CONNECTING THEORY TO PRACTICE – USING TECHNOLOGY TO SUPPORT SITUATED LEARNING IN VOCATIONAL EDUCATION

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Abstract

As an institution whose primary function is to meet the skilled manpower needs of the economy, it is therefore essential that our students not only acquire the relevant knowledge and skills when performing in the real work context, but also be able to solve problem with this knowledge and skills. This paper discusses a new instructional strategy we employed -- situated learning applied in the context of technology-supported independent learning. It is used to bridge the gap between learning of content through formal instruction and real-life application of knowledge and skills in the work environment. To help our instructional designers design and select appropriate technology to create a situated learning environment suitable for independent learning, we have determined the relevant elements of such an environment and come up with a set of guiding questions to help instructional designers design such an environment. To illustrate the application, this paper also describes the situated learning environment designed for a module in the Electrical Technology course.

INTRODUCTION

The learner in this information age is very different. In the past, teaching is based mainly on the "transfer of knowledge" model, which emphasized unidirectional cause-effect relationships and learners were seen as passive while teachers were conservative.

Today, with the demands of the knowledge era, learners need to be active and take more responsibility for their own learning. Traditional classroom methods will not be able to satisfy their educational needs. There is a growing interest in models which engaged learners in problem situations mirroring real-world context. Whitehead (1929) argued that teaching contents that are abstract and out of context will merely result in imparting inert knowledge – or knowledge that students could use to answer items on a school test, but not able to apply when solving problems. Similarly, Brown, Collins & Duguid (1996) stressed that we should move away from the notion that concepts are abstract, self-contained entities that can be taught separately from the context in which they are used. Knowledge is located in the activities of individual or groups of individuals and evolves as the individuals participate in the activity.

As an institution whose primary function is to meet the skilled manpower needs of the economy, it is therefore essential that our students not only acquire the relevant knowledge but also be able to use the knowledge and skills when performing in the real work context. Hence instructional strategies employed, and the context in which the content is taught, should provide opportunity for students to solve practical problems, as well as facilitate the transfer of students' competence to work situations. Situated learning is one perspective of

knowledge acquisition that supports this view. In the following sections, the situated learning approaches and our use of technology as a situating tool will be described.

Situated learning

Situated learning approaches propose bridging the gap between learning of content through formal instruction in the classroom and the real-life application of knowledge and skills in the work environment. Literally, situated means "having a place or location" and learning means "the act, process, or experience of gaining knowledge or skill" (Dictionary.com, 2005). From the perspectives of learning theories, *situated* means positioned and *situated learning* means that learning is placed in a context implying that information is meaningful only in relation to its context (Bredo, 1994; Brown, Collins, & Duguid, 1996; Clancey, 1992; Hung, 2002). These perspectives emphasis the contextual dimensions of knowledge and see meanings as inseparable from its relations among situations and actions. According to this perspective, knowledge does not just occur within the mind of an individual but is fundamentally a co-production of the mind and world (Hung, 2002). Conceptual knowledge is arrived at when one interacts with the environment and through these interactions meaning is understood (Goodson-Espy, Espy & Cifarelli, 2002).

One implication of these perspectives is that knowledge is positioned in relation to circumstance between self and others in the world (Cobb & Bower, 1999). Learning and cognition is fundamentally situated, that is, what is learned and how it is learned and used cannot be separated (Brown, Collins & Duguid, 1996). Knowledge is influenced by the activity, context and culture in which it is used. Thus, the second implication is that mental models within an individual's mind is created in the course of an activity (Bartlett, 1958; Wells, 1999), and generalization in learning is unlikely to occur without active exploration and participation in the situation, that is, learning can only take place in a social setting and context. Students have to be in the situation to acquire new knowledge and form new mental models or revise existing models. Learning thus makes sense and is meaningful only within realistic or authentic situations, contexts or activities and students' active participation in the learning process is important.

In summary, unlike traditional teaching approaches that decontextualised knowledge thus encouraging inflexible and incomplete understanding, situated learning approaches advocate that educational content should be embedded into a realistic situational context and learning should be through active engagement in concrete and authentic learning tasks. As pointed out by Jonassen (1994), situated learning occurs when students work on authentic and realistic tasks that reflect the real world thus providing meaningful learning and facilitating transfer of knowledge to real life situations. In short, situated learning t helps students to

- become more actively engaged in learning;
- construct new knowledge (and thus new mental models) that are meaningful to them;
- relate or apply the knowledge acquired to deal with real life problems or issues; and thus
- increase their cognitive level.

Creating the situating environment – Technology as a situating tool

Fostering learning within a situated context is essentially about creating a situated learning environment. There exist numerous ways to do this and in the recent years,

technology has become a popular tool to situate learning. The set of videodisc programs called the "Jasper Woodbury Problem Solving Series" developed by The Cognition and Technology Group at Vanderbilt (1996) is an example.

Teo (2000) described a process (Figure 1) that stressed the need for Instructional Designers to deliberately provide opportunities for students to interact with the content, and engage in authentic activities and real life applications of the content.

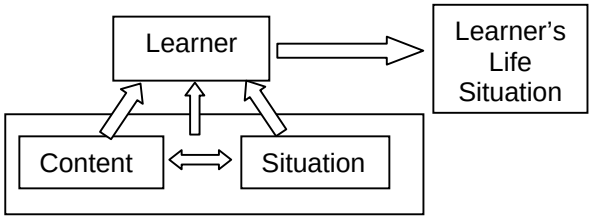

Figure 1: The learner and his content for learning (Teo, 2000)

Concurring with this view, we attempted to extend her model by defining some guidelines that would guide our instructional designers in designing effective situated learning environments suitable for independent learning and selecting appropriate technology tools to create this environment, taking into consideration the characteristics of our content which is in the vocational and technical education domain. To do this, we examined existing literature on situated learning to draw out relevant features that would help us design and create the situated learning environment through the use of technology.

Firstly, situated learning perspectives view knowledge as inherently situated in social and physical contexts (Bredo, 1994; Brown, Collins, & Duguid, 1996; Clancey, 1992; Hung, 2002). Instead of getting students to simply acquire factual knowledge in a discrete manner, detached from the context it is used, these perspectives stressed that learners need to know how the knowledge is used. In other words, they need to know why they should acquire the knowledge for them to take greater ownership of their own learning and hence, become more intrinsically motivated to learn. In addition, authentic situations can help to simulate an expert's ways of action (Korpi, 2000). One element of a well-designed situated learning environment is thus an authentic context that mirrors the real life as closely as possible, replicating its typical elements and problems while incorporating rich conceptual meanings and encouraging students to explore, discover, acquire and apply the content learnt. Multimedia, such as sound, graphics, animations and digital video can effectively represent genuine real world context (McGinn & Roth, 1999; Szabo & Poohkay, 1996). For example, Cognition and Technology Group at Vanderbilt (1996) uses videodisc as a means to present authentic problem situations. At our institution, we are adopting a hybrid of technology tools, including Macromedia Flash animations and videos to present authentic work-related problem situations to learners as a means to situate their learning. Macromedia Flash animations and videos not only make the presentation more interesting but also capture real work situations thus making the problem more realistic. In addition, Macromedia Flash and Authorware would be used to create interactivities that allow students to explore and interact with the problem situation.

Importance of immersing students in authentic contexts also implies the need to engage students in authentic tasks or problem-solving activities that mirror the real world (Brown, Collins & Duguid, 1996; Jonassen, 1994; Winn, 1993). Brown, Collins and Duguid (1996) explained that authentic tasks are the ordinary practices of practitioners in the domain while Jonassen (1995) referred to them as learning tasks that replicate the structures of the activity in real world. Authentic tasks thus refer to those that are commonplace in the daily situations of practitioners or expert in the field (Brown, Collins and Duguid ,1996).

Incorporation of authentic tasks that reflect real-life applications of the content is therefore another element of a situated learning environment. When designing these activities, care should be taken to reflect the real-life cognitive challenges of the tasks. Technology can be used to create graphics, simulation or animation to more effectively present the requirements of the tasks to students.

The primary goal of getting student to engage in authentic tasks in an authentic situation is to help move him/her from a novice to become an expert. Novice learners need support when engaged in more complex tasks than what they could perform on their own. A challenge when designing situated learning environment is thus to determine the Zone of Proximal Development Vygotsky (1978) of the students, and to provide support or scaffold that would help them cross this zone to become expert performer. Support needed could take the form of resources, tools, templates demonstration of heuristics or modeling of cognitive skills. The software used by the Institute for Research on Learning to help students explore algebra concepts (Bransford, Brown, & Cooking, 1999) is one such example. Technology, in the form of simulation or interactive activities can be an effective tool for scaffolding student learning. In our context, interactive activities could be created using Macromedia Authorware or Flash to guide students through the process an expert would adopt to solve the problem or perform the task. At the same time, through the interactive activities, students can work collaboratively with the computer to construct their own knowledge.

When performing a task or solving a problem, expert performers are constantly reflecting on the practical demands of the real world and continually monitoring their own thinking. Reflection is therefore a vital component of situated learning (McLellan, 1996). When designing a situated learning environment, the instructional designer should therefore consciously include activities that would promote reflective thinking. Technology such as Macromedia Authorware or Flash could be used to create interactive activities that require students to reflect on their own learning and to abstract general principles that could be applied to another similar problem situation.

To summarise, designing an effective situated learning environment would involve designing:

- an authentic context that reflects how the knowledge or skills would be used in the work context
- authentic learning activities or tasks that allow students to learn and apply the knowledge or skills
- support or scaffold that would model and guide students through the expert performance process
- activities that promote reflective thinking

Table 1 provides a summary of the above elements, guiding questions for designing each of the elements and possible technology tools to use.

Elements of a situated learning environment	**Guiding questions for instructional design**	**Possible technology tools**
Authentic learning activities or tasks	1. What real-world tasks would require application of the skill/knowledge? 2. How can these tasks be presented such that they are clear, interesting and challenging to students?	Graphics, Animations, Videos, Simulations, Interactive activities

Elements of a situated learning environment	Guiding questions for instructional design	Possible technology tools
Support or scaffold	1. What is the zone of proximal development of students? 2. How should the learning activities be sequenced such that learning is facilitated? 3. What learning support would students need to successfully complete the tasks? 4. How can technology be used to help students through the process of expert performance? 5. What resources would students need to successfully complete the tasks? How can technology be used to help students access the resources?	Videos, Simulations, Interactive activities
Reflective activities	1. How can students know whether they have learnt well? 2. What activities can be designed to help students arrive at general principles that could be applied to another similar situation?	Interactive activities

Table 1: Guiding questions for designing an effective situated learning environment

Teaching of Electrical Installation – An application of situated learning

Electrical Installation is a module in the Electrical Technology course offered at our institute wherein students are trained to install, maintain and service domestic and industrial installations according to the Code of Practice for electrical installation, CP5. CP5 is a document that spells out the requirements for wiring of electrical equipment in buildings. Students taking this module are expected to demonstrate the ability to interpret the CP5 requirements correctly and apply this knowledge in wiring electrical installations.

Previously, this module was delivered through PowerPoint presentations with static graphics and text explanations. Learning was largely passive resulting in students perceiving the content as merely another body of knowledge that they needed to memorise in order to pass the examinations. They were not able to see the real-life applications of the content covered in this module.

Recently, a blended approach has been adopted, where independent online learning using interactive learning objects (Figure 2) complement face-to-face classroom lessons.

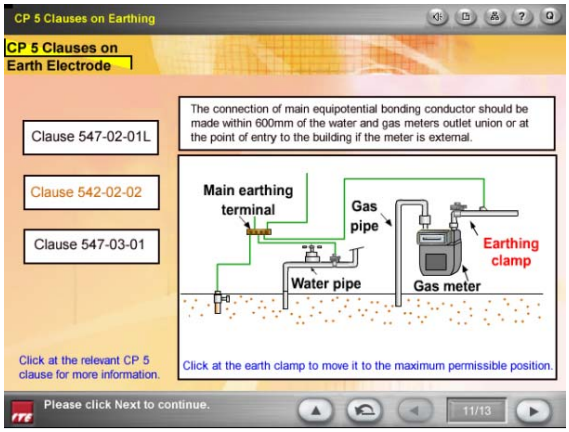

Figure 2: Screen capture from an interactive learning object

Besides interactive learning activities, real-life applications of the content were highlighted in the learning objects. This, to a certain extend, helped students to appreciate the real-life applications of the content. However, students still could not fully comprehend the importance of the clauses in CP5 nor appreciate the consequences of non-compliance until they start work in the field of electrical engineering.

We are currently attempting to bridge this gap by applying the situated learning approach described in the preceding section. For example, to teach the topic on the correct cable sizes to use for different situations, video and animations were used to depict a situation where an electrical installation did not comply with the Code of Practice (Figure 3).

Figure 3: Use of video and animations to depict a problem

Students will be expected to take on the role of the electrician presented in the scenario. They will explore and interact with the problem situation to gather relevant information in order to correctly identify and rectify the parts that did not comply with the regulations. Appropriate and adequate guidance, support and modeling will be provided to help students complete the task (Figure 4). The learning objects developed earlier will be used as reference material to help students acquire the relevant knowledge. Interactive activities that model the expert thought processes in solving similar problem situation will be used to guide students to identify the parts that did not comply with the regulations and take actions to rectify the non-compliance by deciding on the correct cable size that should be used for each part of the electrical installation.

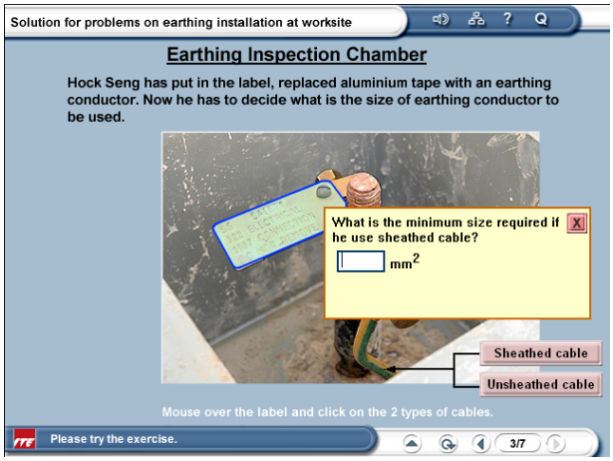

Figure 4: Example of scaffolds provided in the form of a guiding question

Through this situated learning process, students will acquire the knowledge within an authentic context, work collaboratively with the computer and apply higher-order as well as reflective thinking to complete an authentic task that they are likely to encounter in the real work situation.

With this interplay of interactive multimedia activities and direct application of knowledge to a real problem, students will be able to transfer knowledge acquired in the learning objects to the situated learning environment. Learning will naturally be reinforced. Students will no longer be passive learners; one who observes what is happening but does not use what they have learnt to solve an actual problem.

CONCLUSION

Much has been written about situated learning as an effective model for promoting effective learning. Many have highlighted the benefits of this model in providing the context, culture and activities that cannot be separated from the knowledge in order for meaningful learning to take place. The advert of technology has prompted many to harness its capability to support this model of learning. At our institute, in recognizing the potential of situated learning to promote effective transfer of learning to the work situation, we are presently developing blended learning packages based on this perspective of learning. However, effective learning packages are insufficient to ensure learning effectiveness and efficiency. The next task for us would be to convince most of our teachers who are adept at the traditional mode of teaching to embrace the situated learning approach.

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