Creating an Interactive Environment for Software Application Learning in Graduate Programs

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Abstract

Despite the growing application of design and development of constructivist teaching and learning strategies in many fields of study, the effort devoted to exploring the role of the constructivist view of teaching methods for computer software learning is still limited. This study experimented with a new teaching strategy for software applications, in which more interactions and class participation were expected. The strategy had been previously implemented in an undergraduate level course. This was a continuation at the graduate level and aimed to investigate the experiences from both the perspectives of the instructor and students. The findings show that the students strongly felt that the innovative teaching strategy helped them better concentrate in class, which resulted in more peer interactions and class participation. The instructor was satisfied with and appreciated the teaching innovation and considered the strategy effective in meeting the learning goals. Several drawbacks were discussed based on the experience.

Keywords: *interactive learning; collaborative learning; teaching innovation; software application; teaching strategy*

1. Introduction

There is no doubt that research on using computer technology to enhance teaching and learning is rapidly growing. To meet the computer skill demands in almost every field, schools have been including software application learning in their curriculum. However, compared with the numerous studies on how to enhance teaching and learning with technology, the investigation on the methods and strategies of teaching software applications itself has rarely been conducted. It seems that, in the general view, teaching software application is all about repeated operations and does not have much room for innovative teaching approaches. While several studies introduced some tutorials or process capturing software (such as screen recorder software) for the convenience of self-directed learning on software, the development of classroom teaching methods and the investigation of its effectiveness are lacking.

Some of the few studies indicated that most of the software application instructors used a systematic approach for teaching and considered it most effective (Lambrecht, 1999; McEwen, 1996). Their systematic learning approach was based on a behavioral learning theory assumption, in which learning is regarded as a behavioral response to stimuli (Chen & Ray, 2005). In this approach, instruction usually involves step-by-step directions and teacher-centered methods to complete learning tasks (McEwen, 1996). Lambrecht (1999) concluded that this systematic approach for software teaching is better for novices, but not for advanced learners who seek problem solving abilities and concept transferability in the real world.

In graduate programs, students are in an advanced education environment in which they should be capable of self-discipline and self-direction. Research techniques, decision-making skills, and problem solving in teams are essential skills to be acquired in graduate programs (Campbell, 1996). They should have confidence to work constructively in teams as part of establishing professional skills (Hudson, 2000). They should be able to reach the

ultimate goal of a graduate program, being independent and lifelong learners (Lapane, 2007). Therefore, instruction in graduate programs should not be simply filled with lectures and "objective" tests. Particularly, the small size feature of classes in graduate education, which usually distinguishes it from undergraduate, allows the instruction to be better tailored to fit students' background and individual needs (Campbell, 1996).

In the field of design and technology, many production courses (e.g. webpage design, computer graphics, multimedia, animation, film or video) demand knowledge in the use of specialized commercial software. Compared to the deficiency of self-paced learning materials several years ago, learners can now find an abundance of well-developed teaching websites, textbooks, video clips, professional teaching CDs for most commercial software. Richly developed learning content can be easily accessed. Ideally, this would allow more time to be set aside for the development of concepts and ideas rather than using valuable class time for teaching and learning "how to use" software; that is, time would be better spent on the process of creation and "how to apply" advanced software techniques for a better quality production or solution. However, in practice, asking students to learn on their own is still something "easier said than done."

On the other hand, teaching software is a tedious and time-consuming task. Without real-life applications, the techniques learned can be forgotten easily and quickly. Besides, technology is changing faster than we are able to keep up with. No one can predict whether today's software will still stay in the market as a main stream or not several years later after graduation. Therefore, it is more important to let students know the drills of active learning and experience the very concept that learning is more effective through collaboration and sharing than by simply sitting up and listening in a lecture.

Therefore, this study experimented with a new teaching strategy, called Expert Panel. Expert Panel is an ongoing project, sponsored by National Science Council in Taiwan, about developing and creating an interactive and collaborative, student-centred learning environment for a software-oriented course in higher education. This article mainly reports the qualitative data on the evaluation of this innovation by examining the perceptions and experiences from both the instructor and students perspectives. It is assumed that advancing the use of Expert Panel will enhance students' motivation for learning software applications and strengthen their ability to master the art of using available tools to solve real-world problems.

2. Methods and Process

2.1 Theoretical foundation

This study utilized Moore's (1989) three types of interactions as the framework for evaluation—learner-content, learner-instructor, and learner-learner interaction. Briefly speaking, learner-content interaction is a fundamental component in education. It requires learners to intellectually analyze and synthesize the received learning content in order to prepare for the acquisition of knowledge and skills. The learner-learner interaction occurs "between one learner to other learners, alone or in group settings, with or without the real-time presence of an instructor" (Moore, 1989, p. 4). Many methods of teaching, which use a constructivist view, integrate this type of interaction into the instructions and claim that learners' experience is most enriched when learners construct their knowledge and skills together (Ehrlich, 2002). The learner-instructor interaction is "between the learner and the expert who prepared the subject material" (Moore, 1989, p. 2).

2.2 Participant and context

The students who enrolled in the Animation Design course in the E-learning Design and Management department at National Chiayi University and the course's instructor were the participants for the study.

The course is a selective, 3-credit, graduate level course. The primary goal of this course is to help students make good use of Flash software applications to practically develop multimedia animation projects. A small prototype production project was required as the final project at the end of semester.

Fifteen students, 7 males and 8 females, enrolled in the course. Nine out of the fifteen students had some experience using the software. Three of them ever tried to learn Flash through self-study, but admitted that the learning effect was not good enough for application when the time came for real production. Three students barely had any experience with Flash or animation production. The instructor has both academic and industrial experience, and has been teaching software techniques and design related courses for more than eight years in the University.

There were 18 weeks (a total of 54 class units) in each semester. Seven weeks of the total period were scheduled mainly for the instruction of Flash techniques. A 15-seat computer lab equipped with PC desktop computers and a

broadcasting system was used for physical class meetings. An online learning environment developed in the Moodle platform, a course management system, was the virtual classroom to supplement the face-to-face interactions.

2.3 Implementation procedure

The class first met for a course introduction. A multimedia presentation regarding the activity rules and implementation procedures of the new strategy was presented to all the students (Wang & Shiu, 2009). The students were divided into five groups of 3. The innovation was implemented in three main stages. In the first stage, the new strategy required students to acquire skills and knowledge independently with the need to work as a team for collaboration. Self-paced learning was the primary goal at this stage. A broad and general knowledge base was built in advance, both in an e-version and in print, for students to process and select from the vast amount of information available in an organized way. As a group, they needed to come up with and post online at least five questions based on the chapter material they studied for each week's class meeting.

In the second stage, the face-to-face classroom activity created more opportunities for interaction between students. The teacher served more as a facilitator than an instructor. During this stage, problem-solving skills and collaborative learning were the primary themes. Each group in turn stood on the teaching stage and played as the class instructor using the broadcasting system. The group on stage needed to come up with solutions to the questions asked by other groups. Each member in the group was assigned a role and responsibility (see Table 1). Briefly, the "Leading Handler" acts as an expert to demonstrate the techniques of software applications in response to the questions proposed by other groups; the "Right Protector" narrates what the Leading Handler was demonstrating; and the "Left Protector" will provide necessary assistance to the Leading Handler when he/she got stuck during the process of demonstration.

Table 1: Roles and responsibilities of the teaching innovation— Expert Panel

Roles		Responsibilities
Leading handler		Acting as an expert for the demonstration of software applications in response to proposed questions
Right protector		Providing voice-over aside following the demonstration of the Leading Handler
Left protector		Prompter; assisting Leading Handler on stage

The last stage activity was conducted online in the Moodle system, a course management platform. By asking students to review and reflect on their own practices, students examined their learning processes for a better understanding and transformation of knowledge and skills.

2.4 Data collection

Data were collected through a survey of students and interviews with both the instructor and students. The survey questionnaire consisted of two parts. The first part asked for students' demographic information. The second part included 5-point Likert-scale items with "strongly disagree" scored 1 and "strongly agree" 5. The questions asked students about their satisfaction with the learning experiences of using the new strategy in fostering problem solving skills, encouraging active learning, and promoting learning interactions (among the learners, the learning contents

and the instructor). Based on the survey responses, interviews with the instructor and students were then conducted to further collect feedback about the strategy. Comments about the strengths and weaknesses of the strategy and suggestions for further improvements were also encouraged during the interviews.

3. Results

3.1 Student survey

Overall, students felt more satisfied with the new strategy as opposed to the traditional software teaching approach they experienced before (see Figure 1). The average score was 4.6 with a standard deviation (SD) of 0.51. The students revealed that they would like to take the course one more time, if possible, and they would recommend the course to other students (4.5±0.52). However, they did not feel that they would strongly propose the strategy to other software application courses (3.90±0.66).

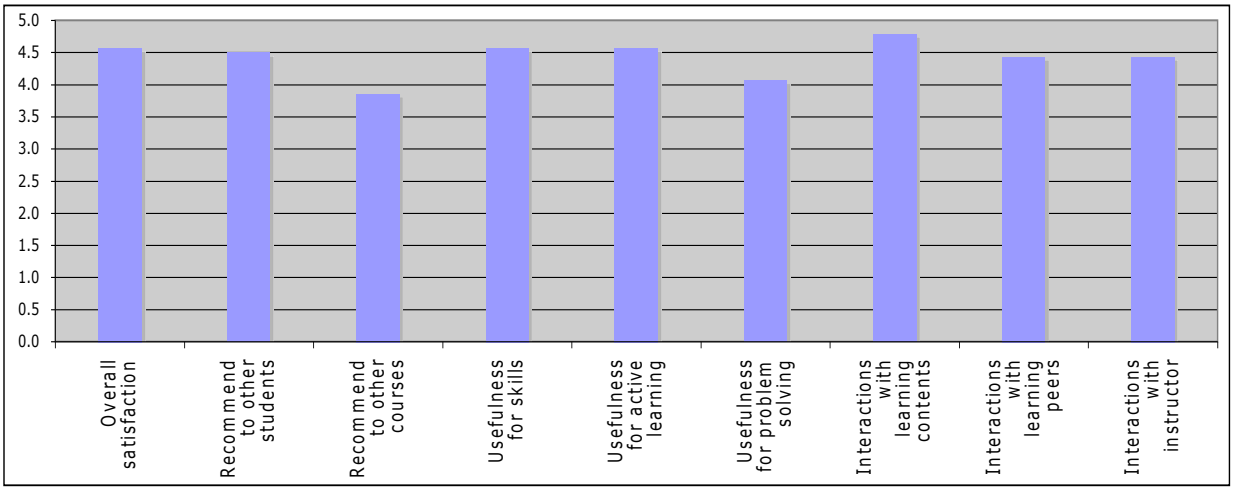

Figure 1: Average scores of students' responses to each survey questions

Most students felt that the new strategy helped them get better familiar with software application and provided more chances to practice and apply the techniques (4.6±0.76). They also felt that the strategy was more helpful for fostering active learning (4.6±0.65), but less for problem solving skills (4.1±0.73). As for learning interactions, they did feel that they benefited from the activities by having more opportunities to interact with their peers (4.4±0.76) and the instructor (4.4±0.51), and that the strategy definitely helped them interact with the learning contents better (4.8±0.43).

3.2 Student interview

Students' interviews were audio-taped, transcribed, and analyzed for common themes and key findings representing that which all interviewees agreed upon and the ideas that represent diverse perspectives. All the interviewed students strongly felt that the innovative teaching strategy helped them better concentrate in class, which resulted in more class participation. They all felt positive about their learning experience with the course.

> *"I like it. This learning approach definitely helps me to concentrate in class because of the "challenges." First, we needed to discuss what kind of questions to ask so that it would be more fun and not make our classmates fall asleep. Second, we couldn't wait to see how others would be challenged by our questions. Third, you might need to squeeze your brain to survive when you're on stage. Therefore, you have no choice but to be an aggressive participant no matter whether you are on stage or not."*

> *"It has always been instructors standing on stage and lecturing, and we just sat and listened. To be honest, it is easy to become absent-minded or even fall asleep, particularly when you encounter some familiar content knowledge, which often results in missing a lot critical and unknown knowledge. The main advantage of this strategy is more focused attention. With this approach it is hard for you to fall asleep."*

Students reported that there was more engagement in learner-content interactions. They spent more time reading textbooks and relevant materials before the class, by themselves, than they had in the past. For the purpose of preparing for questions, they put a lot of effort in studying course material to design interesting and challenging

questions on their own. To avoid the embarrassing moment of "freezing up" on stage, they practiced targeted skills and techniques in advance and searched for relevant resources consistently before each class.

> *"Compared to other courses I took before, I feel much more likely to go through the textbook now. I found I had previewed the materials "several" times for each meeting, which barely happened before, so that I could be released from the worry of getting stuck on stage. When previewing, I usually browse through the content first and then practice on computer after, following the studied information and instructions. For the purpose of challenging other groups, we usually studied and tried to come up with the questions together. It's fun, really fun."*

Due to the fact that the teacher asked them to generate questions related to the materials beforehand, the students stated that it became easier for them to engage in self-directed learning. They became aware that how passively they had been in the past about self-study, and gradually accepted the belief that learning is more effective through thinking, asking and doing. They were intrigued with the fun of coming up with appropriate but challenging questions for other groups. They used words like "brainstorming," "plotting," and "intriguing" to express their feeling in preparing questions. There were a variety of ways to present the questions online such as text description with a dummy, a series of relevant question lists, or some creative project-like questions with demonstrations, etc. (see Figure 2). Perhaps the most interesting by-product of learning by being a questioner was that students often created a demonstration file to visually present exactly what they wanted, in which they learned and practiced the drills after thinking, before asking.

Figure 2: Examples of students' questions posted online

> *"Since I need to raise some questions to challenge others in the class activities, I have to think about the details by browsing through the textbook or searching for some other materials before attending the class, which definitely will strengthen active learning."*

> *"We need to understand very well the problems we intend to propose. I expect that the challenged team members would learn and understand what our questions' intent was. Therefore, all the questions need to be well designed. I wish the challenged team members would go through all the difficulties that I have suffered and I would like to see how they will deal with them. Therefore, all the questions originate from the mistakes and problematic points that I ran into during the process of learning those techniques."*

A collaborative and shared learner-learner interactive environment was created. Students indicated that they shared and supported each other more closely, which resulted in broader learning opportunities. By working as a team, students generated more discussions about various ideas on creating and designing questions. And by looking at other people's techniques in response to the proposed questions, they learned multiple ways of dealing with the same problems. The sharing nature of collaboration and the multiple interpretations and constructions of knowledge and skills were honed through the activity.

> *"Since there is no absolute right or wrong answer for reaching the solutions and the methods of operations might vary from person to person, it is great to have the chance to see how others handle and apply all these techniques. It is quite possible that you will never "see" some "hidden" functions until other demonstrators show them off."*

> *"Through the interactive and sharing nature of collaboration by watching others' demonstrations, you definitely will learn some tricks or know-how without self-awareness. I suggest that you find some classmates with more experiences to take this course with. Therefore, you will gain more from team work.*

Through the collaboration, you will find that three heads are better than one. Having three as a team, even if we cannot expect 1+1+1>3 to happen, we might have at least 1+1+1≥2. With traditional methods, it is quite possible to have 1+1+1= or <1. Anyway, to me, this more collaborative way of learning is excellent."

Students felt that the most effective learning period occurred when they were on stage trying to respond to other groups' questions. They viewed the on-stage tasks as a challenge, which brought great achievement to them. They also acknowledged the fact that this strategy contained embedded problem solving skills, and appreciated the scaffolding mechanism, in which the Right and Left Protectors and the instructor provided "just-in-time" help.

"I would say that the most effective learning period occurred during the time on-stage. You need to confront the unexpected challenges and try to solve the problems right on stage. It is surely a challenge and a great opportunity to train yourself for problem-solving."

"You learn most by answering others' questions and demonstrating them on stage. You might at first use some "unwise" methods of operation. Then, the instructor or classmates would remind you of trying to use hot keys or other methods to better reach the solutions. This is truly a way of learning something."

As an observer off stage and watching the other group's operation, students learned different methods of operation for known skills and effects. They concentrated on the computer screens and watched for how others had achieved their goals. They gave positive comments on "watching." One student mentioned that he felt "truly wonderful" while watching the other group falling into the same traps as he did before and then giving them hints "pulling" them out. They felt that it was more fun than watching the instructor's demonstration.

"When others are responding to the proposed questions, you would learn something new and accumulate your own experiences. Even if you have your own thought, it is worthy to see how others deal with it and make a comparison. It is fun and attractive to see how others suffer from the challenges you set up."

Students also believed that the discussion forum on the Moodle platform brought into play the idea of observing and learning from each other's processes and works.

"After I upload my work, I will go see others. If I find something exciting or surprising, I will "pinch" from them. Next time, I will apply the techniques if possible."

"With the aid of the platform, you can see the work of others' any time you want. Looking at others' work helps me a lot. For example, at one time, after viewing others' works, I was so upset that I felt like redoing my own. The instructor once told us to make the work simple, so I did. But, I soon found that others had applied many advanced techniques to their works and made their works so elegant (see Figure 3)….the disadvantage, of course, is you will "re-do" your work. Especially to me, I am the kind of person who is easy to say "done" as long as it reaches the level of 60 or 70 points. However, when I see a better work of my peer, I will push myself to do more and better."

Figure 3: Examples of students' mid-term works posted online

The interactions between learner and instructor were reported as weaker than in traditional classrooms, in which an instructor was defined as the main knowledge deliverer. The transformed role of the teacher, as a facilitator rather than an instructor, challenged students' cognition of classroom learning. They recognized the class time constrains and agreed that there must be a trade-off as the classroom activities of the new strategy require larger amount of class time. However, a more intense interaction with the instructor was still one of their main concerns.

"Basically, the entire process is pretty smooth except the class time was limited. Because all the participants were busy with brainstorming activities, no one would pay attention to time constraint until the instructor's alert. For every 5 or 6 questions, the demonstrators would run into trouble and got stuck on stage. Usually at that moment, the team member would persist in figuring it out before stepping down. Then

the instructor would remind us that the activity was going into overtime and suggest the team try to solve the problem after the class and post online so that the entire class would not be held back seriously."

"It seems to me the role of instructor has weakened. For now, students become key players and the instructor as supplementary. Maybe she should join us in the group, suggesting some questions, which would help us better capture the essence of tools and the implications in design."

There were some different opinions mentioned by students about the perfect timing for posting questions online. Some thought that the questions should be posted the night before the class to allow for more practice time, saving class time, while some stated that giving questions right in class created a positive tension and more excitement to the classroom.

"It would be better to post your questions the day before so that others may get a chance to prepare. It helps to save some class time"

"It seems to me that posting questions one day earlier has pros and cons. If I saw the questions the day before, I wouldn't enjoy the surprise or excitement when coming to the class. Of course, I may have more time to tackle the questions. However, if I were the tester, I would like to wait until the last minute to "show off" my questions."

"It depends on the difficulty of the question. If the question needs a lengthy discussion, posting your question in class might cost everyone a lot of time. If the question is really simple, posting the question one day earlier becomes superfluous."

Students also raised the issue about the appropriateness of learners' prior knowledge for experiencing this new teaching strategy. They showed some apprehension about going through the learning process with a certain degree of stress. However, having basic prior knowledge and an active learning style, and keeping class size small were suggested for a better outcome.

"Students' personality matters. This course is pretty suitable for those students who like to take challenges. Generally, undergraduates are not proactive enough to take this course. Even graduate students might not benefit from this course if they deeply get accustomed to the traditional listen-and-follow learning method."

"If our new graduate students have a choice between traditional and new teaching strategy for this course, I strongly suggest that they take the class with new teaching strategy. Graduate students need more challenges. I think that it is acceptable for the novice to use the new strategy as well. Running into challenges? Take it! Pressure always exists, now or then, here or there. As a graduate student, learning how to overcome challenge is definitely a requirement."

"For new learners, there might be too much to learn. You need to read the books, go through the operation, and come up with some valuable questions. When you are preparing for the questions, you will see that knowing something is one thing; using what you know to design a question is quite another. To get the most out of the learning experience, you have to learn how to learn."

3.3 Student online reflection

Students wrote their reflections about the course or learning process online after each week's class. Most of them talked about their feelings on stage and expressed their nervousness while working on the solutions. They used words like "going blank," "going blind," and "memory block" in describing their impression of being a problem solver and performer. They also showed their profound appreciation for group members' assistances to make the experience much smoother during on-stage demonstrations. "Having fun," "gaining a lot from the experiences," and "progressing magically" were the most frequently seen expressions.

"It really makes me nervous to act as a demonstrator; the brain became dull and blank. Fortunately, with the aid of peers, I finished with all the questions. I really appreciated all the help and, more important, I learned what weakness to make up for."

"I was the demonstrator this week. Even though I told myself there was nothing to worry about, I still got stuck somewhere during the process. With classmates' guidance, fortunately, I accomplished the mission at the end and found my weakness. It is really fun and helpful."

"Even if I have read through all the materials a few days ago, my memory still failed me. It seems to me that the Protectors play an important role."

"I like the way in which this class proceeds. Thanks to the Right and Left Protector. With quiet listening, careful watching, and more practice, you will make great progress in Flash."

"The interaction between the demonstrator and questioners is filled with fun and laughter…"

Students' reflections uncovered their ability on self-examination about "what they had done," "how they had done it," and "what they should have done" through the learning activities. They were able to become aware of their own shortcomings during the demonstration and searched for additional resources which they felt had been unattained in the class, and then came up with better ways of solving the problems. They were also not tight-fisted with their compliments to others and continually pointed out other group's merits on the performance.

"How excellent the graphic design of this group is! I only pay attention to the embedded techniques, but they even work better on visual presentation of the solutions to the questions"

"I am really surprised by this question from other groups… It is really important to think about 'what kind of effect this tool can provide?'"

"Sorry, we presented a mistaken demonstration in the class today… A better way to do it is…(attached a demonstration file)"

"Afterwards… I read over some other examples and realized the application of this technique is very diverse…"

3.4 Instructor interview

Overall, the instructor is quite satisfied with the implementation and student performance. The new strategy helped to generate classroom interactions and stimulate learning motivations for meeting the learning goals of advancing Flash techniques and animation creation. Probably one of the most observable results of the strategy is the production of their final projects.

"The final project works quite surprised me. It is hard to believe that such good works came from students who had no design background. I think they not only learned the software techniques from the activity, but also the design essentials. The generation of questions and demonstration of solutions inspires their creative thinking."

The instructor also pointed out some concerns regarding the possible contradiction of being a "facilitator" who, on the other hand, needs to meet students' expectation that a teacher should take more responsibility for traditional direct instruction. In some cases, because there was excellent interaction among peers while conducting activities, it resulted in less opportunity for learner-instructor interaction. However, students somehow felt insecure with the class if the knowledge learned was not from the instructor directly. They usually revealed higher satisfaction after teacher-led instruction even if they fell asleep from time to time during the instruction.

"To be honest, the students were performing smoothly and wonderfully by themselves and I just sit back and watch, maybe jumped in for some reminders and corrections. Sometimes I almost forgot that I am the teacher in the class. However, I got a little bit worried sometimes about whether or not I was fulfilling my responsibility as an "instructor." In fact, there was an interesting tendency in the class that the students would stay wide awake throughout peer demonstrations but then fell into vague consciousness in a "very short time" after the teacher, me, started to demonstrate or elaborate."

4. Conclusions and Suggestions

The findings are encouraging in our intent to create a student-centred learning environment in which more classroom interactions and participations were expected. Overall, the results show that the students and instructor were satisfied with the teaching innovation and would like to see the strategy further improved in the future. The course appeared to be successful in engaging students' thinking and learning in class. This study is an initial exploration of the implementation of a new teaching strategy in software application teaching for graduates. The data were very limited in scope and time. Further commitment on continuous implementations and modifications of the innovation coupled with a longitudinal evaluation study is suggested.

The interactions among learners, and between learners and learning content, appeared to be appealing compared to traditional teaching ways, while students marked the lack of learner-instructor interactions as one of the drawbacks of the new strategy. However, it seems to be challenging to embed more learner-instructor interactions in the strategy without sacrificing students' activities in the limited available class time. Whether the suggestion from the students

of having more direct instruction is due to their true need the learning process or the fact that they are more accustomed to the traditional role of teachers, is an intriguing argument and worth further explorations.

Although all the students were committed to the role of a problem solver and felt the on-stage learning periods were most fun and effective, some expressed that there was a lot of pressure due to the challenges of the activity. In the future, in exerting our attempt to change students' learning cognition and behavior, the awareness of an equilibrium between learning pleasure and pressure is necessary for educators as they deal with teaching and learning in the classroom. Of course, further research regarding these issues is expected.

The findings lead us to strongly suggest that continuing efforts on advancing the use of Expert Panel should be sustained. Due to the fact that investigation into the methods and strategies of software application teaching and learning has rarely been conducted, it is the purpose of this paper to strongly advocate continuing efforts in this area. Most importantly, the development of new strategies, other than systematic approach, to enhance students' motivation and interaction is necessary.

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