USING CASE STUDIES FOR KNOWLEDGE CREATION IN THE CLASSROOM

Paulo Rupino da Cunha[1], António Dias de Figueiredo[2]

Abstract *¾ We report an educational experience where case studies are used to foster the shift from traditional "delivery of information" paradigms to "knowledge creation" approaches, supported by superior levels of activity and interaction. In this kind of context-rich environments, knowledge is not only created, but also applied in simulated real-world situations, inducing quite powerful forms of individual and collective reflection. This happens with the learners becoming responsible, not only for their individual learning and assessment, but also for that of their colleagues. In the specific experience described in this paper, in the initial classes, the teacher provided a number of case studies and assisted the students in their cooperative analysis and discussion. At a second stage, the classes used cases built by groups of student, who also got the responsibility of presenting them and guiding the discussion. The groups have also been asked to grade each other. Appropriate justification for this classification was demanded, and counted as an additional factor in the grader's own evaluation. Self-assessment was also asked of every student. The process has proved fruitful and will continue to be applied in coming years.*

Index Terms ¾ Case studies, context creation, knowledge creation, collective reflection.

INTRODUCTION

Our society is craving for a re-evaluation of the mainstream forms of education. Constant and fast transformations in social, political, economical and technical arenas keep raising new challenges.

According to the European Round Table of Industrialists (ERT), a new, non-competitive, form of education should enable the development of individuals with broader rather than deeper competencies, capable of learning to learn, of communicating, of taking responsibilities, of effectively working in teams, and motivated to constantly increase their level of knowledge [1, 3].

The new educational model points in the direction of the valorization and construction of horizontal competencies, closely related to behaviour and personality. Being applicable to different contexts, they become effective in the long run, resisting the fast pace of change of the present day [1, 3]. This framework of competencies is represented in Figure 1.

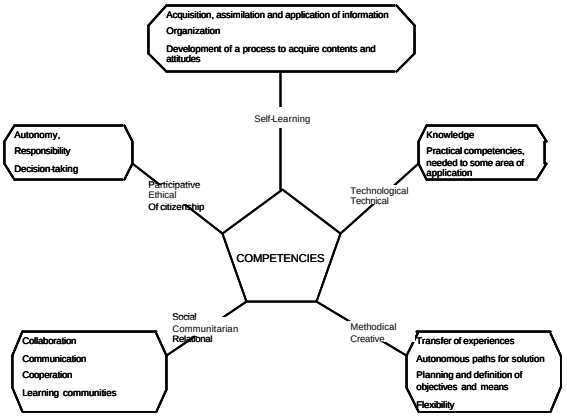

FIGURE. 1
COMPETENCIES FOR THIS MILLENIUM [3].

Some engineering topics reflect the emerging challenges of modern society to perfection. They call for context-rich learning environments where students can simulate real-world experience and combine individual effort with highly interactive teamwork to solve the problems presented.

In the remainder of this paper we will start by giving a brief description of a subject in which new forms of education were used. Then, in the following section, we will discuss further the need to move from delivery-based learning to context-based, knowledge creation settings. Case studies – a learning tool that plays an important part in this paradigm shift – are briefly introduced, before moving on to describe how they were applied in the reported situation. Assessment of the students is discussed just before the conclusions.

THE ENVIRONMENT OF THE EXPERIENCE

Description of the subject

Strategic Planning of Information Systems is a 4th year subject of a five-year undergraduate course taught at the Departament of Informatics Engineering of the University of Coimbra, in Portugal [2]. Its purpose is to help students build the competencies needed to design information

This work is partially supported by POSI - Programa Operacional Sociedade de Informação of Portuguese Fundação para a Ciência e Tecnologia and European Union FEDER.
[1] Paulo Rupino da Cunha, Universidade de Coimbra, Departamento de Engenharia Informática, Pólo II, 3030-290 Coimbra, Portugal, rupino@dei.uc.pt
[2] António Dias de Figueiredo, Universidade de Coimbra, Departamento de Engenharia Informática, Pólo II, 3030-290 Coimbra, Portugal, adf@dei.uc.pt

systems capable of supporting the strategic, tactical and operational objectives of today's organizations. This means being able to look beyond merely technical issues and taking into account socio-cultural and competitive concerns affecting the business and all its stakeholders.

Students are expected to develop the skills needed to work in conjunction with managers and Chief Executive Officers (CEOs), in crafting the strategy of the organization in tandem with the information system that will support it in achieving the delineated goals.

This type of process is frequently carried out in environments characterized by high complexity, incomplete, redundant, contradictory and idiosyncratic data, and by the inexistence of the single best solution typical of some other engineering topics.

Logistics supporting the subject

Since the subject is part of the Informatics Engineering undergraduate course, its students and faculty are naturally proficient with information technology (IT). So, electronic support, such as web and email, are extensively used. All students and faculty use email regularly and all subjects have a web site where syllabus, summaries, reading materials, assignments, links and bibliography are posted. In addition, all subjects also have a dedicated mailing list subscribed by students and faculty.

LEARNING THE SUBJECT

Creating contexts for learning

The current views of learning and education still frequently put the emphasis on *content* while almost completely disregarding *context* [7]. That is, they put the emphasis on the *delivery of information* while almost disregarding *interaction* and *activity*. This impairing is rooted in the mechanistic models of the 19th century Industrial Society, when the ideal of perfection was a machine that repeated the same operations time and again, with high regularity. This was the era when mass education started to materialize, thus suffering the influence of the same management and organizational principles that were proving so well in factories. This was how rows of desks and ringing of bells came to be in schools. This was also how teaching became essentially transmitting "knowledge" from expert teachers to inexperienced students. This was how *knowledge* "became" *content* [7].

In the present society, however, the old premises of the Industrial Society no longer hold, thus making the mechanistic paradigms increasingly inadequate. Learning can no longer continue to mean *transfer of content*, but must become *knowledge creation*. And knowledge creation calls for appropriate *contexts* – activity rich, interaction rich and culturally rich social environments – where students can be active learners instead of passive listeners [7].

Several authors soon emphasized the need for new values in education. Inquiry, participation, collaboration, sharing, collective reflection, social planning and discovery, for example, where emphatically called for [4, 5, 9], while Lev Vygotsky strongly emphasised the importance of new values by pointing out that knowledge does not stem from a transmission process, but from the internalisation of social interactions [13].

Appropriate contexts for knowledge creation (or learning) can be created by using *activities* discussed in [3]. These are categorized into three types:

- *Interaction strategies* (including brainstorming sessions, forums, committees, and storytelling). This type of activities promotes the debate and the exchange of ideas among the individuals. Their role becomes much more active, while the teacher becomes a facilitator of the learning process. The instructor gets, nevertheless, added responsibilities in planning the learning objectives, contents and activities.
  Thinking of the learning process as a transactional encounter, to which students bring their own set of values, skills and knowledge, it is easy to see how interaction strategies help them in building alternative visions and reflection mechanisms to distinguish the essential from the superfluous and get the most from each learning experience [3, 7].
- *Action strategies*: (including simulations, role-playing exercises, and case studies). These activities engage the learners very strongly in the collaborative knowledge creation process, while the emphasis is shifted from the product to the (learning) process. The instructor must take care to ensure high relevance to all involved, and that resources, social interactions and timings are properly managed. Plans must also exist to comply with unexpected events [3, 7].
- *Presentation strategies*: (including dialogs, symposia, and demonstrations). Clearly closer to more traditional, transfer-based, approaches to learning, activities in this category can be used to disseminate information in a structured fashion, to draw attention to a given topic and to stimulate controversy. The presenter gets the control, and can decide on what and how much information to convey, as well as on the pace of progress.
  Presentation strategies can be made to complement very well the previous approaches [3, 7].

Using case studies

Case studies – accounts of situations that raise issues or problems for analysis and solution – have been extensively used in several areas of education, such as medicine, law and business [8]. The Harvard Business School, in particular, introduced the use of cases in business administration courses in the early 1900s, and continues to use them as the predominant instrument for learning [8].

It is believed that case studies are particularly suited to the training of practitioners, where both knowledge and

skills must be developed in order for them to act effectively in their respective professions [8]. This description clearly fits engineering, namely in the area of complex information systems design for organizations. Accordingly, the authors decided to adopt case studies based in real situations as part of the *action strategies* employed to "teach" Strategic Planning of Information Systems.

Using case studies to create context for the subject

The proposed cases are very similar to normal business case studies, in that they describe a concrete situation in the life of an organization, for example, the new challenges faced by logistics and transportation companies with the growth of e-commerce, or the introduction of a revolutionary product by a mobile phone operator. The main difference is that, normally, there are some details about the information system supporting the described situations, and the students are asked to comment on it or to make recommendations on how to produce the evolution of that information system. This calls for the development of a very specific set of skills that weave together knowledge from the information technology and management camps. One particularly important competence that must be built is related to the ability to perform a strategic diagnosis of the business, using instruments such as SWOT (strengths, weaknesses, opportunities and threats) analysis [6, 11, 14], value chain analysis [10, 14], or the identification of critical success factors [12].

These management concepts were introduced to the students in traditional lecture-style classes, where the underlying theory was explained, while the application to case studies was made in more interactive and collaborative sessions. For these, the students were divided into two classes of twenty-four elements each. These, in turn, were organized into six groups.

The initial three cases of the semester were provided by the teacher. In the first half of the session, each group debated the case and drew its own conclusions. In the second half, the teacher asked for contributions and acted as a facilitator among the various groups, as each defended its own viewpoint and argued the other's. In this highly interactive environment, two hours class time is usually not enough to complete a deep analysis of the case studies, so there are usually some tasks to be completed afterwards.

For the first case study, each group got the assignment of completing the analysis and recommendations. For the second case study, this task was asked of each of the two full classes, thus "forcing" the six groups in each of them to collaborate and agree on a common standing. Finally, for the last case study, provided by the teacher, since students already had some experience, the assignment was given to each of them individually.

All assignments were emailed to the teacher, who posted his comments on group and class submissions on the subject web site, so that the students could identify points for improvement in their work.

Meanwhile, each group of students, in each one of the two classes, also had a running assignment: writing and analysing a case study about any chosen topic or company. This work contributed to help students develop additional technical and social skills, such as research and consolidation of information on the chosen topic, and structuring letters, questionnaires, interviews and conversations with real managers and Chief Information Officers (CIOs) of the companies under study.

After finishing the three initial cases provided by the teacher, the learning process could thus proceed with the cases developed by the groups. In this second stage, the group whose case was being analysed also got the responsibility of "taking the teacher's role" in presenting it and guiding the discussion.

It is interesting to notice that the dynamics created by the highly interactive face-to-face sessions propagated to the electronic mailing list of the subject. Since the cases studies were about real-life organizations, it became quite frequent to see students sending highly relevant messages to the list, quoting press information or other sources, on the issue at hand. Even when the focus had moved on to the next case, it was not uncommon to continue to see on the list news relating to previous cases. However, the most rewarding fact to witness, from an educational viewpoint, was the students sharing, on the email list, data and documents obtained on the Internet or from the very companies under study, while it would have been much easier and gainful for those who found the information to keep it for themselves. This spontaneous form of sharing started to occur even within the individual assignment of the third case study proposed by the teacher.

Assessment

Several complimentary techniques were used to assess the students.

All written assignments related to the cases proposed by the teacher were graded. As to the cases developed by the groups, assessment considered the quality of the case itself, the facilitation of its discussion, and the group's own analysis of the situation – this was requested, but not presented during the sessions with the other groups.

All individual interventions during the debates were also accounted for. This kind of continuous assessment was made possible by three facts:

- The relatively small size of the classes.
- The transfer of facilitation responsibility to the groups whose case was under discussion (freeing the teacher to concentrate on appreciating the quality of the student's interventions).
- The use a laptop with a small database of all students that included their photos. This helped the teacher registering notes on every student as they intervened, without the cumbersome method of using name tags or requesting the students to identify themselves before speaking. As a side effect, it was possible to start

knowing the students by name in a relatively short period.

The six groups in each class were also asked to grade the performance of each other using a serializing scale (marking from 1 to 5, without being allowed to give the same classification twice). Appropriate justification for this classification was demanded, and counted as an additional factor in the grader's own evaluation. The classifications provided by the various groups, together with the accompanying justifications, were made anonymous by the teacher and put up on the course web site, together with the rest of the learning materials, so that the students could know the opinions of their peers. Those classifications were not used for the final marking, though.

Every student was graded on one final assignment, similar to the one made in group – writing and analysing a case study on a chosen subject. Each student was also asked to self-assess performance across all the activities involved in the course.

A more traditional written examination was used to test some formal knowledge related to the lectures.

In this first implementation of the described experience, the final grade was obtained assigning 50% to the written examination and 50% to continuous assessment. The relatively high weight assigned to the written test was decided as a precaution, since there was no past indication on whether the intended continuous assessment would be feasible or effective. In fact, since the environments are so dynamic and a lot of teamwork is involved, assessment-wise, a lot more responsibility and effort is put upon the instructor.

In the future, the authors are planning to reduce the weight of the written examination to 25%.

CONCLUSION

The educational paradigms rooted in the Industrial Society models of the 19th century – mainly based in *content transfer* from teacher to student – are becoming increasingly inadequate as the eagerly waited Knowledge Society emerges. New attitudes are needed that can only be fostered with a different kind of education – one based on *knowledge construction* by the learners themselves, given the appropriate *contexts*.

Some areas of engineering clearly illustrate this need, calling for environments where students can simulate real-world experience and combine individual effort with highly interactive teamwork.

We have described an educational experience where a series of learning activities, revolving around the use of case studies, were used to help students develop the skills needed to act on situations where, as professionals, they will be called to assist the top-management of organizations in crafting the strategy and the information system that will enable it.

The experience has proved effective and rewarding, and has, since, been applied again, this time in a similar subject that is part of a Master's degree in Informatics Engineering. Thanks to the confidence gained in the past, the weigh of the written test was reduced to only 25% of the final mark. Nevertheless, the grades seemed to reflect accurately the performance of the individual students.

The authors intend to continue using the educational model described in this paper, adjusting it and improving it in a reflexive way as consecutive experiences accumulate.

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