsky 1978, Piaget 1971). Both ways start in a pre-judgement, a fore-structure of understanding allowing what is to be interpreted or understood to be grasped in a preliminary fashion. The seminar should make it possible for participants to adjust ideas in favour of the "better argument" (and not to hold on to and defend ones own, less functional ideas). "Texts" are used to facilitate taking a distance from the Self, when discussing the ideas. This might be a psychological explanation. The philosophical tool to go about it is Socratic *elenchus* in the Popper way. The cumulative

refuting interpretation is a systematic and critical analysis of the ideas, sorting out those which do not pass the test. The adjusting part of refuting interpretation is a result of a creative, intuitive process, where new "brave" ideas are found and tested (Lindström, 2000). This is meant to apply both to the individual and to the group, see figure 1.

Figure 1. Intellectual process in seminar

	Intrapersonal thinking process	**Interpersonal, contextual thinking process**
Cumulative interpretive process	Confirming and deepening OR refuting one's own idea or understanding	Group working together to find evidence and to confirm OR refute previous ideas or understandings
Creative adjustment interpretive process	Changing one's own idea or understanding as a result of a new idea found and tested by self or other participant	Group discussion leave previous assumption, idea or understandings and build further dialogue on a new idea being presented and tested by some participant

The interpersonal and intrapersonal processes are considered interdependent: the individual influences the group and vice versa. The group actions will gradually be internalized by the individual: The interpersonal thinking modes will teach the individual a thinking disposition, a habit becoming a virtue and later part of character. This "apprenticeship" seems to suggest the group as a "master", making use of "multiple zones of development" (Brown 1994, Kumpulainen & Mutanen, 1999). Someone in the group is always a bit further ahead in understanding. The dialogical virtues function as a promoter of this internalization taking place by fostering an open atmosphere**.** The space created must be safe for taking intellectual risks.

4.2. The intended functions of the seminar process

The seminar is a "game" to be played, with specific rules to learn and master. The context is constructed to support this learning: a closed room, everyone in a circle, specific rules. The steps in the seminar plan are constructed to have different functions in promoting the implied complex learning process, see figure 2.

Figure 2. Intended functions of seminar process when learning
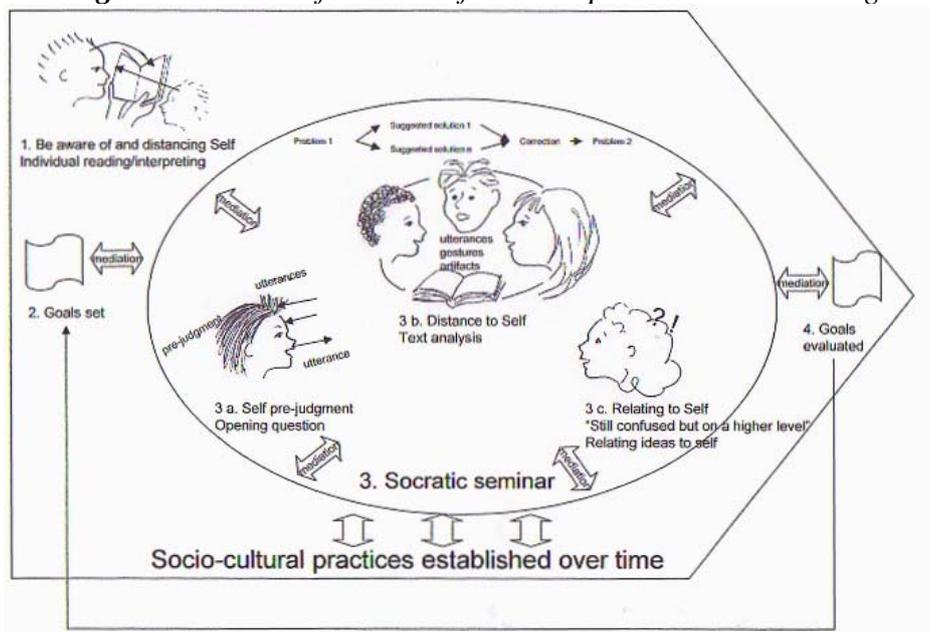
1. Before entering seminar: Individual reading/interpreting:
Intended function: Activate the individual's pre-judgement, thinking and refuting
Intended psychological process: Taking a distance from Self
Intended intellectual process: Intrapersonal-creative adjustment

2. & 4. Pre- and post-seminar: Personal and group goals set and evaluated:
Intended function: Focus on the "rules" of the seminar, the dialogical virtues
Intended psychological process: Evaluating and improving personal and group behaviour
Intended intellectual process: Intrapersonal and interpersonal-cumulative

3 a. First seminar step: Opening question
Intended function: Relate ideas to participant's present understanding, elicit ideas in the "text"
Intended psychological process: The participant is here accountable to the pre-judgement with what he/she starts before entering into cooperative group thinking
Intended intellectual process: Intrapersonal-cumulative

3 b. Second seminar step: "Text" analysis
Intended function: Make it possible to distance from everyday experience by cooperating in group using critical *elenchus*/ Popper's critical problem posing strategy examining the text
Intended psychological process: Be free to think differently, not personally held accountable
Intended intellectual process: Interpersonal-creative adjustment

3 c. Third seminar step: Relating ideas to self
Intended function: To relate the new ideas to participants' everyday life
Intended psychological process: Personally integrating new knowledge and insight
Intended intellectual process: Interpersonal-cumulative

There is a pair-relation between the functions of the steps. The first step in a pair starts a process; this is developed by the functions from other pairs and is finally consolidated by the last step in the pair. The individual interpreting (1) is related to "text" analysis (3 b), both promoting critical *elenchus,* taking a distance to Self, by interlocution with "text". The opening question (3 a) starts a process of realizing, challenging and maybe changing points of view that is consolidated when relating the new ideas to self (3 c). The goals set (2) will be consolidated when evaluated (4) and this will lead to new goals set in the next seminar. The goals are set and evaluated outside the seminar circle. The seminar circle is an arena where intellectual/dialogical virtues are trained in action. The process is closely assessed and the outcome is discussed before and after the seminar but not within. Mediation is thereby intended to take place between the steps outside and within the seminar circle. Learning is intended to have impact both on the practice of the following seminars and on general socio-cultural practices over time: the individual's critical thinking and self-reliance, and on democracy.

4.3.   Discussion and questions

This is a rough picture of what is intended in the Socratic seminar. It is probably not the actual outcome. When participants are "masters" of seminars all the different steps ought to display all intellectual/dialogical moves described if the seminar-training is to meet the goals intended. One might suspect that the working order of seminars will change over time and that the different planning steps more or less will merge. The teacher facilitating will probably have to change from being an active role model to being more passive, as the group learns (the traditions generally promote a passive role). The seminar promotes a complex interplay of dialogical and intellectual skills, taught by assigning different focus to the methodological steps. But is it reasonable to think that students in group voluntarily cooperate to refute the ideas of each other or does the teacher have to be more actively questioning (e.g. in 3 b)?
The underlying pedagogical theory of Socratic seminar presupposes the individual and the group thinking process to be similar. It suggests that the group acts, reacts and thinks as an individual does. The actions carried out in "group thinking" are supposed to function as a role-

model for the individual thinking. But is it reasonable to suppose that a group could have an idea? If so, where is this located if not within the individuals? Is it possible to teach complex things like thinking and democratic dialogue in this fairly simple way? Previous research suggests that it's possible to some extent (cf. Billings & Fitzgerald 2002).

5.   Conclusion

The ultimate goal of the seminars is individual character, citizens that will master the intended habits of mind to form a democratic society in cooperation with others, as well as personal goods. The independent traditions presented use the same fairly simple methodology to reach complex outcomes and goals. If this is possible to achieve in education, it would certainly be worth a closer study. At this point, I consider one of the most intriguing issues the relation between the individual and the group, suggested by the Socratic seminar traditions. The supposed relationship between individual thinking skills (or virtues) and "group thinking" is worth looking closer at. A focus to start with might be: *How are (are not) the methods and effects of the intended seminar process exposed and generated in group interplay?*

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Global Emancipation through Educational Social Networks: Shaping a new dialogue of action through community

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Abstract

In this paper three case examples are presented from a five-year international study of educational social networks for global school development. The purpose of the study was to examine the ways in which networks create changes in the teaching and learning environments, and in what ways such changes responded to the current call for 21st century citizenship and learning. The philosophical premise of education for emancipation is used as an analytic lens for examining the potential of the social networks for a broader purpose of education.

Key words: Global citizenship, social networks, collaborative learning.

1. Introduction

Paulo Freire (1970), Maxine Greene (1988), Bell Hooks (1994) and others have promoted the notion that education is about freedom and emancipation. They suggest that giving voice and creating space for students, teachers, and educators to engage in reflection and dialogue about society and social values is a primary task of education. Freire (1970) suggests the need for a pedagogy that empowers the self to move beyond conditions of oppression and control. Accordingly, he argues that together, in reflection and dialogue the oppressed can liberate themselves. He states that "no one liberates himself by his own efforts alone, neither is he liberated by others" (p. 53). This message has a double meaning in a global age, for at one level it reminds us the importance of education for self-empowerment and emancipation, and at another level it urges us to engage in community as a way to transform.

Maxine Greene (1988) argues the need to develop education as a public space in which youth give meaning to freedom in order to actively engage in shaping society, rather than accepting external control, demands, and structures as an objective reality. The current political systems of control, both culturally and institutionally have perpetuated a negative effect on freedom whereby we have come to accept such things as accountability and high stakes testing as *the* reality for what is important to education. Greene contends that such a view is "antithetical to….education for freedom" (1988; p. 22). More and more we see that the institution of education is being objectified by government controls, and now additionally with international politics. Educators are spinning by the minute to respond to new rhetoric about the "future citizen" (knowledge worker), and the need to reinvent the curriculum and classroom learning. Unfortunately, the rhetoric and policies are changing so rapidly that educators are forced to bypass pedagogical reflection and planning that is necessary to develop healthy learning environments, in favor of developing responses to the "rhetoric of the month".

Bell Hooks (1994) talks about "engaged pedagogy" as necessary to emancipate teaching for social action and transformation. Her work communicates the importance of seeing oneself as subject rather than object, thereby empowering self to engage in transformation and to question oppression and injustice. This concept of empowering ourselves to engage in shaping life, rather than accepting the status quo is, I contend, of central importance to education in a global age. It has implications for both teaching and learning, as educators and students engage, together in community to reflect on the global social condition. While Hooks focuses more on the self as teacher, I suggest that her notion of empowerment through the subjectivity of self is an important feature to a larger argument for educational development in a global age that is framed within a metaphor of community. Considering education as

emancipation within a global framework draws added value from the social networks (Stephenson, 2005) and communities of collaboration that are building internationally. These networks are powerful silos for voice and emancipation that can spread the impact of an engaged pedagogy from self to community.

The purpose of this paper is to provide evidence of the importance of social networks for educational development and programming, that impacts teaching and learning. Through educational social networks educators, students, and in some cases local communities, are adapting the curriculum and learning environments in order to be engaged in a global response to social development. Through such learning networks, students are more self-driven, independent, and active in not only shaping their own learning, but also identifying what is important to study; in effect they are shaping the curriculum through their global engagement.

The "flatening of the world" (Friedman, 2005) with developments in digital technologies, gives rise to a new opportunity for educators to develop a pedagogy that engages youth in social learning networks, and uses global trends and conditions as the curriculum. Within this framework, emancipation comes from sharing our own knowledge and perspectives in community with others to shape change. Nelson (1993) states that, "communities are the primary loci—the primary generators, repositories, holders, and acquirers—of knowledge" (p. 124). She suggests that the "agents who generate knowledge are communities and sub-communities, not individuals" (p. 124). Stephenson (2005) further points to the importance of social networks, claiming that "relationships [the heart of social networks] are the true medium of knowledge exchange" (p. 248). Situating engaged pedagogy within a global social network community has the potential to shape a new discourse of humanity through knowledge sharing, which is not dominated by politics and control, but guided by care for one another.

2.   Research Methodology

This paper presents findings from a five-year study of schools engaged in the International School Connection, Inc. (ISC) network for global school development. The ISC is a global learning network that provides support systems for professional development and school connections to engage educators and students in shaping learning environments that contribute to making a difference in the global social and economic conditions. The vision of the ISC is "for students to be prepared during their school years as global citizens, and to work with people in other parts of the world on common projects and learning activity" (www.iscweb.org/about_us/mission_vision). Within the ISC network are a number of member schools and school districts from countries around the world, including Spain, Finland, Sweden, Canada, Russia, China, Singapore, the U.S., Columbia, and Norway. Each brings to the ISC a commitment to the vision and mission, as well as experience and knowledge in educational development, which fosters a global community of learning. Individually, the programs in each of the member countries provide important contributions to their local and regional contexts. Collectively, they contribute to a global dialogue for social action.

Three methods were combined in this study, including ethnography, grounded theory, and case study. This choice was made to address the unique complexities and opportunities of conducting research in virtual settings. As a researcher, I approached my role in the virtual community as an ethnographer "living online" and participating in annual meetings with members of the network community. I chose grounded theory as an epistemological framework to reflect not only the exploratory nature of the research but also to match the emergent nature of social networks and the outcomes that result over time. Case study method was also incorporated since the network only represents cases of schools around the world,

and is thus not generalizable. Together, these three methods combine to create an exploratory study of the emerging phenomenon of international education social networks for global emancipation.

3. Findings

Findings from this five-year study suggest that schools engaged in social networks can extend not only their educational programming, but as well create new learning spaces for youth that address the 21st century challenges of living and work (UNESCO, 2002): independent, pro-active, socially responsible, digital literacy, collaborative, sensitive to diversity, communication skills and team orientation. Three cases are provided in this paper to highlight the ways in which schools engaged in the ISC are contributing to global emancipation through an engaged pedagogy. The school programs and projects highlighted in this paper are not unique to world. There are, and have been, many schools around the globe that address multiculturalism, diversity, environmental issues, and democracy challenges. What is unique is their connection within a larger global social network and the potential they have over time for shaping a difference in generations to come.

3.1 Case 1: Ottawa Canada- AY Jackson School

In Ottawa Canada, for example, there has been a focus on cultural diversity for years. Using international languages as a central part of the educational community, curriculum and pedagogy focused on a recognition and respect to the cultural heritage of its students and families, and provided a greater sense of emotional and psychological stability for students. Collectively, recognizing different languages as culture, according to the school board documents, helps to establish an openness to other cultures and bridging of communities. Within the last two years the Ottawa-Carlton School Board has extended the focus on language and multiculturalism to anti-racism and globalization, recognizing the importance of caring about the global human condition and the mulit-cultural tapestry of the world (OCDSB, Report # 06-151, 2006). Through a variety of local programs student and faculty ambassadors, curriculum criteria, and faculty training, educators are hoping to contribute to positive change in the social and cultural dynamics of their communities. Further, through international networks and partnership programs, the school board is actively engaged in working with schools in other countries to develop programs addressing anti-racism. The word is spreading, and the dialogue is changing as educators are engaging themselves in self-reflection and awareness about their role in addressing imbalances in human equity and diversity.

In 2006, the AY-Jackson High School was awarded as the first Global Learning Center (GLC) school. According to the GLC application document international studies is a whole-school initiative that promotes cross-cultural understanding and encourages the active participation of students in global community issues. Evidence from the programming shows that the work of the school is changing the curriculum as well as the learning environment. By opening the classroom to the world, youth are engaged in developing knowledge about global phenomena, as well as developing skills for collaborative social development. According to the school leadership, there is a belief that "by helping students understand that they are global citizens, and by teaching them ways to see with a global perspective, classrooms can lay the proper foundation for solid global citizenship education." (p. 5; 2007). Through participation in the ISC, the AY-Jackson High School and the Ottawa-Carlton School Board provide a benchmark for other schools world-wide regarding how curriculum and global development can be interconnected. And furthermore, how integrating internationalization in the whole school can change the learning environment for youth.

3.2 Case 2: Gripenskolan Sweden

For years, Gripenskolan (Gripen High School) has been engaged in learning projects and teacher exchanges with schools in the Baltic states, through a grant from UNESCO in 1989. Since that time they have developed other projects in Tanzania and Kilamanjaro, which begin with a course at their school in "knowledge about developing countries". At the 2005 ISC Summit, The principal reported an example of a book they use in their curriculum, called: The Voices that Never Become Silent: Thoughts about Democracy and Other Important Matters. The book is a collection of poems and reflections written by students at the school after visiting one of the Holocaust Concentration Camps during an international project. In 2005, the Principal of Gripen High School was named educational representative of Sweden to the United Nation's 10 -year program on sustainability. His local and regional efforts have led to an even larger engagement at the global level as a voice for engaging education in caring about the global condition. Through the ISC network, the Principal is serving a key role in helping to engage larger numbers of educators from around the globe in dialogue and programming related to sustainable development. This work is naturally connected to the development work in Ottawa Canada that focused on anti-racism and expands the discourse on educational involvement in global development.

3.3 Case 3: Pasco-Nanjing Global School Connection

In 2006, the Global School Connection was established between Pasco Middle School in Florida, USA, and Nanjing Shuren International Junior High School in Nanjing, China. The program offers children an opportunity to communicate, learn, share, problem solve, and grow with other children around the world. Members of the Pasco Middle School GLC Staff have been communicating face-to-face, via video-conference, and with Skype phone with principals and teachers at the Nanjing, in an effort to establish a relationship to enable our students to learn from one another. In February 2007, the first student led video-conference learning activity took place in which students from the two schools led each other in a class lesson. Students working the program learned not only about the subject matter for teaching, but as well learned about different teaching methods. The students from the two schools meet regularly through technology to share with one another about their lives and to learn together about the general academic subjects. Most recently students were paired in thematic teams to work together across cultures. Among the topics included are: religion and philosophy, the great-wall-of -china, education, family traditions, customs, and agriculture and industry. In a short time, the collaboration has changed the teaching and curriculum in the school, as well as the relationship between teacher and student. Moreover, the students are engaged in global learning communities developing subject knowledge as well as lifelong learning and active citizenship skills.

3.4 Building a responsive future through education networks

The three examples are just several of the ways in which schools connected in global social networks are beginning to forge a new path for the development of youth, education and society. Through social networks, schools are able to share resources with one another that are changing the ways in which students are engaged in their learning, as well as the focus of the learning. An additional finding also emerged from the study that suggests caring about the planet and global community is reflected in the diversity of contributions. Schools engaged in social networks can provide diverse perspectives and responses to a common concern, as well as combine resources for collaboration. The model reflects additional contributions that are made by schools participating in the ISC network. Among the contributions are perspectives and experience in working with democracy, student-driven learning, global environmental issues, brain-based learning, leadership for sustainable school development, and futures

education. The model illustrates the variety of programs present with the schools and school districts among members of the ISC network as of 2005. Many of these participating schools are also engaged in other networks, extending their discourse even farther. As these educators come together in dialogue, they not only share about their own educational programming, they also reinforce a new discourse on education that builds on an ethic of care, and gives agency to educators and students alike to engage in human social development.
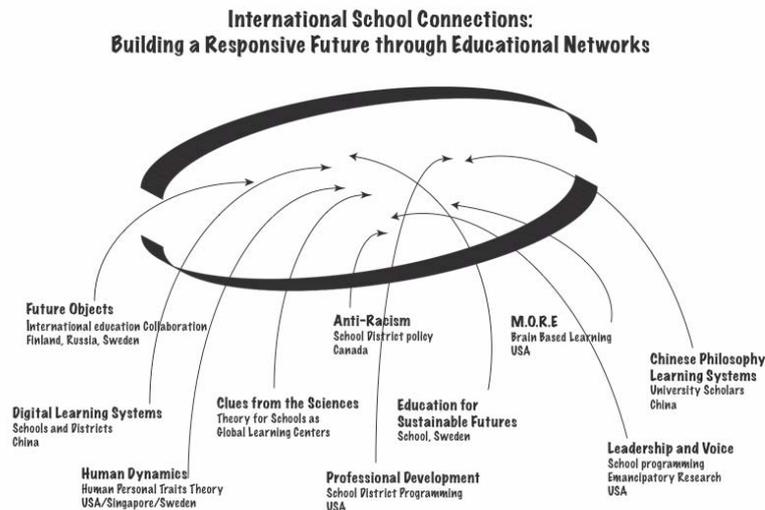
In singular, each of these efforts is commendable. In combination they reflect the importance and power of collaboration, as all persons engaged in the network learn from and with one another, impacting changes in their local conditions at a more rapid rate, with far reaching consequences for global action. Educators in the ISC have joined together, along with others, in a global community of practice to share information and shape knowledge collectively about learning and education in the global age. Together, in a community of practice, they give voice to a new discourse on education that has the potential to emancipate the human and environmental conditions on a global scale.

4. Conclusions

In this paper I have provided a few examples of the ways in which schools are expanding the learning environment through social networks. It is beyond the length of this paper to provide more detail. However, the study does show that over time the social networking has created stronger ties between educators, students and their communities. Affected are the perceptions and attitudes of the members about global issues and the importance of civic engagement. Furthermore, teaching models and the learning environment are changing in ways that support the kind of 21st century living that is emerging with globalization, technology and the network society. In addition to the practical pedagogical changes that are occurring in the schools, education social networks are also emerging in ways that help to shape an engaged pedagogy and ultimately create a space for learning for emancipation and freedom.

This study further demonstrates that through the use of global social networks, education has the possibility to be a counterforce to economic globalization by giving voice to a new international discourse. Capra (2002) states that, "in the information age, networking has emerged as a critical form of organization in all sections of society. Dominant social functions are increasingly organized around networks, and participation in these networks is a critical source of power" (p. 149). The current discourse is dominated by capitalism, corporate

control and terrorism. Through programs focused on diversity, social justice, anti-racism, sustainability and the environment, a new discourse can spread that reminds us of the importance to care about humanity and the environment above all else. It is thus conceivable that Freire's concept of liberatory pedagogy will have far reaching consequences for developing global community if schools continue to develop in this direction. It is anticipated that the youth who develop their knowledge and skills within this global context of networking will continue to contribute to a global responsiveness for humanity and the planet, liberating themselves and society.

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Evidence through the Looking Glass:
Developing Performance and Assessing Capability

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Abstract
This paper discusses an approach to authentic assessment that has been developed through a series of research studies over the last 20 years. It presents a conceptual argument for how task-focussed, creative thinking can be heightened within a performance assessment context through using strategic evidence prompts. Using case studies of the originating project for this approach and then more recent studies, it illustrates the strategies that were used, the assessment evidence that was generated as a result and, most importantly, the positive impact on the designing and thinking skills of the learners involved.

Key words: Authentic assessment; evidence; creativity; designing.

Research in England for the Assessment of Performance Unit (Department of Education & Science) in the late 1980s embraced Design & Technology for the first time. The research team at Goldsmiths College developed new approaches to structuring assessment tasks and identifying qualities of capability (Kimbell et al., 1991, 2004: Stables and Kimbell, 2000). A series of projects conducted with Research Councils, industry and professional bodies has subsequently built on this work extending it both *practically* into new models and approaches to assessment, and *conceptually* by exploring the mechanisms of mind and the parameters of performance that comprise capability in design & technology. The work has been done with age groups from 5-18 in schools and with adults.

Drawing on this body of work, this paper presents a conceptual argument about how task-focused, creative thinking occurs and can be heightened through strategic use of evidence prompts when the task arises within the context of authentic assessment. In particular, it focuses on questions of *evidence*. By exploring the twin faces of evidence, we consider who it is for, how it can be provoked, what can be seen from it, what learned from it, and, ultimately, how it can support the development of thinking skills of both learners and teachers.

The brief we were presented with for the APU research first made us fully aware of the challenge of evidence. We were to assess the design & technological capability of a 2% sample of the 15 year old population of England, Wales and Northern Ireland (about 10,000 learners). Design & Technology came in the wake of subjects such as science, maths and English and these surveys had set certain precedents – e.g. that assessment should be largely *paper and pencil*, undertaken in *short time frames* and sent to randomly selected schools to be administered by teachers in the schools.

Since design & technology activities typically involve far more than just pencil and paper work, and since projects typically last for days/weeks rather than minutes, there were some serious challenges in the brief we were set. We were committed from the outset to assessing through authentic activity, where performance is linked directly to process. Creating assessment activities within these constraints forced us to focus very directly on how we could engage learners in a design activity quickly, how we could set a challenge that could genuinely be addressed in short time frames and how we could reap a range of evidence of capability in such a setting.

We outline below our approach to this first project and then draw on three more recent projects to illustrate the central theme of this paper; that eliciting evidence for assessment

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serves a treble-acting purpose. At one level, when done effectively, evidence can deliberately be promoted through an activity and can thereby be exposed to scrutiny by assessors. This is the first and most obvious purpose of evidence in an assessment setting. At a deeper level however if (in the eyes of the learner) the activity is sufficiently authentic, then the prompted display of evidence enables the learner also too to 'see' (probably for the first time) the evidence that they have just created. Reflection on this evidence then enables learners to improve whatever is the focus of their thinking; the *product* they are designing. So not only do *assessors* gain insight into learners' thinking, through this display of evidence, but so too do *learners* themselves. When done effectively, their thinking is laid bare for them to see for themselves and benefit from. But the issue does not even end there, for at a yet deeper level, learners are affected not just by being encouraged to modify and enrich the product they are working on. They also begin to modify their design processes so as to maximise their ability to make their thinking explicit. Making this thinking explicit to others (including assessors) has the *double purpose* of helping them to improve their product, and thereafter the *treble purpose* of improving their more generic designing processes.

Our awareness of these layers of significance emerged first in the APU project in which we designed tasks for 10,000 learners based on short, paper and pencil activities. Our immediate concern was to develop assessment tasks that would instantly motivate and engage learners. We believed that if we wanted to assess performance, then to be valid, that performance had to take place in as authentic a way as possible. Our approach was to develop a rich context, with abroad range of design issues and challenges embedded within it, and to trial it with a group of 15year olds, both to see if it engaged them and to see the capability it laid bare. With this first activity we were not disappointed on the engagement front. We created a scenario of a local community taking over and developing waste-ground for community purposes – meeting spaces, children's play areas etc. We identified a range of design challenges and then engaged groups of learners in addressing particular tasks. The learners quickly took ownership of their task and from the way they handled it we could comment on their enthusiasm, effort, collaboration and so on (attitudinal things) but unfortunately, as it turned out, we could say very little about their capability. We had (as an evidence base) a few drawings and some models, but no idea about *why* they had done the things they had done or what they *thought* about them. We had virtually no evidence of their design thinking.

Our response to this - in the next trial – was to stop the learners every ten minutes and asked them to write down what the had just done, why, and what they planned to do next. This was a form of protocol analysis based on a version of concurrent verbalisation (see Ericsson & Simon,1993) through which we sought to 'get inside the heads' of the learners involved in the activity so as to reveal their thinking. Despite being somewhat laboured, it was a tactic that worked in so far as it provided some valuable insights into their actions. The learners' reaction was interesting, for they found it annoying and valuable at the same time. It had been tedious to stop and go through this protocol every ten minutes, but at the same time it had provided a 'pause for thought' that they might not otherwise have taken. We realised we could get them to reveal their thinking on task but that, as a way of operating, it was too blunt an instrument. By refining the approach, what prompts we used and when we used them, we could develop a more effective and subtle approach.

Critical to this was the model of design & technological thought and action we were developing concurrently with the activities. This model (Figure 1) rejected the prevailing linear and cyclical models of design process in the literature of that time (see Kelly et al., 1987). The model we were developing promoted a view of activity that took the development of a speculative or 'hazy' initial idea to the point of becoming an effective working reality through an iterative process of thought and action. From our first activity trial, it was

apparent that we could 'see' the *action* components through the tangible evidence of the drawings and models that emerged as the designing progressed. But the thinking elements, being more ephemeral, were largely invisible. The prompts that we then built into the task targeted this thinking and increasingly we found ourselves able to expose it to the light of day.

Figure 1. An iterative conceptual model to describe designing processes

THE INTERACTION OF MIND AND HAND
A SCHEMATIC ILLUSTRATION

IMAGING AND MODELLING INSIDE THE HEAD

CONFRONTING REALITY OUTSIDE THE HEAD

HAZY IMPRESSIONS

DRAWINGS, SKETCHES DIAGRAMS, NOTES, GRAPHS, NUMBERS.

SPECULATING AND EXPLORING

MODELLING IN SOLID TO PREDICT OR REPRESENT REALITY

CLARIFYING AND VALIDATING

PROTOTYPING OR PROVISIONAL SOLUTIONS

CRITICAL APPRAISAL

THE POTENTIAL OF MORE DEVELOPED THINKING   THE POTENTIAL OF MORE DEVELOPED SOLUTIONS

The prompts were built into the activities through a structured, unfolding booklet that worked as a portfolio for the short activities, (which we later came to term an 'unpickled' portfolio, as it did not involve 'steeping' the learners in a long term project: Stables & Kimbell, 2000). Our concept of the portfolio is as a working document that grows dynamically with the project or task, rather than being merely a repository (Kimbell et al., 2007). To illustrate how tasks were structured in this way, the following is the sequence of events from one task.
Watch a short (8 minute) video, introducing a scenario and highlighting design opportunities and issues (e.g. around the increasing difficulties elderly people face in preparing food)

1. Consider the task and 'jot down' initial design ideas
2. Prompt 1 – what will the design need to do and be like if it is going to be successful
3. Prompt 2 – review work to date and annotate with a *red pen*, identifying which ideas are good – and why, and which need changing or abandoning – and why.
4. Continue to develop design ideas towards a solution.
5. Prompt 3 – review your work and note down all the design problems that still need to be sorted out.
6. Prompt 4 – note down what do you now need to know (that you don't already know) to take your ideas further. How/where will you fin out?

7. Prompt 5 – look back at the task and your own success criteria – how do your ideas measure up?

Our aim in this was to reveal the learners' thinking to provide us with evidence of capability. But in the process of doing this, the response of learners was unequivocal. They were being provoked into thinking more deeply about the matters in hand, demonstrating the rich double-sided nature of the evidence being prompted.

Within the task we ask learners to do something (for example some 'red pen' evaluatory annotations). We can then 'see' the level and depth of their thinking at that moment. But (critically) so do they. This process of asking for the evidence does a range of things:

- it tells them that this thing (red pen etc) is an appropriate thing to do;
- it allows them to think about it and answer the question / do it;
- it thereby allows them to recognise (metacognitively) that they have done it;
- in the process it improves their grip on the task;
- but (more important procedurally) it also enables them to import the thing (red pen etc) into their own practice … so their practice (including their thinking) becomes richer and more robust.

It is as if the evidence speaks in a mirror - to the listener (directly) and back to the speaker (indirectly) creating a form of playback. The 'playback' in turn has two benefits: directly improving the learners' product and indirectly improving the learners' process. So, in general, the more we can encourage the learners to speak to us, the more they hear themselves externalise their thinking, developing both the design ideas they are working on and the generality of their practice. The approach has importance in its potential for developing learners' self-awareness and the requirement to externalise their thinking supports learners' metacognition. In the context of well-designed authentic tasks therefore, good assessment has the effect not merely of *gauging* learners' capability but also of *enhancing* it. In three more recent projects, we have taken forward these ideas, extending the range of evidence being collected and (hence) offered back 'in the mirror' to learners.

Assessing Design Innovation was a project undertaken for the Qualifications and Curriculum Authority (responsible for all national assessment in England). The focus of this project – as the title implies – was on innovation, and our efforts were on the challenge of identifying (and then promoting) innovative performance. One of the approaches we adopted was with the use of a digital camera. Once learners were involved in the task, we created a photo-story-line of their work, including their evolving modelling, taking a photo approximately every hour throughout the six hour activity. (Figure 2)

This was originally done to provide assessors with a snapshot story-line of the route that learners took to their prototype solution, but we soon realised (once again) that this new kind of evidence was having an additional effect on learners' performance. This arose because these photos – once taken - were immediately printed and returned to learners as thumbnail images to stick in their unfolding booklets. Once learners realised that this was happening, and that more images would be taken through the activity, two significant things happened:

a) they began to *anticipate* the photos and were ready to show us what they thought of as the most significant developments in the work over the last hour.

b) they became more confident with their modelling – prepared to butcher existing models to extend them into new forms or arrangements. The hard photographic evidence enabled them to be less 'precious' about preserving the models themselves.

Figure 2. A photo-story-line

In both of these ways the evidence for assessment enhanced their performance on the task and we are confident that many of them will also have internalised this photo-story-line concept into their designing approaches.

Our current project, *e-scape*, takes this idea yet further. The concept of e-scape is that learners' portfolios are no longer paper-based but digital. Learners work with hand-held digital tools (PDAs – see figure 3) using them as

Figure 3. Using the digital tools

- a sketchbook
- a notebook
- a camera
- a voice recorder

As they undertake the task, their work appears simultaneously and dynamically in a secure web-space. Here, given the right access codes, the work can be viewed not only by the learners themselves but also by teachers and assessors.

The single biggest innovation here is the newly possible use of voice files. We have repeated the routine of taking photographs of the evolving work, but have supplemented in two ways. First we have made learners themselves responsible for taking the photos, when cued by us to do so. They can choose what to photo and how to 'stage' it so that it best tells us about the evolving work. Second we have asked them to record a 30 second 'sound-bite' to explain how the work is progressing, what is working well and what needs further development. These sound files are fantastically interesting, revealing all kinds of evidence of learners' thinking as it unfolds. And, once again, the process of making it explicit for us naturally makes it clear also to them. They are working their thoughts out as they record them for us. Their evaluations of the process are highly revealing of this metacognitive benefit.

Finally, in another current project (*Creativity and Progression in Transition through Assessment for Learning in D&T*: McLaren et al. 2006, Bain and McLaren, 2006) we have sought to highlight this metacognitive benefit, using the approach to support 'sustainable assessment' (Boud, 2000). In addition to the self and peer reflection built into the activity we included a learner self-reflection tool through which they reflected on their own performance by focussing on the following:

- I was best at …
- the easiest thing was …
- three things I learned were …
- three things I want to get better at are …

Each learner completed two design tasks, with a nine-month gap between the first and the last. In some schools, intervention strategies focusing explicitly on developing self and peer evaluation skills were introduced during the time between the two tasks. What transpired was evidence of a relationship between these intervention strategies, levels of performance and the

quality of thinking displayed – including through the self and peer reflections. As with previous use of the tasks, motivation and engagement were high and attitude positive. Once again, the evidence prompts within the activity not only provide insights to support external assessment, but they also provided the clues to help learners improve their evolving prototypes. But quite explicitly in this case it was not only their product-based thinking that was enhanced, but also their self-awareness of themselves as designers and as learners.

Taken together, we believe that these projects demonstrate very clearly how evidence operates in complex ways with learners in assessment tasks. Evidence is – in a real sense – seen through the looking glass. And once seen, this evidence can be the spur for development both of the product being designed and of the mind that lies behind it.

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Critical Features of Word Meaning as an Educational Tool in Learning and Teaching Natural Sciences

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Abstract

The educational challenge of polysemy of words used both in non-formal (every-day) and scientific formal languages is addressed. An analysing tool, the triadic approach, has been elaborated to make this kind of polysemy of words explicit by discerning three different sets of meaning: non-formal, a scientific quality and a physical quantity, respectively. The discernment process is a particular way of seeing the critical aspects of variation of meaning simultaneously connected to one and the same invariant word (symbol).

Keywords: Conceptual change, physical quantities, polysemy, science education, temperature, word learning

Introduction

It is a well documented fact that words imported from non-formal every day language and used as defined terms in formal scientific language makes up a challenge in both teaching and learning. The extensive research on learners' conceptions of scientific concepts is a salient exponent of that fact (cf. Duit, 2007). For instance, the foundational scientific terms force, temperature, electric current, heat and energy are found to be difficult to attain among learners both on elementary and advanced levels. Even science teachers in secondary schools have shown deficiencies in their ability to define such terms (Galili & Lehavi, 2006).

In science educational research, learning scientific terms is generally treated as a process of conceptual change. In the standard dyadic approach the learner is supposed to make a cognitive transition from a pre-instructional conception of a natural object or phenomenon to the current scientific concept (Duit, 2003) (see Fig.1).
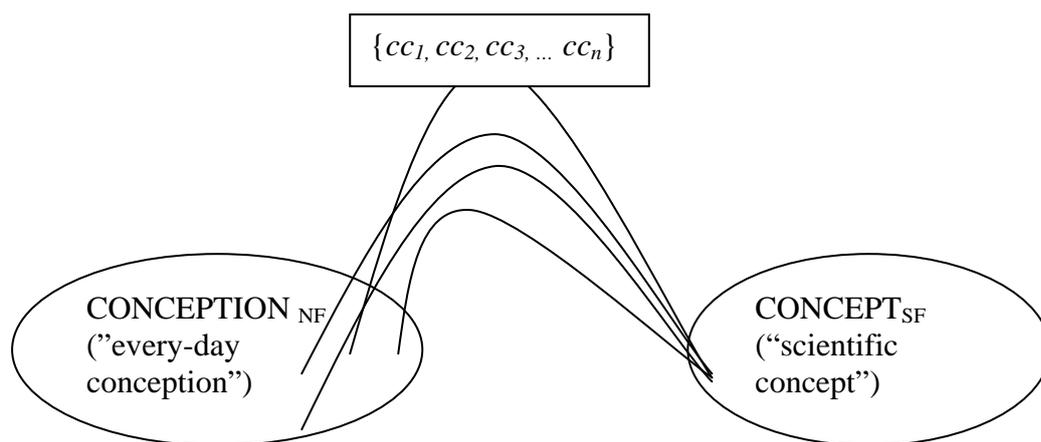

Fig 1. The standard dyadic conceptual change approach. The set $\{cc_1, cc_2, cc_3, \ldots cc_n\}$ denotes 'conceptual change' – theories aiming at identifying the educational conditions for the transition from a non-formal conception to the formal (scientific) concept.

For instance, learning the scientific formal (SF) concept TEMPERATURE$_{SF}$ is looked upon as a transition from the every-day non-formal (NF) conception TEMPERATURE $_{NF}$ to the scientific formal (SF) concept TEMPERATURE$_{SF}$.

However, starting from semiotic/semantic perspective the word 'TEMPERATURE' expands a "sense-spectrum" (cf. Cruse, 1986, 71- 74), a space of meaning, simultaneously including the common parlance meaning TEMPERATURE$_{NF}$ or, more correctly, a set of non-formal meanings {NF}, TEMPERATURE$_{\{NF\}}$ and the dual scientific meaning enclosing the current scientific scientifically delimited property/quality (SP) of a phenomenon, TEMPERATURE$_{SP}$ and the physical quantity (PQ), *TEMPERATURE*$_{PQ}$. This *triadic approach* analysis makes the polysemic situation of a term as TEMPERATURE explicit, opens up for consecutive discernments of critical features in the meaning making processes and thereby also revealing the conceptual complexity involved in the attainment of scientific knowledge (Strömdahl (in preparation for an international journal)). The fine-grained analysis of the relationships between world and language using 'the semiotic triangle' including the elements symbol (word), meaning and referent (Ogden & Richards, (1923) 1989) is elaborated in Strömdahl (ibid.) but is only implicitly accounted for in this article.

Aim

The educational implications of the application of the triadic approach will be explicated by using the word TEMPERATURE as an example. By applying the triadic approach to the word (term) TEMPERATURE its "sense-spectrum" will be briefly identified. Focus is put on the critical features of discerning the scientific meanings of TEMPERATURE within the categories of qualities and the coherent system of physical quantities.

Analysis

The polysemic situation of TEMPERATURE is visualised in Fig 2. The non-formal set of meanings TEMPERATURE$_{\{NF\}}$ includes ideas of warmth and cold, bodily experiences of events connected to these ideas and e.g. quantitative statements of temperature by simple readings of thermometers. Previous empirical research has revealed a lot of sense confusion among pupils and students about the differentiation between heat and temperature (see e.g. Tiberghien, 1983; Kesidou, Duit & Glynn, 1995; Wiser & Amin, 2001; Duit, 2007). In non-formal situations these non-formal senses can be sufficient for proper every-day communication and actions. Similar non-formal ideas have also been a starting-point for finding out the material nature of warmth and cold in the history of science. By painstaking efforts classical thermodynamics has ended up in attaching the word TEMPERATURE to the property, here denoted TEMPERATURE$_{SP}$, of every body that follows the zeroth law of thermodynamics: 'If two bodies are each in thermal equilibrium with a third body, then they are in thermal equilibrium with each other'. If the third body is a thermometer its readings will have physical significance. The quantitative aspect is expressed by *TEMPERATURE*$_{PQ}$ which is a base physical quantity belonging to the coherent system of physical quantities within the International system of Weight and Measures, SI, and the mathematics of quantity calculus. From a statistical thermodynamic point of view TEMPERATURE$_{SP}$ is interpreted as the relative change in possible energy distributions among the particles in bodies when a given amount of energy is transferred between them. The total number of distributions increases when energy is transferred in the direction when the one body gains more distributions than the other loses. Spontaneous transfer of heat (energy) takes place when the relative gain of numbers of distributions of that body that receives the energy is bigger than the relative loss of distributions of that body who releases energy. This direction is the most probable. The body with biggest relative change in distributions has the lower temperature

since it spontaneously receives heat from the other. This interpretation is in alignment with the notion of absolute temperature (T). The formal expression for this interpretation and the notion of absolute temperature is dU/dS = T, where dU denotes change in inner energy and dS change in entropy.

From a more general phenomenological point of view TEMPERATURE$_{SP}$ can be looked upon as the intensity of the motion among the molecular and atomic particles.
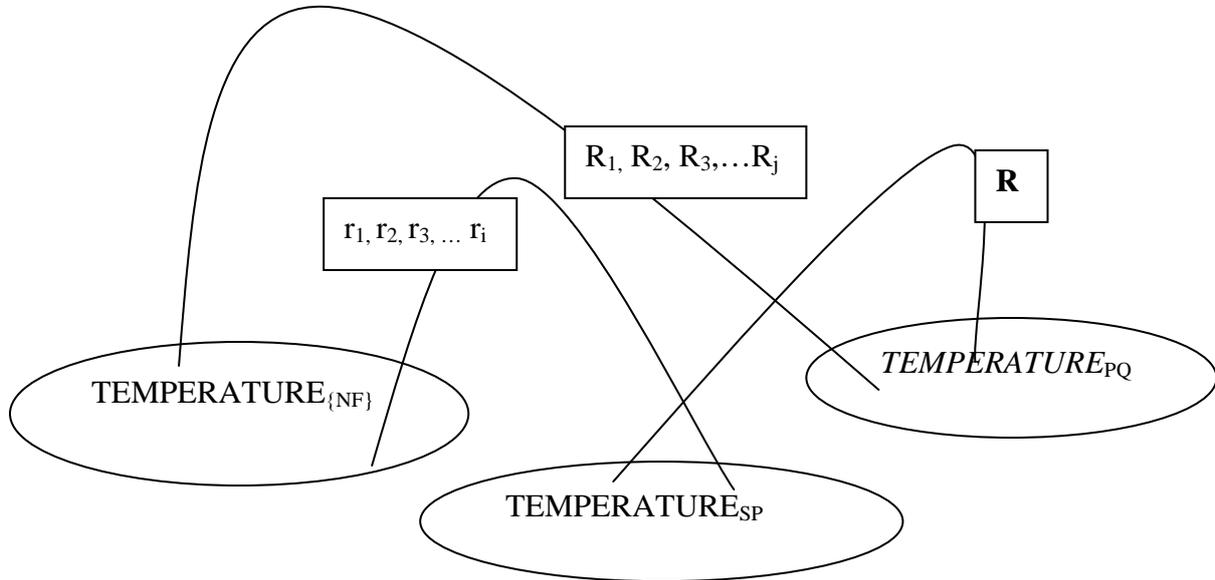

Fig. 2 The triadic approach applied to the term TEMPERATURE. The possible relationships {r_1, r_2, $r_{3, ...}$ r_i }, **R,** R_1, R_2, R_3,…R_j}between the different senses can only be empirically determined but are not further focussed in this paper.

If the intended object of learning is the scientific formal (SF) TEMPERATURE$_{SF}$ three discernments seem to be necessary to catch the "sense-spectrum", identifying the often taken for granted set of TEMPERATURE$_{\{NF\}}$, the identification of TEMPERATURE$_{SP}$ as a quality (property) of a material phenomenological process and the identification of *TEMPERATURE*$_{PQ}$ as a base physical quantity (PQ) within the coherent system of physical quantities (SI) and quantity calculus.

TEMPERATURE$_{SP}$			*TEMPERATURE*$_{PQ}$	
Quality (property)		Process	Quantity (base physical quantity)	Quantity (derived physical quantity)
Macro-level	Micro-level	Changes of the Quality (property)	Measurable by thermometers graded in the SI unit K (Kelvin)	
Zeroth law at thermal equilibrium	Relative energy distributions among the particles in a body			

Figure 3 Critical features briefly identifying the scientific meaning of the term TEMPERATURE. The category TEMPERATURE$_{\{NF\}}$ is omitted in this figure, since the focus here is the discernment between TEMPERATURE$_{SP}$ and *TEMPERATURE*$_{PQ}$

The discern act is even two-dimensional, both a discernment of the three categories (NF, SP, and PQ) and discernment within these categories (see Figure 3) to identify critical features and to focus on them simultaneously (cf. Marton et al., 2003). Discernment within the SP – category is connected to the critical features of a quality (property) on the macroscopic and microscopic levels respectively and as a process. Within the PQ-category the discernment is connected to identifying the coherent system of base and derived physical quantities. As a base physical quantity $TEMPERATURE_{PQ}$ has the same categorical status as the other six base quantities, like e.g. $LENGTH_{PQ}$ and $TIME_{PQ}$. In other words TEMPERATURE can be discerned on the one hand by being a member of the base physical quantities and on the other hand contrasted against the derived physical quantities (cf. Figure 3). As indicated above, TEMPERATURE as a scientific term gets its statistical thermodynamic meaning in the context of other scientific terms like e.g. ENERGY and ENTROPY, making up a coherent whole. These individual terms are also polysemic and can be analysed by the triadic approach.

From an educational point of view the triadic approach makes it possible to classify the sense-space of every scientific TERM by *categorical induction* (Murphy, 2002, p 243ff) according to the categories NF, SP and PQ : $TERM_{\{NF\}}$, $TERM_{SP}$ and $TERM_{PQ}$, revealing the critical features and thereby reducing the cognitive load to attain the scientific term.

Conclusion

The educational value of the triadic approach analysis is to elicit the polysemy, the space of meaning, the 'sense-spectrum' of terms in a way that makes it possible to discern the critical features identifying the intended learning object, here exemplified by the scientific meaning of $TEMPERATURE_{SF}$ as $TEMPERATURE_{SP}$ and *$TEMPERATURE_{PQ}$*. Besides the meaning of $TEMPERATURE_{\{NF\}}$ and its relationships to the scientific meaning is made possible. Subsequently, in learning the scientific meaning of $TEMPERATURE_{SF}$ the demand put on the learner and the teacher is to discern these categories of semantic distinct meaning and references of the one and the same polysemeous word TEMPERATURE and to disambiguate the term according to context.

Discussion

Most research on students' conceptions (especially alternative conceptions or misconceptions) and teaching and learning science concepts is framed by different conceptual change theories. The present investigation starts from semiotic/semantic perspective by introducing *the triadic approach*, expanding a space of meaning, a 'sense-spectrum' of terms comprising three categories. The triadic approach is applicable to any term to sort out its scientific significance and its category membership. As an example let us look at the word 'light'. $LIGHT_{\{NF\}}$ is not only polysemeous but also a homonym, viz. it has senses that are totally different, e.g. a phenomenon connected to human vision, a property of a weight and a nutrition property in the context of "light beverages". In optics, the meaning is a defined scientific phenomenon $LIGHT_{SP}$ (electromagnetic radiation visible to the human eye) but lacks a meaning of a physical quantity ($LIGHT_{PQ}$ is non-existent). Thus, the approach can be applied to rule out category membership, in this case the category membership of a physical quantity.

Compared to the common conceptual change research in science education on attainment of scientific terms, the triadic approach adds among other things the aspect of category membership, facilitating category induction by discernment of the critical features in the categories of scientific qualities and quantities; the latter differentiated in base and derived physical quantities.

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Promoting Social and Cognitive Development in Schools: An Evaluation of 'Thinking Through Philisophy'

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Abstract
This study investigated the effects of collaborative philosophical enquiry on children's cognitive abilities, critical thinking and socio-emotional perceptions. The study took place over a four-year period in mainstream classes in primary schools in Scotland. This paper provides a summary of the overall evaluation.

Keywords: Philosophy for children, thinking, evaluation, cognitive ability.

Introduction

A key aim of Clackmannanshire Council's policy of *'Learning to Succeed in Clackmannanshire'* has been to help children become more independent thinkers and more effective problem solvers. A philosophical enquiry approach was introduced to primary school classrooms as an element of this strategy.

The initiative used Paul Cleghorn's (2002) programme 'Thinking through Philosophy' to provide a structure for challenging children to think critically and creatively. The Thinking through Philosophy programme provided stories and poems that acted as a stimulus to prompt thinking. The stories and poems included a high degree of 'ambiguity', i.e. they were open to different interpretations by the children in ways that could stimulate discussion as to the meaning of each story.

Aims

This initiative aimed to investigate whether regular participation in collaborative enquiry can lead to:

1. Developments in cognitive ability
2. Developments in critical reasoning skills and dialogue in the classroom
3. Emotional and social developments

Previous evidence was already available supporting these outcomes. Prior to the Clackmannanshire project, the author critically reviewed previous research literature relating to the evaluation of Philosophy for Children (Trickey and Topping, 2004). This review used a meta-analytic technique to compare and combine results and found a consistent positive 'effect size' across all Philosophy for Children studies reviewed.

The Clackmannanshire initiative raised the question of what outcomes would result from using collaborative enquiry in mainstream classes of approximately 30 pupils. Would previous positive findings be replicable in large classes facing the 'normal' constraints of funding and professional development time?

A key element in this process is the emphasis on developing a community approach to 'enquiry' in the classroom that enables children to construct a more considered understanding of the subject material than would be possible through a more traditional individual learning approach. One of the characteristics of this process is an increase in the use of supportive but cognitively challenging open-ended questioning by the teacher.

Methodology

The study investigated two questions:
'Can philosophical enquiry lead to positive outcomes in children when simultaneously used across primary schools in a local educational authority with classes of 30 children and teachers with little previous experience of collaborative enquiry methods.'

'If so, what is the nature of these outcomes?'

The outcomes of the Thinking through Philosophy programme were evaluated through:

1. *standardised tests* administered to experimental and control classes to provide measures of cognitive ability and self-esteem.
2. *analysis of classroom discussion* using video recordings to provide measures of critical thinking and dialogue.
3. *analysis of the perceptions of pupils, teachers and head-teachers* using questionnaires to provide an indicator of social/emotional development.

The first two evaluation methods used a traditional two by two pre-post experimental design. One population of children participated in one lesson each week using the Thinking through Philosophy programme while the matched control classes followed their usual curriculum. Both populations were then retested at a later stage under the same conditions.

The third evaluation method, while equally rigorous, used a more qualitative design. Questionnaires were used to elicit the perceptions of pupils, teachers and head-teachers of outcomes arising from the Thinking through Philosophy programme.

Method 1: Standardised Tests
The standardised tests used were the Cognitive Ability Tests (CAT) and Myself-as-a-Learner (MALS).

a) Cognitive Abilities Test (CAT3)
The Cognitive Abilities Test (Lohman, Thorndike and Hagen, 1993) provided measures in standardised scores of Verbal Ability, Nonverbal Ability and Quantitative Ability for each pupil using multiple-choice questions.

'Pre-initiative' standardised scores were obtained in the three overall abilities for a sample of 105 Experimental pupils and 72 Control pupils. Follow up testing took place 16 months later. The results of each of the children were compared with how they performed in initial testing and how they performed in follow-up. There was an overall average gain per pupil of **6** standardised points when the verbal, quantitative and nonverbal scores of the experimental subjects were summated into a total Cognitive Abilities Test score. There were highly significant gains in all three cognitive ability areas (i.e. verbal, nonverbal and quantitative ability). There were no gains in the cognitive ability scores of the control group.

The results thus suggest that even one hour's use of an enquiry-based teaching methodology each week can have a significant impact on children's reasoning ability. There was anecdotal evidence from both teachers and pupils that the use of enquiry-based methods extended well beyond the 'Philosophy hour'.

b) Self Perception as a Learner and Problem Solver
Burden's (2000) 'Myself as a Learner' (MALS) was constructed to focus upon 'academic self-concept' as against an all-embracing 'self-concept'. MALS provides a measure of 'students' perceptions of themselves as learners and active problem solvers within educational

settings'. The scale comprises of 20 statements, e.g. 'I need lots of help with my work'. The students rate themselves on each statement on a five-point scale.

'Pre-initiative' scores were obtained for 186 pupils comprising of 134 'Experimental' pupils and 52 'Control' pupils. This procedure was then repeated six months later as a post-test measure. The pre- and post-test results were matched for every one of the 134 experimental pupils and every one of the 52 control pupils. Those pupils who had been involved in the Philosophy programme improved their self-esteem scores (significant at the 0.05 level) over this period. There was no significant difference between the pre- and post-test results of the control pupils. These results suggest that enquiry-based approaches are conducive to promoting self-esteem in learning situations.

Method 2: Video Recordings

Twelve video recordings were obtained of classroom discussion comprising of six pre-test recordings and six post-test recordings. Eight of the twelve recordings were of experimental classes who had a weekly Thinking through Philosophy lesson for six months and four were of control classes who had no involvement with the programme.

'Pre-initiative' video recordings were made of classroom discussion of a Greek fable. The teacher first read out the story and then explored its meaning through discussion with the class. The teachers were asked to repeat the exact same task with the same instructions six months later. The discussions were again video-recorded.

Each video recorded classroom discussion was scored using a structured observation schedule. Specific behaviours were selected for scoring on the grounds that they were readily observable and measurable and provided an indication to which the broader aims of the programme had been achieved. A measure of inter-observer agreement was gained to ensure the observation schedule was sufficiently reliable.

The classes involved in the Thinking through Philosophy programme increased their scores in the following behaviours (all significant at $p<0.05$ level). The rate of pupils supporting their views with reasons doubled in the experimental group over a six-month period. Teachers doubled their use of an open-ended follow-up question in response to pupil comments. The percentage of time that pupils were speaking (compared to the percentage of time that the teacher was speaking) increased from 41% to 66%. The length of pupil utterances in the experimental classes increased on average by 58%. There were no significant changes in the discussions taking place in the control classes.

Method 3: 'User Questionnaires'

The perceptions of pupils, teachers and head-teachers of the outcomes arising from involvement with the Thinking through Philosophy programme were obtained through:

1. systematic analysis of questionnaires completed by 77 pupils after six months
2. observations elicited from a questionnaire completed by head-teachers after six months
3. verbal and written comments from participating teachers throughout the initiative (elicited during support meetings and through diaries maintained by the teachers)

During the analysis of the pupil questionnaires, all pupil responses for each open-ended question were assigned to categories that were judged to reflect clear themes in the pupils' responses. The reliability of this approach was gauged by obtaining inter-rater comparisons.

The responses indicated that the pupils saw 'communities of enquiry' as leading to an increase in their participation in classroom discussion and to gains in their social/emotional development and thinking. The study provided evidence of improvements in pupil's

communication skills, *confidence* and *concentration.* The study also suggests that the process of community of enquiry helped pupils learn to *self-manage their feelings/impulsivity* more appropriately. Pupil responses to each question were subjected to Chi-Square analysis to determine the probability of these scores occurring by chance. Seven out of the ten questions were significant at the 0.01 level and two questions at 0.04.

Evidence of significant gains in the social/emotional development of the pupils was considerably strengthened by the level of consistency of results at three different levels, i.e.

1. consistency of pupil responses to the different questions in the questionnaire
2. consistency between pupil perceptions, class-teacher perceptions and head-teacher perceptions,
3. consistency of findings from different evaluation methodologies, e.g. a) the questionnaires and the video analysis of classroom discussion both provided clear evidence of increased participation of pupils in classroom discussion; b) the pupil perceptions of increased confidence matched gains measured on standardised tests of self-esteem.

Sustainability of cognitive gains
Both experimental and control groups of pupils were followed up by retesting with the Cognitive Abilities Test as they approached the end of their second year of secondary education. The pupils who had regularly participated in communities of enquiry in primary school had not experienced any further enquiry at secondary school. The control group similarly had not been involved in community of enquiry activities at secondary school. The group that had participated in enquiry and achieved significant cognitive gains at primary school demonstrated that these gains were fully sustained following two years of secondary education despite no further experience of enquiry. Similarly the control group who had showed no cognitive gains in primary school also showed no gains in secondary school. The main conclusion arising from this additional study was that cognitive gains achieved through regular participation in collaborative classroom communities of enquiry *proved sustainable* despite the absence of further experience of classroom enquiry in secondary school.

Conclusions and Implications
The Clackmannanshire study provided evidence that one hour of classroom philosophical enquiry each week in primary schools can be highly cost-effective in promoting:

1. sustainable gains in cognitive ability
2. developing critical reasoning skills and dialogue in the classroom
3. emotional and social developments

The study demonstrated that such developments can take place in mainstream classes of 30 pupils with teachers with little previous experience of leading whole class enquiries. However, developing open 'communities of enquiry' is likely to require a shift in pedagogy for many teachers. The role of the teacher in supporting whole class enquiry emphasises the role of the teacher as 'curious facilitator' rather than 'expert instructor'. The availability of appropriate and adequate training and credible support for teachers is thus crucial to achieving positive outcomes.

Challenging pupils to think independently in collaborative classroom communities may not be easy. However, as the current study demonstrated, there are potential gains for pupils. The nature of these educational gains seem increasingly important as the purposes of education are redefined in a rapidly changing world of information technology and global

economy. Evolving curricula now placing increasing emphasis on thinking and interpersonal skills.

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