Interactive Multimedia and Problem Based Learning: Experiencing Project Failure

URBAN NULDÉN
Department of Informatics School of Economics and Commercial Law
Goteborg University and the Viktoria Institute Sweden
nulden@informatik.gu.se

HELANA SCHEEPERS
Department of Informatics, University of Pretoria, South Africa and
Department of Computer Science
Aalborg University, Denmark
hscheep@econ.up.ac.za

In this paper we discuss research on computer support for experiential learning and problem based learning (PBL). Experiential learning combined with interactive multimedia has received a great deal of attention in both educational practice and research. We suggest that the advancement of multimedia technology also provides an opportunity to extend problem based learning and combine it with experiential learning. We have focused on the very early phase of PBL, often called the “vignette.” The vignette is used by the teacher to present a problematic situation that should serve as stimulus for a self-directed learning process. We have surveyed experienced PBL students and teachers with the purpose of finding ideas on how the vignette can be enriched or transformed by interactive multimedia. The analysis of the survey then served as input for the design of an interactive multimedia vignette prototype. The prototype was evaluated in two different settings: university and industry. Our conclusion is that the prototype works as a tool to integrate experiential learning and problem based learning. We found
that the interactive multimedia added important dimensions to the first phase of the PBL model. We end the paper with a systematization of the results from the evaluation into a methodology, PIE, for integrating problem based learning, interactive multimedia and experiential learning. A more extensive evaluation of the prototype and the methodology will be reported at a later date.

A great deal of attention has been focused on interactive multimedia, especially within the educational domain. Many educational institutions have produced different types of educational interactive multimedia courseware to replace or enhance educational activities. In this paper we show how interactive multimedia can be used to combine experiential learning (EL) and problem based learning (PBL). Experiential learning is participative, interactive, and applied. By experiential learning we refer to work in small groups, where what is learned is directly related to what happens in the group and how it happens. It is sometimes also referred to as learning-by-doing or learning-in-doing (Kolb, 1976). John Dewey recognized this already in 1916 when he noted that schools continued to tell students what to learn despite research clearly showing that teaching by telling does not work, and that learning by doing does work. Examples of experiential learning are simulations where the students are (somewhat) in control of the process and different types of games such as role plays.

Problem based learning on the other hand is described by Boud and Feletti as:

…a way of constructing and teaching courses using problems as the stimulus and focus for student activity. It is not simply the addition of problem-solving activities to otherwise discipline centered curricula, but a way of conceiving of the curriculum which is centered around key problems in professional practice (Boud & Feletti, 1991, p.14).

…problem based courses start with problems rather than with the exposition of disciplinary knowledge. They [the problems] move students towards the acquisition of knowledge and skills through a staged sequence of problems presented in context, together with associated learning materials and support from teachers [ibid.].

Using this understanding, it is clear that it is the problem that drives the process of learning, not the presentation of subject content or knowledge.
Hence, the starting point of learning in PBL is a real world phenomenon or problem the learner wishes to learn more about. That is, a problem that is relevant from the perspective of the learner’s future profession. The problem, or rather the problematic situation, is identified, designed and presented to the students, who then themselves define what the actual problem is. As most pedagogical approaches PBL has many strengths and offers opportunities. However, in this research, we would like to focus on one issue we find to be problematic but also very central in PBL—namely introducing the problem.

The responsibility of the teacher is to present or introduce the phenomenon or problem in a stimulating way. In PBL, this is done through what we call a ‘vignette.’ A vignette is usually a document that can be anything between a single paragraph and a twenty-page case study. Graphics such as pictures and cartoons are used to enrich the vignettes, and recently, video clips are also used to add dimensions to the vignette. From the definition above of PBL, it is clear that the vignette is mainly understood as a starting point for self-directed learning. The experience of actually working with the vignette is not explicitly emphasized.

EL and PBL are alternative pedagogical models that are gaining popularity in all levels of the education system. Computing education such as software engineering, management information systems, computer information systems and informatics are no exceptions. The context for this research is computing education and training in a broader sense. In this research we use project failure as an example of a phenomenon that occurs frequently in different types of projects to exemplify our ideas. Using failures as a vehicle for learning is advocated by for instance, Schank who claims that for learning to take place there has to be expectation failure (Schank, 1997). The learner has to experience something else than expected. He claims that real thinking does not start until the learner fails, and has to explain the failure. In other words, thinking and explaining catalyze learning. Outcome feedback is a similar and related conception—an action is taken and the learner observes the outcome.

IT project failures are well known to researchers and practitioners in both industry and academia. There is a large body of literature of case histories (Brooks, 1975; Oz, 1994; Sauer, 1993), empirical (Ewusi-Mensah & Przasnyski, 1994; Ewusi-Mensah & Przasnyski, 1991; Lucas, 1975), efforts to systematize the empirical work (Flowers, 1997; Lyytinen & Hirschheim, 1987), and of how project failure should be approached in higher education (Nulden & Scheepers, 1998).
Project failure is strongly related to project management, a practical task educators often find difficult to teach realistically with traditional and conventional methods. Courses covering project management often simulate real world project like situations. The early project management simulations were built on very rational ideals, while current simulations include more complex dimensions. Today, educators design cases and simulations where students are requested to perform in realistic situations and under business pressure. Common ways to enhance the realism is communication and interaction with simulated project staff, users, and consultants. Another way is pin-pointing typical project problems such as absenteeism, staff diverted to higher priorities, design problems, technical problems, changed requirements, personality conflicts, overstaffing, and resignations. Educators try to make sure the students experience the situations as real as possible. Experiential learning such as scenarios and simulations are often realized using different types of technology. Section five in this paper discusses some examples of interactive multimedia for this purpose.

With problem based learning, interactive multimedia, experiential learning and computing education, more specifically project management and project failure, as a theoretical and contextual background we formulate the following three research questions to be further elaborated in this paper:

- Can computing technologies enhance problem based learning? And more specifically addressed in this paper: How can interactive multimedia enrich the vignette?
- How can experiential learning and problem based learning be integrated in a methodology?
- Can interactive multimedia vignettes be used outside a formal education system to train and educate in project management related issues in corporate training programs?

These questions were approached with a rather pragmatic methodological attitude. The aim of this paper is to explore the research questions and discuss design ideas with some limited empirical support. Therefore, this paper is mainly a conceptual paper. Methodological issues such as observation and content analysis are discussed in section six. The result of the implementation will be reported at a later date.

The remainder of the paper is organized in the following sections: First, learning and facilitating learning is discussed. Then in the section Problem Based Learning in Practice we outline our experience of working with PBL. In the next section, we give a brief overview of implementations of
interactive multimedia in higher education. In the following section, we elaborate our ideas about PBL, experiential learning and interactive multimedia vignettes. In the Evaluation section we describe how the ideas were evaluated using a low-tech prototype. A discussion of the evaluation is next and then we propose and outline the methodology we call PIE. In the last section, we draw conclusions, propose implications, highlight limitations and outline our future work.

LEARNING AND FACILITATING LEARNING

In this section we discuss problem based learning and experiential learning. We view the two from the learners’ perspective as well as from the educators’ perspective. PBL is a way of designing and conducting educational activities using problems as stimulus and focus for learner activity (Boud & Feletti, 1991). Similarly, in experiential learning the educator is providing stimulus to help students have a concrete experience.

The role of the teacher has surely become different and more complex. In our view, teaching is facilitation of learning and not a transfer of knowledge. Whereas much of the responsibility for the learning lies in the realm of the students, the responsibility of the teacher is to create conditions in which learning is possible (Laurillard, 1993). At undergraduate level, students are exploring already known knowledge, but they are breaking new knowledge at a personal level.

Problem Based Learning

Problem based learning is not another way of teaching as it builds on a fundamentally different understanding of learning than traditional teaching. Problem based learning represents a significant challenge to orthodox beliefs about education and learning (Margretson, 1991). We find PBL to be more of a mind set of the teacher and a philosophy about education than an educational methodology ready to be adapted by any teacher.

In PBL the students’ own questions, experience, formulations, and conceptions of problems serve as the basis for learning. Participating in change and self-directed learning are central competencies today. PBL is commonly claimed to be a method that will assist students in developing a set of competencies: (a) adapting to and participating in change; (b) dealing with problems, making reasoned decisions in unfamiliar situations; (c) reasoning
critically and creatively; (d) adopting a more universal or holistic approach; and (e) practicing empathy, appreciating an other person’s point of view.

In many ways, PBL is an implementation of the constructivistic model of learning. PBL is a change of understanding of learning from a transfer of information from teachers to students towards social interaction and individual constructing of knowledge. This model asserts that people construct knowledge by making sense in terms of what they already know. According to constructivism, people can only understand what they have constructed themselves (Leidner & Jarvenpaa, 1995). Learning is an active process when learners develop their own mental models. In our understanding of PBL, the group is an important resource for the learning process and extending constructivism to include social interaction and collaboration among the learners we have a cooperative model learning or collaborativism (Slavin, 1990).

Constructivism and collaborativism are by default deep learning. Deep learning—compared to surface learning—is when learning goes beyond routine memorization of facts and instead towards a deeper understanding of the phenomenon under study (Ramsden, 1992). To take on deep learning the individual must be engaged (Norman & Spohrer, 1996). Therefore, to engage learners, PBL aims to challenge them enough to become involved in the problem and eventually, in the ideal situation, be true “problem owners.” The ownership of the problem is one of the central principles of PBL as it is asserted that ownership is crucial for deep learning. To assist students in becoming problem owners they are challenged with an authentic task or problem that is relevant and presented in a context. This way the students experience the kind of situations they will be dealing with in professional life. The importance of making the experience as concrete as possible is emphasized for instance by Kolb (1976).

As PBL encourages open-minded, reflective, critical, and active students it is a threat to teachers who search to maintain total control over the content to be learned and demand absorbing, passive students. Educators who conceive education as a one-way process of information transmission and restrict the notion of problem to small, atomic, single difficulties with a single optimal solution are uncomfortable with PBL. With PBL, the role of the teacher is changing from a provider of facts to the one who facilitates a learning environment and creates a sense of community.

As the starting point for learning in a PBL setting is the problem, challenging the students to become problem owners is sometimes difficult. Some teachers manage to challenge students with very little. Others need some form of support. With this in mind, we have investigated the field of
experiential learning to find support for design of vignettes that challenge students. From a PBL perspective, the difficult task for the educators is to identify what type of experience the learner should have to become problem owners as discussed above.

**Experiential Learning**

Experiential learning is participative, interactive, and applied. It means contact with the environment and confrontation to processes that are uncertain. Experiential learning involves the whole person; learning takes place on the cognitive, affective, and behavioral dimension (Gentry, 1990). The educator is responsible for providing the experiential stimulus. The quality of the stimulus will vary depending on the pedagogical approach applied. Gentry discusses different pedagogics and how they can be applied in experiential learning situations (Gentry, 1990).

In this research experiential learning refers to small group work, where what is learned is directly related to what happens in the group and how it happens. Various terms have been used to label the process of learning from experience. Dewey used learning by doing, and others have discussed this process in terms of experienced based learning, trial and error and applied experiential learning (Gentry, 1990), and that the best learning is by doing (Graf & Kellogg, 1990). Senge’s reflection in action is another similar conception of learning (Senge, 1995). The Association for Business Simulation and Experiential Learning (ABSEL) Task Force defines experiential learning as: “A business curriculum-related endeavor which is interactive (other than between teacher and pupil) and is characterized by variability and uncertainty.”

In experiential learning, concrete experiences are subjected to individual and group reflections, sometimes referred to as process evaluation, as well as attempts to generalize in order to be able to experiment with new behavior. The learning at different levels can be conceptualized in two levels. On the one hand, individual orientation involves:

- Self-awareness by using personal inventories, reflections on one’s own values, preferences, and behavior in various work groups and feedback from others,
- recognition that people are different, and that such differences can be productive, and by using typologies such differences can be better understood, and
empathy (feeling, insight into other individuals’ values, ideals, orientations, and so forth, which can be different from one’s own) through the same methods as above.

On the other hand, in group and organizational orientation:

- Group dynamics and processes by observation of actual behavior, such as group roles, development stages, cohesiveness, climate, conflict resolution, exercise of power, projections, and other aspects of the emotional and cognitive tensions which are part of small-group life.

Experiential learning has been practiced since the early 1950’s. Examples of experiential learning are internships, live case, case studies, role-play, games, and simulations. Simulations of different types are probably the most common and have long been a feasible way for educators to present complex matters such as visualization of mathematical, production, and logistic processes.

Activities including experiential learning can also be damaging (Jones & McLean, 1970). The reason for the damaging effects, they explain, is that the instructor does not recognize the methodological conflict in using gaming and simulation. For the purpose of this research, we found a number of general characteristics of experiential learning activities that must be under the control of the educator or designer of the activity (Graf & Kellogg, 1990). First, *chained decisions*, where the result of one set of decisions influences the rest of the decision making process. Second, *debriefing*, which refers to the type of debriefing that is given after the activity has been finished. Third, *skill focus*, that refers to the type and range of skills being taught. Fourth, *computerized*, which refers to the rationale in the use of computers delivering the activity.

**PROBLEM BASED LEARNING IN PRACTICE**

In this section a framework for PBL in practice is outlined. The practical implementation of PBL does of course vary as this is only one possible model. Central to our model of PBL is the ‘base-group’ session where the students work in groups of seven to eight for one to two weeks. A course can contain one or many sessions, and in the extreme case consist of only base-group sessions. An educator facilitates the group process and assures that the group works according to the PBL model outlined below. The critical issue is to facilitate but at the same time keep a low profile not to interfere with the group dynamics. The base-group work is guided by the eight-step model briefly outlined below. Before the group starts to work, a lecture, or
equivalent, is held to set the borders of the session to start. This is done partly to make sure the students do not get lost in working with the vignette. This lecture and the delicate facilitation is to guarantee that the students cover, for the course, relevant material.

- **Step 1**: Introduction to the vignette. The purpose of this step is to challenge the students by presenting the vignette with a content and a format so that they become problem owners.
- **Step 2**: Group discussion and identification of the problem or phenomenon covered in the vignette. If the problematic situation is presented in a challenging format, this step covers many aspects of the problem.
- **Step 3**: Brainstorming around the results from step 2.
- **Step 4**: Systematize the brainstorming in the previous step. Find relations, categorize and eliminate irrelevant sections of the brainstorming.
- **Step 5**: Formulate concrete learning objectives and state clear questions to work with.
- **Step 6**: Search and gather facts and information.
- **Step 7**: Systematize the new knowledge and validate the knowledge in relation to step 5.
- **Step 8**: Document and present the acquired knowledge in an appropriate way. Examples are reports, seminars, role plays, and video to mention a few.

The model is divided into two distinct phases. The first phase (steps 1 through 5) consists of three hours of concentrated discussion and work in the base-group supported by the facilitator. In the second phase (steps 6 through 8) students work on their own for, as in our case, one to two weeks. Below is an example of a paper-based vignette used successfully in an introduction to database course.

Note that this vignette is considered as very structured in the eyes of the more orthodox and purist PBL practitioner. The style of problem can be viewed as falling along a continuum, with students constructing the problems themselves at one end, and the teacher being fully responsible for the construction at the other end.
Local or Central Databases

Storage of data can be distributed throughout an organization. The objective of this session is that the students should: understand the difference between locally and centrally stored data; discuss and understand advantages and disadvantages of each strategy; and discuss how to reach a proper balance between the strategies.

At a meeting, hospital management discusses IS/IT strategy. The matter under discussion is the new patient data system and whether data about patients should be stored locally at each clinic, or centrally at the computer department. A full day is devoted to this matter.

CIO of the hospital—“Obviously, data about patients must be stored in a central facility and managed by computing experts. This is necessary to guarantee security and integrity of the sensitive information. Information in the hands of the wrong people would be catastrophic. A central database is the only alternative and my department has the right knowledge and experience for this.”

Senior physician of psychiatry—“From my opinion, information must be stored locally. To me, responsibility of the patient includes the responsibility for the information. And psychiatric information is of no interest to others than us. Why should the information be stored anywhere else than with us, it is ours.”

Professor of social medicine—“I disagree. We use a lot of psychiatric data in our research. What you call your data is very valuable to us. That is true for all patient data within the whole hospital and I think I speak for many other clinics at this hospital.”

Box 1. Example of paper based vignette

While it is very easy for educators to become enthusiastic about PBL as an alternative model, there are of course potential drawbacks. Some PBL becomes mechanical in practice, applied to train students in problem solving and acquire the knowledge for only this. It is also problematic that students many times rush into problem solving before the problem is really understood. In these cases, the potential for deeper, holistic, creative reflection and learning is lost through the predefined problem solving process.

MULTIMEDIA

Innovations in technology, such as multimedia, hypertext, video, the Internet and virtual reality, are now making impact on teaching and learning. The computer has made experiential learning a realistic option for
many educators. In this section we make a brief review of some implementations of interactive multimedia (IMM) in different educational settings. The section is by no means covering the field of IMM in educational activities, but gives an overview with a few examples.

The design of interactive multimedia has undergone a revolution in the last 10 years. Trivial HyperCard stacks and behaviorally oriented drill and practice applications common in the 80’s have given way to richer interactive applications where the learner is relatively free to explore at her own pace. Recently, we find there is a shift from IMM supporting the individual learner to IMM supporting a group of learners. For instance, many applications are designed to facilitate interaction between a dyad of learners working with the same PC.

As shown above, the use of hypertext permits links among pieces of information such as text, sound, and graphics, that permit the user to “explore ideas and pursue thought in a free and ‘nonlinear’ fashion” (Bieber & Kimbrough, 1992). Kendall and others compare a hypertext based (IMM) computer systems analysis case with a conventional case and role playing (Kendall, Kendall, Baskerville, & Barnes, 1996). They found that use of hypertext allows students to navigate through the organization, interviewing and examining documents in the order they prefer rather than in the pre-described linear fashion. Their conclusion is that hypertext was an important departure from the traditional activities conducted. The interactivity and nonlinearity of hypertext means that the students learn computer systems analysis and design by exploring an organization, rather than reading a case study of one.

In a medical education and training context, the Cardiac Tutor places students in situations where they solve problems while the system reasons about the problem being solved and about how to best respond to the students’
idiosyncratic actions (Park & Wolf, 1996). The Cardiac Tutor is a knowledge-based simulation for teaching about cardiac resuscitation. The simulation was coded using extensive expert inputs. The goal for the simulation is very clear: save the patient by selecting the proper procedures.

Boston chicken is another example, a little less prestigious than the cardiac example, where trainees practice ringing up orders on a simulated cash register in order to become faster and more accurate, helped by an online tutor (Schank, 1997).

In a construction context (Ahmed, Thorpe, & McCaffer, 1997) discuss different simulations. Baumark I and II simulate different stages in the construction industry. They demonstrate different types and sizes of contracts that might be undertaken by companies. The simulation puts the players in decision making situations and forces them to study their actions and reflect over the consequences. Similarly, Constructo—a construction project oriented game which gives students the opportunity to develop their own problem understanding and solving model. This by confronting them with simulated tasks and placing them in the position of being in charge of a construction project facing similar difficulties as real world managers.

In a systems development education context, Farrimond and others (1977) are applying current multimedia techniques to transform current paper based case studies into interactive multimedia simulations. They have developed a mouse driven virtual world. The goal of the interactive case study is not to lead or guide the students towards a specific goal but to provide a context in which to explore the “real” world. The world in the simulation is a set of interconnected rooms which are populated by people, documents and other objects. The students construct their own meaning by interacting with the material rather than being taught something explicitly. A fundamental principle in their work was to make everything as generic as possible through the use of a case study language (CSL).

In the examples above there are many different ideas about the desired educational outcome. Much of the multimedia training is no better than the old—it just looks sexier. We can also see a shift from CD-ROM towards the “web,” as a dominating technology, but also a shift from multimedia for individual learners towards multimedia application for teams or groups of learners. This shift was described in a previous section of the paper in that constructivism is extended with the social dimension—collaborativism.

Many of the simulations outlined above are quite similar to what we suggest in this paper. They are all informed by experiential learning in the way they are designed. However, traditional scenario based simulations often provide only a few paths through a situation and no ability to adapt the presentation to perceived user needs or individual knowledge (Park &
Wolf, 1996). We also find that none of the simulations we have studied is explicitly building on the model of problem based learning. By this we mean that we can not find that they serve as a starting point for further work and learning. In the following section we elaborate these ideas further.

**DESIGN AND IDEAS**

In this section we outline our ideas on how to combine experiential learning and PBL, and more specifically, the first step of the PBL process, that is, the vignette and how it can be more challenging. As stated before, advancements of multimedia technology provide us with an opportunity to enhance the design and presentation of vignettes. We have shown examples of the possibilities, and we have claimed that the examples do not explicitly build on ideas related to PBL.

Armed with this knowledge we continued by approaching an additional source of information. We surveyed 20 master level students, 10 men and 10 women, average age of 28 and all with at least six months experience of PBL and three experienced facilitators with two open ended questions through email:

- In your opinion, what makes a good vignette good, and what makes one poor?
- How would you describe the relation between the basic group, their work, and the vignette?

As students and facilitators responded via email they did not remain anonymous. However, we did not find this to be a problem in this type of survey. Content analysis was applied as methodological approach. That is the process of identifying, coding, and categorizing the primary patterns in the data (Patton, 1990). The survey was analyzed by coding of keywords in their responses. The keywords were then categorized in three main groups. From the two questions and through induction, three issues came out clearly. The quotes are taken from the email responses.

- First, several students pin-pointed what we call the soul of the vignette, “I think that it is important that the vignette shows that the author has put his heart in it, not just made ‘another vignette’.”
- Second, real world relevant cases, that is, material from what is happening in the world at the moment: “The vignette should include topics currently discussed in media.”
Third, variation and layout, especially in a longer module with a number of vignettes they have to be designed in various formats, and they should be “enhanced with something that exceeds the language.”

Some students also stated that: “We miss the unexpected in the vignettes,” and “We have not experienced any really touching vignettes.” In addition to this, we find our own experience of facilitating PBL sessions to be consistent with these conceptions. Our major observation is that a great number of vignettes seem to have very low quality when it comes to stimulating and challenging the students. Supported by the literature, the result of the survey, and our own experience as facilitators we started to elaborate our ideas about multimedia vignettes. Figure 2 below summarizes the conceptual ideas in the research.

![Design framework](image)

**Figure 2.** Design framework

Basically, our idea is the design and development of a vignette about IT project failure as discussed in the introduction. The purpose of such a vignette is to direct the attention of the base-group to the complexity of IT project management. The idea is to have the base-group acting as project members. They will navigate through a project over time and make decisions about the project. Figure 3 below is an outline of a whole vignette.
To generalize the ideas, an important aspect of this research is to develop and establish a terminology for designing cases as described in this paper. The scene serves as building blocks for the vignette. New information about the project is presented in each scene and the group is required to make decisions about things such as technology, personnel, and dates. Each scene in the vignette consists of a series of WWW pages with one or a number of objects embedded. Examples are graphics, sound, movies, or database interfaces. The purpose of the scene is to present information to the base-group and in some of the scenes the group are then required to make a decision. Figure 4 below is an example of a scene where the base-group has to make a decision about choosing an additional ‘virtual’ project member.
The students get some background information to make the decision. In this scene, a simulated email with the news that the most experienced programmer has suddenly left the organization and the project manager that is, the base-group, has to hire a new programmer. In this example, they have three potential candidates, as shown in figure two. Information about each of the prospects is presented, such as CV, personal web page and so forth. Each person has both good and less desired characteristics, which makes the choice a trade-off for the group. No matter which person is hired, there will be consequences later in the scenario. Our intention is to make the students, not only read about the problem, but actively be part in the creation of it. That is, they experience the sense of time and how they have been part of the project during this time. Decisions made are actually made by the base-group and they have thereby invested themselves in the decisions.

In the scenario, time passes in the project and the group faces additional information, and has to make other decisions. Finally, as figure 3 about the whole case shows, the group will end up in the single last scene of the vignette. This is how the educator responsible for the vignette makes sure
the students meet the learning objectives of the PBL session. Let us give an example of end scene. After the group has worked with the vignette for one hour and has been confronted with various project problems, they have been making a number of decisions about database managers, upgrading of software, hiring and firing of people and so forth. They are becoming more and more aware of that the project is probably about to fail. The last scene is from the board-room were the president of the company and the CIO question your (the base-group’s) ability to manage the project.

EVALUATION

Note that the evaluation is about a concept, not a functional prototype, nor any aspect of learning. In the evaluation phase we decided to include people from the industry. One of the reasons for involving industry, as stated in the introduction, was to determine if the interactive multimedia vignette could be used in a training situation with professionals. A second reason was to guarantee the relevance of the problematic situation to be described in the vignette. We suggest that many of the PBL ideas are easily transferred to other adult learning situations outside the formal education system, such as corporate training programs. Supporting employees in acquiring critical skills and knowledge quickly and effectively has become a organizational key objective, not just a training goal. As early as 1979, Warren made the strong statement that: “Training is no longer, like the house organ, nice to have if you can afford it. It is becoming a basic tool for increasing the effectiveness of the organization. […] The organization’s problem becomes not whether to train but how” (Warren, 1979).

Two groups, one at the Business School of a Swedish University, and one at a large manufacturing industry in Sweden were selected to participate in the evaluation. Involving the industry introduced some additional constrains on the vignette. Our initial ideas with a vignette covering a whole project and a large number of problematic situations that are common in projects were reformulated. The industrial partner found the ideas interesting but wanted us to limit the problematic situations in the vignette to only a few. They suggested the vignette presented in the prototype to mainly deal with the problem of people coming and going in projects. The issue they were interested in was how to maintain an efficient group even if people come and go due to different reasons. For our purposes, this request did not require any major changes to the ideas. The prototype scenario was designed accommodating their requests.
The Interactive Case Prototype

Below is a short description of the scenario used in the evaluation. The prototype interactive case consisted of a sequence of scenes implemented in Microsoft Power Point (PP). The scenario contained a number of scenes setting the stage and providing the group with the background information about the problematic situation. This information was presented in smaller blocks of text on several PP slides. Figure 5 and 6 below are examples of scenes. The purpose of this was, as discussed above, to allow the group to reflect and discuss issues raised in the scenario while it was presented. After the group had received this information, explicit scenes where the learners (students and the industry group) were required to make decisions were presented. From a methodological perspective the evaluation was conducted through observation. Notes taken during the evaluation with the two groups are summarized below.

![New environment and new tools](image)

**Figure 5.** Scene from the interactive case

We decided to evaluate the prototype with the student group first. The reason for this is that we consider the student group to be fairly experienced with the PBL methodology and that the input we will get for them is valuable to prepare ourselves for the second group. This implicates that we could consider changes to the prototype before the second part of the evaluation. We also found approaching the students first would minimize the possible errors we otherwise would bother the professionals with.
The student group participating in the evaluation consisted of a subset of the group surveyed about their opinions about PBL. Because of their experience with PBL, we found the group to be a very valuable source for evaluating the prototype. The whole class (21 students) of an MBA program were asked if they were interested in participating in a short experiment on computer supported vignette. Seven students were then chosen to participate in the evaluation.

The setting for the evaluation was a conference room with a table, a portable computer, a projector, and a large screen to project on. The students were given a short description of our analysis of the survey, our ideas in general and the purpose of the vignette they were about to work with. As all students were experienced with PBL this introduction was fairly short. Three persons observed the group and made notes. One of the observers acted as facilitator, but his role was very limited as the group was used to this form of work.

The person closest to the computer grabbed the mouse and started the scenario. The group worked quietly with the first eight scenes containing the background information. They nodded their heads when they were ready and waited for the next scene. No discussion or comments were

**Figure 6.** Scene from the interactive case

**Observing the Student Group**
made. The only sound came from the projector. However, when the first interactive scene appeared the discussion started. The discussion followed a pattern we had expected, but they also raised issues concerning the actual ideas about the prototype. The group constantly made connections to their own experience of PBL. As the whole group was from the same class they had a large shared background of experience for the discussion. This was the case for the rest of the evaluation session. Short comments were made during the information scenes and more extensive discussions in the interactive or decision scenes. The group worked and discussed in an efficient and goal directed way. It was obvious that their experience of PBL helped them in structuring the group work in this phase of the PBL model. The discussion was raising issues concerning PBL as an approach and not less about the actual content in the scenario. Many ideas and aspects surfaced. We found this to be a very valuable input for the further design of the interactive case. The scenario in the vignette worked as recapitulation and evaluation of their own work during the passed year in PBL groups.

All members of the group found the prototype and the scenario to be of value. According to them it was easy to understand, although some found it to be too much text in some of the scenes. None of the students found the design to be too simple. A richer multimedia form with more embedded objects would not automatically raise the quality of the vignette, probably the opposite. However, the interaction was found limited due to the interactive case implementation with sequential scenes. Observing the students, it was very interesting to see how they altered their discussion from the actual problem presented in the scenario, to a discussion about their own relation to PBL.

That the scenario ended with a fairly concrete task for the group to work on was not a problem, this despite the fact that this is a conflict with the PBL methodology as discussed above. The group members themselves should define the problem to work on, not be given a problem. Summing up the students’ comments during the evaluation session they found that this type of scenario should work as a good way to introduce and engage students to work with different problematic situations. They emphasized that this was certainly a promising alternative to the traditional paper based vignettes they had worked with so far. Again, the group started a discussion about the uniform and very limited challenge offered by the vignettes they had experienced during the past year.
Observing the Industry Group

The evaluation at the industry was performed with professionals who work exclusively in projects and are organized in teams. The observation was conducted by a graduate student supervised by one of the authors. Of course the situation for the professional team was different from the situation of the students. However, we find the similarities more interesting to discuss in the light of this research.

The setting for the second evaluation was a team room at the industrial plant. It was not a room in the normal sense, instead it was a section of a larger room. The team room contained a large conference table, some smaller tables, and a table with a computer and large screen where the evaluation was conducted. The group of people who initially agreed on participating was unfortunately not complete. Only four people from different teams were able to participate. The facilitator for the group belonged to a different department of the company. She received some instructions in advance about the role and purpose of the team leading role she was about to enter.

The team received a more extensive introduction to the task than the student group. The basics of PBL were explained as a background. They started out quietly much like the first group. They hummed after they had read through the text in the information scenes and the person with the mouse clicked on to the next. The work was methodological and gave the impression of being very efficient. When they reached the first interactive scene about whether work practice really had changed the group started a quiet discussion. The discussion escalated after a little while and they penetrated the alternatives, and agreed on one alternative. The facilitator was successful in trying to get everyone’s opinions. Most comments were in the form of agreeing on what already was said and there were few real efforts in surfacing new aspects at this stage. The group felt a bit more at ease and started to use the supplied drawing and writing material to articulate and explain their standpoints. At the next interaction scene there were further discussions. One person said “this is the way it is,” and the others agreed. The team leader worked to get the group to reach consensus on the decisions to be made in this scene. Several team members worked through the text a number of times. Everybody seemed to wait for the others to make the first move.

When the group reached the actual task about suggesting an introduction program for new project members an extensive discussion was taking place. The roles of the different people in the group were that one person was actively brainstorming while one was actively concretizing the brainstorming. The other two had more drawn back roles and they added marginally to the ongoing discussion. Working with the task the voices were low,
however when the discussion moved from a generic one to a discussion concerning their own work situation the discussion became tense. They questioned their own situation. The discussion went in circles—A depends on B that depends on A—for a long period. Suggestions on how to solve the problems are articulated, but many suggestions are not discussed at any length. The suggestions were different but also very conventional and rational. The team leader was trying to lead the group towards consensus. She was focusing on the most open person in the group by addressing questions directly to him. The others agreed to what this person said. For a moment they looked back at the eight-step PBL model provided, but the model was obviously confusing for the group. They finished their work and presented a draft of an introduction program for new project team members.

An interesting observation is that the scenario actually worked as a catalyst for the team to talk about their own situation in the company. They also raised issues that in no way were connected to the scenario. As with the student group, the team was stimulated to put their situation in a larger context, and viewed the work in the perspective of this larger context. We felt that they raised several issues of great value for their unit, and maybe for the whole company.

The team had no problem in moving through the interactive case. They recognized the issues raised in the scenario. Smiles and laughter were frequent as they moved through the scenario. One of the participants found “…the interactive parts to be good—you become engaged and ‘wake’ up.” The group agreed that the format was good in that they were introduced to a problematic situation in a stimulating way, and the team was presented with a task to complete. They found that the embedding of the instruction in the scenario was helpful. “When you do it yourself you engage in a learning process that is much more efficient than a traditional one.” Similarly to the student group, they did not think that additional multimedia would automatically add anything to this type of scenario. Sounds, animations and so forth, could actually be disturbing if they are not found motivated. The team suggested a more explicit structure of the scenario and a more explicit assignment related to their current problems. They also suggested that this could be solved with a hypertext based structure instead of the sequence they were presented with in the evaluation.

**DISCUSSION**

The evaluation raises several issues we discuss more in detail in this section. Summing up the evaluation, we found that the student group approached
the scenario from mainly a PBL perspective. The interactive scenario stimulated them to work as with a PBL vignette. The industrial team worked with the scenario from their current situation and experience. The interactive scenario was in many ways a catalyst for them to reflect on their own actual work situation.

Observing the students work with the scenario, it is obvious that this type of alternative vignette add to the process of PBL in a formal educational setting. The prototype was easy to use as the interactive scenario consisted of a sequence of PowerPoint slides. The student group focused on the intended issues before they reached the end of the scenario. The group stopped at the interaction scenes and discussed the situation, while they reflected and analyzed the situation to understand and problematize. We did not get the feeling that they were rushing to move on in the scenario. On the other hand, they did not spend *too much* time either. A very important observation is that they clearly spent more high quality time with this vignette than when working with the traditional paper based one. However, this was only one observation and there is certainly a need for more extensive, systematic, and in-depth observation.

The industry team found a lack of structure in the scenario. This is a very delicate problem to approach. On the one hand, the scenario must not be too superficial and put words in the participants mouths. The scenario should guide the group, but not control them. On the other hand, and from the company’s side, the aim or the expected outcome must be very clear. PBL was seen as a somewhat ‘unstructured’ approach. As the group, according to PBL, defines their own problem. However, here the problem and the task for them to work with was provided in the scenario and perceived as satisfactory.

In this research we did not attempt to measure some dimension of learning, as this is not within the scope of this research. However, we do use our own judgement of how engaged the students are. Our full conviction is that when students are engaged and work hard by their own interest, they are actually engaging in deep learning.

Comparing this to case teaching we find many similarities, but also many differences. One is that the vignette is more of a starting point than a case. That is, in case teaching the case discussion is the main learning activity, which is consistent with experiential learning. Whereas the vignette in PBL is aimed at mainly starting the process. Therefore, in this research, we have combined the ideas of “actual learning” and starting point.
Proposing a Framework and a Methodology

With the discussion above as a point of departure, we propose a methodology, PIE, which is outlined below. Problem based learning, Interactive multimedia and Experiential learning (PIE) is a three phase methodology for structuring educational activities in modules, using case based simulations.

<table>
<thead>
<tr>
<th>Phase one.</th>
<th>Experience. The group experience the interactive case facilitated by an instructor. The instructor ensures that the group reach the end of the scenario and leave the session with the problem on their mind. Duration two hours.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase two.</td>
<td>Reflection. Duration one week.</td>
</tr>
<tr>
<td>Phase three.</td>
<td>Feedback and discussion. The group meets together with the instructor and discuss the problem presented in the interactive case. Duration two hours.</td>
</tr>
</tbody>
</table>

Figure 7. Framework and methodology for PIE

CONCLUSION

In this section we draw conclusions, propose implications, highlight limitations and outline our future work. This paper has discussed how experiential learning (EL) and problem based learning (PBL) can be integrated by the use of interactive multimedia (IMM). We have designed an interactive case prototype about project management. The prototype was evaluated in two different settings. The three research questions below guided the research and serve to summarize the findings.

- Can computing technologies enhance problem based learning? And more specifically addressed in this paper: How can interactive multimedia enrich the vignette?

Using information technology to search information on the ‘net’ is a natural activity in PBL today. Technology for student presentations, for instance PowerPoint, is also frequently used in a PBL context. The vignette has not received the same attention however. Our limited evaluation suggests that interactive multimedia enhanced vignettes provide dimensions to PBL. A main advantage we found in our evaluation was how interactivity of the vignette slows down the process. In other words, we can help (force)
the students to spend longer time at the problem, understanding and problem definition phase.

- How can experiential learning and problem based learning be integrated in a methodology?

We have proposed PIE as a methodological approach for integrating Problem based learning, Interactive multimedia, and Experiential learning.

- Can interactive multimedia vignettes be used outside a formal education system to train and educate in project management related issues in corporate training programs?

We claim that PIE is an approach that is useful in organized corporate training about project management. The three phase approach provides both experience and time for reflection.

The main limitations of this research, as we see it, are two. First, the very simple prototype designed to implement our idea about interactive multimedia vignettes. Second, the limited evaluation conducted. However, as our aim with this paper is to discuss the problem of challenging learners in a PBL setting, and suggest how these problems can be handled, we do not find these limitations to be problematic for our purposes in this paper.

Whereas the findings so far are tentative, we argue that the survey showed us some important things about the design of vignettes, both traditional and multimedia. For the continued work, we will involve more professionals to ensure reliability of the content in the next phase which is to fully implement the failing project vignette, followed by an evaluation of the usefulness of it. We are currently transforming the ideas to a web-based interactive scenario. Further, our intention is to explore the possibility to develop a generic framework or software tool for the design of multimedia vignettes.

The questions also initiated informal discussions among the students. This was the case with the evaluation too. We believe this type of intervention in an ongoing educational program, in this case a program where PBL was the main form of activity, invites to reflection and discussion among the people participating, learners as well as educators. This will result in a deeper understanding of the educational process and how it can be improved.
References


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