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FACILITATING A MEANINGFUL LEARNING EXPERIENCE FOR STUDENTS BY MULTIMEDIA TEACHING APPROACH

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Abstract

In order to reduce the drawbacks of traditional education, multimedia teaching approach was used so as to enhance the learning effectiveness. For the purpose of achieving the goal of meaningful learning, multimedia teaching approach was applied to engage students in active, constructive, intentional, authentic and co-operative learning. For promoting intentional learning by identifying important aspects of the performance, students and teachers could work together to develop a rubric to gather information about the learner's performance, and use the information as input for reflection on the performance. After applying multimedia teaching approach including tailor-made interactive computer animations and computerized simulation of real processes in my two taught subjects, all my students indicated that they understood the know-how, know-what and know-why of all the real processes. Majority of students performed very well in both coursework and the examination. No fail grade was found in either coursework or examination.

Keywords: Meaningful Learning; Multimedia Teaching; Interactive Computer Animation; Computerized Simulation

Introduction

In a traditional lecture, it is common that students just sit and listen provided they are lucky enough to have a copy of the notes and do not have to write. This kind of traditional lecturing is highly inefficient for at least three reasons. Firstly, the students will derive little additional benefits from attending the lecture if they can read the notes beforehand. Secondly, research has shown that most students have an attention span of only about 15 minutes. Thirdly, students are not required to think about what they have heard as the lecture proceeds and many will not think about it anymore once the lecture is over; this will lead to the development of poor study habits and encourage rote learning. In order to reduce the drawbacks of traditional education and shift the focus from the traditional "teacher-centered teaching" to the desired "student-centered learning", multimedia teaching approach was introduced to facilitate a meaningful learning experience for students so as to enhance the learning effectiveness.

What is Meaningful Learning?

The primary goal of education at all levels should be to engage students in meaningful learning, which occurs when students are making meaning. While schools play a variety of important social, custodial, and organizational roles in communities, their primary obligation should be to help students to learn how to recognize and solve problems, comprehend new phenomena, construct mental models of those phenomena, and given a new situation, set goals and regulate

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their own learning (learn how to learn). Figure 1 shows the relationship among different attributes so as to generate meaningful learning. If we want to achieve the goal of meaningful learning, we should use multimedia teaching approach to engage students in active, constructive, intentional, authentic, and cooperative learning [6].

As shown in Figure 1, different attributes so as to generate meaningful learning are interrelated, interactive, and interdependent. That is, learning and instructional activities should engage and support combinations of active, constructive, intentional, authentic, and cooperative learning. Why? Because we believe that these attributes are synergetic. That is, learning activities that represent a combination of these attributes result in even more meaningful learning than the individual attributes would in isolation. Multimedia afford students the opportunities to engage in meaningful learning if used as learning tools [1, 3, 5, 7].

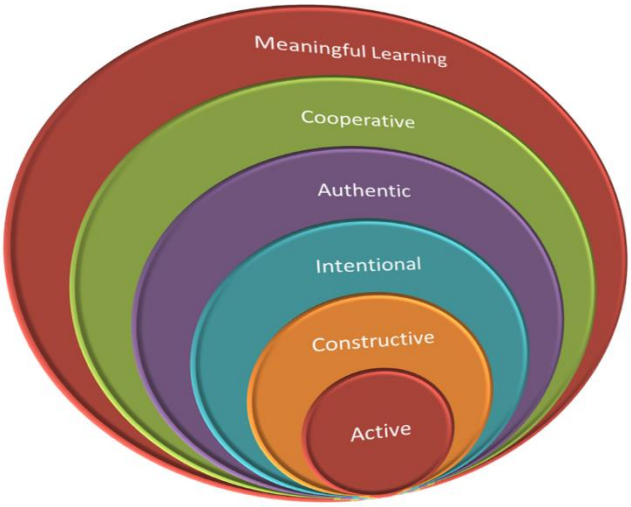

Figure 1. Five attributes for generating meaningful learning as a whole.

Meaningful Learning Is Active (Manipulative/Observant)

Learning is a natural, adaptive human process. Humans have survived and therefore evolved because they were able to learn about and adapt to their environment. Humans of all ages, without the intervention of formal instruction, can develop sophisticated skills and construct advanced knowledge about the world around them when they need to or want to. When learning about things in natural contexts, humans, interact with their environment and manipulate the objects in that environment, observing the effects of their interventions and constructing their own interpretations of the phenomena and the results of the manipulation. For example, before playing sandlot baseball, do kids subject themselves to lectures and multiple-choice examinations about the theory of games, the aerodynamics of orbs, and vector forces of bats? No! They start swinging the bat and chasing fly balls, and they negotiate the rules as they play the game. Through formal and informal apprenticeships in communities of play and work, learners develop skills and knowledge that they then share with other members of those communities with whom they learned and practiced those skills. In all of these situations, learners are actively manipulating the objects and tools of the trade and observing the effects of what they have done. The youngster who consistently hits foul balls will adjust his/her stance and handgrip on the bat continuously in order to manipulate the path of flight and observe the effects of each manipulation. Meaningful learning requires learners who are actively engaged in a meaningful task (not just pressing the spacebar to continue) in which they manipulate objects and parameters of the environment they are working in and observing the results of their

manipulations.

Meaningful Learning Is Constructive (Articulative/Reflective)

Activity is necessary but not sufficient for meaningful learning. It is essential that learners articulate what they have accomplished and reflect on their activity and observation – to learn the lessons that their activity has to teach. New experiences often provide a discrepancy between what learners observe and what they understand. They are curious about or puzzled by what they see. That puzzlement is the catalyst for meaning making. By reflecting on the puzzling experience, learners integrate their new experiences with their prior knowledge about the world, or they establish goals for what they need to learn in order to make sense out of what they observe. Learners begin constructing their own simple mental models to explain their worlds, and with experience, support, and more reflection, their mental models become increasingly complex. Ever more complex models will enable them to reason more consistently and productively about the phenomena they are observing. The active and constructive parts of the meaning-making process are symbiotic. They both reply on the other for meaning making to occur.

Meaningful Learning Is Intentional (Reflective/Regulatory)

All human behavior is goal directed. That is, everything that we do is intended to fulfill some goal. That goal may be simple, such as satiating hunger or getting more comfortable, or it may be more complex, such as developing new career skills or studying for a master's degree. When learners are actively and willfully trying to achieve a cognitive goal, they think and learn more because they are fulfilling an intention. Multimedia (Technologies) have traditionally been used to support teacher goals, but not those of learners. Multimedia need to engage learners in articulating what their learning goals are in any learning situation and then supporting them. Learners should be required by multimedia-based learning systems to articulate what they are doing, the decisions they make, the strategies they use, and the answers they found. When learners articulate what they have learned and reflect on the processes and decisions that were entailed by the process, they understand more and are better able to use the knowledge that they have constructed in new situations.

Meaningful Learning Is Authentic (Complex/Contextualized)

The greatest intellectual sin that we educators commit is to oversimplify most ideas that we teach in order to make them more easily transmissible to learners. In addition to removing ideas from their natural contexts for teaching, we also strip ideas of their contextual cues and information and distill the ideas to their "simplest" form so that students will more readily learn them. But what are they learning? That knowledge is divorced from reality, and that the world is a reliable and simple place. But, the world is not a reliable and simple place, and ideas rely on the contexts they occur in for meaning. Learning often fails because students learned to understand the ideas as algorithmic procedures outside of any context, so they have no idea how to relate the ideas to real-world contexts. Most contemporary research on learning has shown that learning tasks that are situated in some meaningful real-world task or simulated in some case-based or problem-based learning environment are not only better understood, but also are more consistently transferred to new situations. Rather than abstracting ideas in rules that are memorized and then applied to other canned problems, we need to teach knowledge and skills in real-life, useful contexts and provide new and different contexts for learners to practice using those ideas. And we need to engage students in solving complex and ill-structured problems as well as simple, well-structured problem. Unless learners are required to engage in higher order

thinking, they will develop oversimplified views of the world.

Meaningful Learning Is Cooperative (Collaborative/Conversational)

Humans naturally work in learning and knowledge-building communities, exploiting each other's skills and appropriating each other's knowledge. In the real world, humans naturally seek out others to help them to solve problems and perform tasks. Then why do educators insist that learners work independently all of the time? Schools generally believe that learning is an independent process, so learners seldom have the opportunities to "do anything that counts" in collaborative teams despite their natural inclinations. When students collaborate without permission, educators may even accuse them of cheating. However, we believe that replying solely on independent methods of instruction cheat learners out of more natural and productive modes of thinking. Often, educators will promote collaborative methods of learning, only to resort to independent assessment of learning. Learners, they believe, must be accountable for their own knowledge, so even if you agree, at least in principle, with collaborative learning principles, the hardest part of applying your beliefs will be assessing learners. We cannot forget that most learners are strategic enough to know "what counts" in classrooms, so if they are evaluated individually, collaborative learning activities may fail because students realize that group outcomes are not important. Collaboration most often requires conversation among participants. Learners working in groups must socially negotiate a common understanding of the task and the methods they will use to accomplish it. That is, given a problem or task, people naturally seek out opinions and ideas from others. Multimedia teaching Approach and interactive computer animation can support this conversational process by connecting learners in the same classroom. When learners become part of knowledge-building communities, they learn that there are multiple ways of viewing the world and multiple solutions to most of life's problems.

Assessing the Meaningful Learning

Performance assessment refers to the process of assessing a student's skills by asking the student to perform tasks that require those skills. Performances in science might examine the ability to design a device to perform a particular function or to mount an argument supported by experimental evidence [2, 4].

The performance assessment should have the following elements:

- Students must construct a response or a product, rather than simply select from a set of pre-defined alternatives or answer. So, we saw that students can create or "construct" a new broadcast rather than completing a multiple choice test on current events.
- Assessment then consists of direct observation or assessment of student behaviour on tasks or on the product that they produced, and further, the tasks or products are designed to resemble activities commonly required for functioning in the world.

Rubrics and Meaningful Learning Environments

Many terms are used to name the documents or methods we use to assess learner performance. These include scoring grids (because they are often in grid form), scoring schemes, rating scales, and perhaps the most commonly used term – rubrics.

By definition, a rubric is a code, or a set of codes designed to govern action. In educational

settings, the term has evolved to mean a tool to be used for assessing a complex performance. In schools, rubrics often take the form of a scale or set of scales. In a typical classroom, for example, oral reports are mysteriously graded (neither students nor teachers can really tell you where the grades come from) and a few comments generally accompany the grade. Little substantive feedback about the performance is made available to the student, who cares only about the grade received.

Consider, instead, a meaningful learning environment in which the students and teachers work together to develop a rubric that will promote intentional learning by identifying important aspects of the performance, use the rubric to gather information about the learner's performance, and use the information as input for reflection on the performance. That reflection provides evidence to improve the performance. Rubrics can be an important tool for innovative educators who set out to create and enhance technology-rich, meaningful learning environments.

My Experience Sharing on Applying Multimedia Teaching Approach on My Taught Subjects

In this section, I would introduce the application of multimedia teaching approach on two of my taught subjects. One subject was Industrial Engineering Techniques and Methods. Another subject was Manufacturing Technology. In order to achieve the goal of meaningful learning, multimedia teaching approach was applied to engage students in active, constructive, intentional, authentic and cooperative learning.

The Background of My Students

All my students came from grammar secondary school. Lack of industrial knowledge and experience were found for all my students. And, some students even did not have any engineering sense. In accordance with majority of students' feedback, all the students came from Chinese as the Medium of Instruction (CMI) secondary school. This was the great challenge to me since I officially needed to use 100% English as the only one teaching language in this subject, and I really used 100% English to teach all the students. Since all the students were lack of both industrial knowledge and experience, it was a great challenge to me to teach a lot of difficult technical concepts and theories in the lessons.

Tailor-made Interactive Computer Animations

Computer animation is the process used for generating animated images by using computer graphics. The more general term computer generated imagery encompasses both static scenes and dynamic images, while computer animation only refers to moving images produced by exploiting the persistence of vision to make a series of images look animated. Given that images last for about one twenty-fifth of a second on the retina fast image replacement creates the illusion of movement.

For the purpose of generating meaningful learning, five attributes such as active, constructive, intentional, authentic and cooperative were integrated as a whole to make interactive computer animations as so to illustrate the difficult concepts and theories. After seeing the interactive computer animations, all my students indicated that they not only understood the difficult concepts and theories, but also they understood the know-how, know-what and know-why of all the industrial processes.

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Computerized Simulation of Real Processes

A simulation uses a mathematical description, or model, of a real system in the form of a computer program. This model is composed of equations that duplicate the functional relationships within the real system. When the program is run, the resulting mathematical dynamics form an analog of the behaviour of the real system, with the results presented in the form of data. A simulation can also take the form of a computer-graphics image that represents dynamic processes in an animated sequence.

Computer simulations are used to study the dynamic behaviour of objects or systems in response to conditions that cannot be easily or safely applied in real life. For example, a nuclear blast can be described by a mathematical model that incorporates such variables as heat, velocity, and radioactive emissions. Additional mathematical equations can then be used to adjust the model to changes in certain variables, such as the amount of fissionable material that produced the blast. Simulations are especially useful in enabling observers to measure and predict how the functioning of an entire system may be affected by altering individual components within that system.

In my taught subjects, computerized simulations of real processes were added into the laboratory work to stimulate the students to learn more efficiently and effectively. Due to my great enthusiastic effort, generous help, active and stimulating teaching style, all the students fully understood of what the subject was, and they all gained a lot of useful knowledge and experience as a whole.

Using Rubrics to Assess Active, Constructive, Intentional, Authentic, and Cooperative Learning

Rubrics were used in the assessments to create a meaningful learning environment in which the students and teachers work together to develop a rubric that will promote intentional learning by identifying important aspects of the performance, use the rubric to gather information about the learner's performance, and use the information as input for reflection on the performance. That reflection provides evidence to improve the performance. Feedback about the performance is made available to each student.

Assessing Active Learning

Assessing active learning, where learners explore and manipulate the components and parameters of multimedia-based environments and observe the results of their activities. If the learning activity or environment includes active learning, to what extent does the environment promote manipulation of real-world objects and observations based on these activities?

Assessing Constructive Learning

Assessing constructive learning, where learners articulate what they know and have learned and reflect on its meaning and importance in larger social and intellectual contexts. If the learning activity or environment requires constructive learning, to what extent does the environment cause learners to perceive puzzling dissonance and form mental models to explain incongruity?

Assessing Intentional Learning

Assessing intentional learning, where learners determine their own goals and regulate and

manage their activities. If the learning activity or environment requires intentional learning, to what extent does the environment cause learners to pursue important, well-articulate goals to which they are intrinsically committed? To what extend can learners explain their activity in terms of how the activities relate to the attainment of their goals?

Assessing Authentic Learning

Assessing authentic learning, where learners examine and attempt to solve complex, ill-structured, and real-world problems. If the learning activity or environment includes authentic problem solving, to what extent does the environment present learners with problems that are naturally complex and embedded in a real-world context? To what extend do the problems the student present cause higher-order thinking?

Assessing Cooperative Learning

Assessing cooperative learning, where learners collaborate with others and socially negotiate the meanings they have constructed. If the environment or activity includes cooperative learning, to what extend does the environment promote meaningful interaction among students and between students and experts outside of school? To what extend are learners developing skills related to social negotiation in learning to accept and share responsibility?

Results of Applying Multimedia Teaching Approach

Originally, the classes were quite noisy. After using multimedia teaching approach including tailor-made interactive computer animations and computerized simulation of real processes to illustrate the difficult concepts and theories, all my students indicated that they understood the know-how, know-what and know-why of all the real processes. And, silence was found in the lessons. On the other hand, some students initially were always late for more than 15 minutes in tutorials and even 30 minutes for lectures. After I used the multimedia teaching approach, they began to come to the lesson on time.

All the students had showed that they could successfully apply all the learnt concepts and theories to solve all the practical and daily-life problems by completing all the group project, individual assignments, test, and examination. Majority of student performed very well in both the coursework and the examination. No fail grade was found in either coursework or examination.

Conclusions

Multimedia teaching approach could be used to reduce the drawbacks of traditional education. The attributes such as active, constructive, intentional, authentic, and cooperative for generating meaningful learning were identified. Rubric could be found as a good tool for creating a meaningful learning environment. Learning effectiveness could be enhanced by using multimedia teaching approach to illustrate the difficult concepts and theories. After using the multimedia teaching approach, all my students could successfully apply all the learnt concepts and theories to solve all the practical and daily-life problems by completing both the coursework and the examination.

References

[1] Chung, S. C., Shen, T. C. (1999). *A Comparison of the Effect of Traditional Teacher-Centred Instruction and Multimedia-based Group Learning on Fostering Students' English Oral Fluency*. In Cumming, G., Okamoto, T., and Gomez, L. (Ed.), Advanced Research in Computers and Communications in Education (pp.882-883). IOS Press.

[2] Fung, S. K. (1999). *Resources and Strategies in Using the Multimedia Technology in Special Education*. In Bradbeer, R. (Ed.), Current Practice in Multimedia Education (pp.141-150). City University of Hong Kong Press.

[3] Hozumi, K. (1999). *The Status of Multimedia Educational Environment: Its Perspective Based on the Comparison of Japan and USA*. In Cumming, G., Okamoto, T., and Gomez, L. (Ed.), Advanced Research in Computers and Communications in Education (pp.884-885). IOS Press.

[4] Klassen, J. and Milton, P. (1999). *Decision-making in the Pre-production Stages of Developing an Interactive Multimedia Package*. In Bradbeer, R. (Ed.), Current Practice in Multimedia Education (pp.19-32). City University of Hong Kong Press.

[5] Miyamoto, H. (1999). *Multimedia Courseware for Skill-acquaintance Learning*. In Cumming, G., Okamoto, T., and Gomez, L. (Ed.), Advanced Research in Computers and Communications in Education (pp.886-887). IOS Press.

[6] Pritchard, G. E. (2002). *Improving Learning with Information Technology*, National Academy Press, Washington, DC, USA.

[7] Williams, N. (1998). *Educational Multimedia: Where's the Interaction?*. In Monteith, M. (Ed.), IT for Learning Enhancement (pp.153-170). Swers & Zeitlinger Publishers.