

Prevention activity, design activity: to the emergence of creative design in the prevention of risks

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Résumé

Depuis une quinzaine d'années a été introduit en France un Enseignement relatif à la Santé et à la Sécurité du Travail (ES&ST). Il s'agit de former des professionnels qui adoptent des conduites qui intègrent la prévention des risques dans leurs activités ordinaires. Ce qui suppose de penser la maîtrise des risques comme une composante de la qualification professionnelle. De nombreuses études ont montrées qu'il existe des écarts entre les savoirs mis en jeu par les professionnels dans leurs pratiques et ceux portés par l'institution scolaire. En situation professionnelle, l'opérateur doit s'adapter au contexte et prendre des décisions face à des situations nouvelles. L'élève doit alors évoluer entre une école qui ne transige pas avec la sécurité et celle de l'entreprise qui s'en accommode en fonction des situations rencontrées. Dans un contexte théorique d'ergonomie cognitive et d'analyse de l'activité de conception, nous envisagerons les activités de prévention des risques comme des activités de conception et nous proposerons une réflexion sur les caractéristiques des situations et des activités qui sont susceptibles d'être proposées par l'enseignant afin de favoriser la capacité d'adaptation en situation professionnelle des élèves.

Mots clés : prévention des risques, activité de conception, processus d'enseignement - apprentissage

For the last 15 years, Education relating to the health and safety of the work (ES&ST) has been introduced in France. It is to train professionals who adopt behaviours that integrate the prevention of risks in their ordinary activities. This presupposes to consider the control of risk as a component of the professional qualification. Numerous studies have shown that there are differences between the knowledge put at stake by professionals in their practices and those worn by the educational institution. In professional situations, the operator must adapt to the context and take decisions in new situations. The student must then evolve between a school that does not compromise with the safety and the safety of the company which accommodates according to the situations encountered. In a theoretical context of cognitive ergonomics and analysis of the activity of design, we will consider the activities for the prevention of risks as the activities of design and we will propose a reflection on the characteristics of the situations and activities which are likely to be proposed by the teacher in order to foster the capacity for adaptation in professional situation of students.

Introduction

The prevention of risks related to the practicing of a profession takes an increasing place in the strategies of definition of employment. This dynamics of integration of the conduits of prevention in the intimacy of the gestures represents a major stake of evolution of the practices of the professionals; it is a question of training professionals who adopt behaviours which integrate the prevention of risks in their ordinary activities. From the vision of the professional who observes rules to ensure his safety, it is necessary to substitute that of the professional who develops skills in order to control the risks, whatever is the professional situation met. This presupposes to consider the control of risks as a component of the professional qualification.

For a great part, this dynamics of integration and generalization of prevention of risky behaviours rests on the training of the future professionals, in particular within the framework of the education. Consequently, about fifteen years ago was introduced, a Teaching relating to the Health and the Occupational safety (ES&ST). This teaching, which does not constitute “a new” discipline, is built around a traditional triptych of formation in France and rests on the articulation between two places of formation: the school and the company. This organization which reflects a dichotomy relatively old between theory and practical rests on fields of different knowledge of reference (Cheneval-Armand, 2010). Thus, the analysis of the various levels of knowledge concerned in the founding texts, the programs and the practices of the professionals show that differences exist between the knowledge of the professionals in their practices and those carried by educational establishments. For the professional who confronts concrete, real and daily problems, safety must be thought in terms of compromise between the need for applying the regulation to ensure its own security and the obligation to carry out the interventions. At school, the report to the standard will settle in this confrontation. So the pupil will be subjected to this double injunction, that of the school which does not compromise with safety and that of the company which puts up with it. That brings about a shift between school activities which say how it would be necessary to do (and that explains it and largely justifies it) and the occupations in which it is necessary to do by preserving the productivity. It thus has there a tensioning between two worlds with the radically different purposes, put under tension which supports the adoption by the references pupils to the practices of the professionals, which considerably limits the claim to make the practices of prevention evolve in the direction of institutional waitings (Cheneval-Armand, 2010).

For all that, this variation, between the ideal model carried by the school and the pragmatic models of the professionals, can be close to the capital distinction presented by Ombredane & Faverge in 1955:

“Two perspectives are to be distinguished from the outset in the analysis of the work: what (what is to do), and how (how the considered workers do it ?)” (J. Leplat, 2011).

According to De La Garza & Fadier (2004), the variations with the prescribed task (what there is to do) represent the top of human skills. Thanks to their intelligence, the operators play fast and free with the rules which they find expensive, unsuited or inapplicable with the need for the situation. This adaptive capacity based on the actors remains essential to regulate all the unusual situations (Amalberti, 2007) or when the objectives of safety and production are contradictory (Hollnagel, 2004). Consequently, it is advisable to wonder : how the school, in conjunction with the company, can develop the pupils' capacity to adapt to situations, this intelligence at work which is necessary to adapt to varied situations, even to new situations that the operator never met or when the objectives of safety and production are contradictory (Pastré, 2005).

Of a descriptive and understanding nature, the committed work will make it possible, initially, to analyse the activity of the pupils, the tutors in companies and the teachers in order to establish the feature of the didactic situations in the prevention of risks which will make it possible to develop the capacity of adaptation of the future professionals. In the long run, the led analyses will enable us to think of the innovating situations of teaching-training likely to be proposed by the

teacher in order to support the pupils' capacity to adapt in professional situations. In this study, we will present the analysis of the activity in risk prevention as well as the methodology considered which is part of the theoretical framework.

Prevention activity – design activity

Herbert Simon in his work *The Sciences of the Artificial*, was the first who suggested to approach the design either as a professional status or as a particular type of cognitive activity. According to this author, the design is an activity aiming at imagining and at realizing in ver time of the things called “artefact”, with which the finality is to satisfy the needs for the Man (Simon, 1969/1996). In this definition of the design, we find two key words: imagine and realize. The first one refers to a cognitive activity. The second one to a productive activity. This definition thus makes it possible to characterize the activity of design, on the one hand as a cognitive activity (internal) and on the other hand as a productive one (external). According to Visser,

“if we agree with this definition, design activities are not the monopoly of BE Engineers anymore. In that case, other operators are also encouraged to engage in activities which, in an analysis in cognitive ergonomics, fall within the design” (Visser, 2002)

Thus, from a cognitive point of view, the design can be characterized by properties of the problem to solve, representations and processes of resolution implemented to solve it, and to finish developed solution (Falzon, et al., 1990; Visser, 2002).

So we will consider the activities of risk prevention like activities of design. For example, at the time of the phase of setting in safety on a task of maintenance of the refrigerating systems, the technician proceeds to the implementation of preventive measures which can be of organisational nature like the presence of a second technician, but so technical with the setting not under tension of the installation, the placement of protective equipment collective (life line) or individual (wearing of glove, use of insulating tools). Thus an important part of the activity of the operators in prevention in the same way that any activity of design consists in specifying the couple problem-solution. As of the moment that the operator/originator starts to build a representation of the initial specifications of problem and that he undertakes their analysis, he starts to specify a solution. Starts a process of design then. The professional reflects front, during and after the action and during its reflection, it mobilizes representations and knowledge of various sources. Thus, a technician who carries out a task of commissioning of an air-conditioning proceeds in successive phases:

- i. Building planning phase: depending on the specifications, the technician assesses the workplace in order to organize the work that is to be done. Knowledge of the places and the equipment to be installed must allow him to evaluate the inherent risks in the place of work. This risk evaluation allows the operator to decide upon organizational procedures (personnel or machines to handle and carry equipment based on weight and bulk of heavy machinery, specifically adapted tools to carry out the work), collective protection measures (permission to turn off energy supply voltage anticipated for linkup) and individual protection procedures (gloves, earplugs).
- ii. Implementing equipment phase: this phase has two stages: the first one allows for the preparation of supports destined to receive machinery parts and connection zones. The second is the fixing of the parts onto the supports as anticipated. Depending on risks and constraints, the technician decides how to assemble the parts in the building planning phase.
- iii. Connecting parts and electrical circuits phase: depending on the planned voltage alteration (total, partial or none), the technician can move on to the connection without any risk, or taking them into account if there are any.

To implement methods and procedures, it has resorts to cognitive resources of the designs of thought, in other words designs of reasoning, interpretation, creation of assumptions, evaluation and decision (Vergnaud, 1995). These designs make it possible to identify the relevant knowledge, to differentiate them to face a singular situation. The professional returns then in a process of creative design. There is no single solution with a problem of design. The solution adopted finally is not either “correct”, or “incorrect”: it is an acceptable solution among others. The “final” specifications at which an originator arrives can be disputed, not because they would be incorrect, but because, following different criteria, another solution could be adopted, by the same originator or another (Bisseret, Figeac-Letang, & Falzon, 1988). Facing a security problem, two professionals will not inevitably choose the same solution or the same procedure (Duboscq & Clot, 2010) whereas at the school one often learns to the pupil a single procedure facing an identified problem. The actions can be reproduced as they are if, with the same interests, correspond similar situations, but are different or combined in a new way if the needs or the situations change. Thus the professionals must develop a capacity of adaptation and plunge themselves in a situation of creative design to quickly find a solution: the emergence of creative ideas.

From professional behaviours to the emergence of creative ideas

The occupation makes a professional meet a large number of known and unknown situations. Leplat (1985) qualifies these activities of execution, which involves mechanisms already made up at the subject, of “routines”. Concurrently to that, when the subject is confronted with a non-routine and unusual occupation, it must “invent” a process of resolution by mobilizing knowledge and practices available. The designs of actions are, in an action, which is transposable, differentiable or can be generally applied to one situation or to a following one, in other words what is common to the various repetitions or applications of the same action (Piaget, 1973) and which makes it possible to bring about an adapted solution. The design is thus the structure of the action - mental or material -, the invariant which are preserved of a singular situation at another, and is invested, with more or less adjustments, in similar situations. It is what one can call “the operational form of knowledge”, that which makes it possible to act as situation.

This development process led to the development of new knowledge or the implementation of new practices. This occupation becomes in its routine turn when the knowledge and the practices are controlled and that they make it possible to solve, without mediation, the current problems posed (Ginestie, 1995). This approach joined that which proposes Deforge (1995). Speaking about the production of objects, he says that when the process makes up of continuation operational well defined and that he is based on data delimiting the field of the solutions strictly, then there is no emotional investment on behalf of the men who are in the system of production and they are reduced (always theoretically) with the role of agent. On the other hand, when the data input are fuzzy and that there are no functional indications for the exit nor of formalized process at disposal, the man must invent, to fill spaces of uncertainties, the original processes at best of the data and the result required. One can thus consider that the direction of knowledge, for the expert, is related to the particular context including the problem, in the ecological conditions under which this knowledge will function. So the experiment in the broad sense falls under the development process i.e. the development of new knowledge. For Lubart et al. (2003), an “idea can be new for a person given but not the being for another according to its former experiments”. In this direction, we can consider an idea as new when the subject is confronted with an occupation unusual and non-routine and that it must “invent” a process of resolution by mobilizing knowledge and practices available. Models contributing to explain the emergence of creative ideas were proposed. We can quote the case of model A-GC “Analogies et Gestion de Contraintes” (Bonnardel, 2000, 2006). According to this model, the dynamics of the creative activities of design is explained in particular by two cognitive processes being able to act in opposite directions: the realization of analogies and the management of constraints. The realization of analogies causes to open the space of search for ideas in order to arrive to solutions more or less creative and adapted to the professional situations

met. The management of constraints makes it possible to direct the realization of analogies and to gradually circumscribe the space of research according to knowledge of the originator (designs of action). Thus within the framework of the training of the future professionals in risk prevention, it will be a question of having a reflection on the characteristics of the creative situations of design into didactic of vocational trainings, aiming at developing the capacity of adaptation through the emergence of the creative ideas.

Methodology

Our methodological approach will contribute to associate two methods which, used jointly, will make it possible to finely explore the activity of the pupils, the tutors of training course and the teachers in situation of creative design in risk prevention.

The field of experimentation concerned companies specialized in the installation and maintenance of heating, conditioning and refrigerating equipments. They therefore, and specially in small and average sized business, constitute a sector providing jobs for young people graduates and are regularly held training company for young people in initial education.

The experimental protocol to be implemented for data collection will consist into three phases:

- Choice and analysis of the task of creative design in risk prevention in the sector of installation and maintenance of conditioning and refrigerating equipments.
- Proposition of the same task to a pupil in a school context and to a pupil in a professional context. This stage will be subject to an audiovisual recording of the pupil's activity in both contexts.
- Semi-structured interview of the tutor, of the professional and of the pupil : all the interviews will be subject to a complete transcript of the verbalizations.

Our work will be based on an analysis of the activity by the analysis of the points of view (Wolf, Burkhardt & de la Garza, 2005). In this context, we will use jointly a discursive analysis and a data geometrical analysis (main component analysis) with reference to Burkhardt's studies concerning the analysis of the points of view of designers in production system. Thus, our methodological approach will contribute to explore the points of view of the actors. We will use discussions and verbalization analyses through specific methods allowing the reproducibility and the comparison of various corpora. This approach will enable us to finely analyze the speakers' speech and therefore, to give useable results by means of semi-structured interviews. For all those studies, the teachers' and students' speeches will be transcribed again verbatim.

All the entries of charge collected will be the object of an analysis of contents at the same time from a quantitative and qualitative point of view. From a quantitative point of view, the data collected will be the object of an exploratory analysis from "point of view" (Wolff, Burkhardt, & De La Gaza, 2005) using the software TROPES. From a more qualitative point of view and to come to enrich the quantitative analysis, the linguistic statements, considered as significant from the point of view of the activity of creative design to risk prevention, will be analyzed by the use of formalisms and systems of simple rewriting (Lebahar, 2007).

Conclusion

The analyses led in this study, will enable us to release the operational invariants, the inferences and the strategies, the rules of action and anticipations i.e. the organization of the control of each actor for a class of situation given. This level, the comparison of the levels of organization between the tutor and the teacher must offer an explanatory lighting to us on the characteristics of the didactic situations which will make it possible to develop the capacity of adaptation of the pupils necessary for the control of the risks and to develop suitable professional competences. In the long run, the led analyses will enable us to think of the innovating situations of teaching-training and in particular the formations organizing itself around the training by project.

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