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# Applying motivational analysis in a Web-based course

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An important facet of effective Web-based instructional design is the consideration of learning activities to stimulate students' learning motivation. In order to create a motivating interaction environment, the design of motivational strategies to foster student interest in learning is essential. The study employed Keller's ARCS Motivational Model (focusing on Attention, Relevance, Confidence, and Satisfaction) in the design and implementation of a Web-based lesson. Co-operative learning activities and a task-oriented approach were used to augment students' learning motivation. During the implementation process, motivational problems were analysed, and instructional adjustment was made. Various data sources were used in order to assess students' learning and motivation. The ARCS Model was used as the main theme in summarising the motivational approach in the Web-based learning activities. Overall, students were positive about the innovative learning approach.

**Keywords:** motivation; ARCS; ergonomics; Web-based instruction; online interaction; higher education; task-oriented learning

## Introduction

Online education and training is one of the important issues currently faced by global multi-national corporations and universities. Systems devised to assist in the conception and design of new learning activities are developed, used and evaluated to suit the required learning objectives (Bailey, Zalfan, Davis, Fill, & Conole, 2006). In spite of the wide variety of Web-based technology developed to support learning activities, some important educational elements, such as teaching styles and motivation issues, have been largely missed in the teaching systems. Therefore, there exist many problems in current Web-based learning systems (Huang, Yen, Lin, & Huang, 2004). As technological developments accelerate, both teachers and students learn new technology and new ways of constructing knowledge from innovative classroom experiences (Eib & Steele, 2004; Russell & Schneiderheinze, 2005).

To support students' self-directed learning in a Web-based learning context, the motivational issues related to students' devotion to the lessons and courses should be analysed. Within the Internet-supported learning, motivational issues to reflect multiple ways of communication among teachers and students become a major component. Since learners have a greater amount of exposure to different forms of communication, online interactions among students and between students with their teacher are crucial in promoting a motivational Web-based learning environment (Westera, 2005).

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The importance of motivation as a positive influence on learning is acknowledged in the literature. It is contended by several studies that motivational factors are those that are prominently anchored in the cognitive engagement and learner-control aspect of the learning process (DeLong, Winter, & Yackel, 2004; Mayer, 2001). To promote learning, educators should identify components of instruction that increase learning motivation, allowing students to be motivated to pursue and use knowledge and skills to practise in their real lives (Song & Keller, 2001; Wongwiwatthananukit & Popovick, 2000). Elements related to motivation design should integrate both internal and external factors to create or change the learning conditions/environment that influence an individual to learn (Astleitner & Wiesner, 2004; Keller, 1983, 1987).

Keller's ARCS Model (1983, 1987) focusing on creating, stimulating and maintaining motivational environments has been researched and adopted in various Web-based learning settings (e.g. Chang & Lehman, 2002; House, 2003; Means, 1997; Huang, Huang, Diefes-Dux, & Imbrie, 2006; Pivnick, 2003; Small, Zakaria, & El-Figuigui, 2004; Song & Keller, 2001; Wongwiwatthananukit & Popovick, 2000). The ARCS Motivation Model consists of four requisite components for motivating learning: (1) Attention – gaining and sustaining attention to the instructional content; (2) Relevance – relating to learning objectives and future use of learning; (3) Confidence – building confidence in learning and accomplishment; and (4) Satisfaction – promoting the potential for learning satisfaction (Keller, 1983, 1987). With the emphasis on co-operative effort in co-construction of knowledge in higher education, motivational analysis in the Web-based learning context becomes essential in assessing the quality of learning (House, 2003). Strategies of supporting students' self-directed learning and issues related to students' devotion in the lessons and learning activities in the Web-based learning context can be examined from a motivational perspective as the basis for improving learning.

Within the Web-based learning context, the use of motivational innovation is not only limited to the design of instruction, but also the ongoing use of communication tools and electronic resources provided along the process of learning and interaction (Small et al., 2004). In this study, Keller's ARCS Motivational Model is used to examine motivational problems within a Web-based learning environment. Specifically, several research questions were identified and explored, including: (1) What were the motivational problems encountered during the Web-based learning process? (2) How was the course adjusted to support students' learning motivation? (3) What task engagement and learning were exhibited by students as a result of students' perceived attention, relevance, confidence, and satisfaction in the Web-based learning context? (4) How did students' learning achievement relate to their involvement?

## Method

### *Targeted Web-based learning setting*

A Web-based learning lesson, 'Computer Ergonomics' was the targeted instructional programme for this study. Within the lesson, notions of health care were integrated with computer use. Participants were students from a library and information science major background. Since new technologies are changing the face of information services, library professionals spend a great deal of time planning the hardware and software implementations of electronic information services. In 'Computer Ergonomics', ergonomic issues were emphasised to make students become acquainted

with various ergonomics problems in the digital environment so that students would be more concerned with ergonomic issues for providing digital services in their future career.

Subjects participating in the whole Web-based learning course were 40 junior students (17 males and 23 females) majoring in Library & Information Science at Fu-Jen Catholic University, Taiwan. Although 42 students were first enrolled in the 'Media Services' elected course, only 40 completed the course (two drop-outs). The lesson was organised into various units, including CTS (Carpal Tunnel Syndrome), RSI (Repetitive Stress Injury), CVS (Computer Vision Syndrome), ERGO (Ergonomics in Library), and ACCESS (Accessibility in Library).[1] The Web-based learning lasted for 12 weeks. Within the online learning, students signed up with three or four persons as a team, collaborating in learning the instructional content, finishing the tasks assigned in the worksheet for each unit, and accomplishing a final research project to fulfil the course requirement. In the electronic forum, students would be able to respond to information posted toward specific individuals or the group. The URL provided in the electronic forum also allowed quick access through the posted links.

### *Motivation innovation in the Web-course*

To encourage students' motivation in learning the Web-based materials, various *attention* and *relevance* strategies were used when designing the instructional content and implementing the Web course. For example, the use of various video clips and graphics for promoting healthy computer operation and task-oriented assignments were embedded to foster students' awareness and this motivated them to explore relevant knowledge and to make the learning connection between the knowledge and themselves. Through the process of knowing by doing, students made sense of their own learning.

To help students gain learning confidence and satisfaction, allowing comprehensive control of the learning process by the learner is needed. Various *confidence* and *satisfaction* strategies were used to help students obtain their meta-cognitive skills in the search and use of Web-based resources, and reflect on what they learn, so that they were able to experience learning enjoyment. Within the instructional implementation, frequent feedback for hints or guidelines and self-review questions were used to help students focus and reflect on the knowledge to be learned and tasks to be accomplished.

### *Data collection*

Along with the learning process, a group task was assigned in each course unit. One of the unit assignment examples is listed in Table 1. At the end of the course, each group needed to write a research paper on the ergonomic issues related to the course content as a term group project. Unit assignments and the term research project were graded and used for assessing students' learning achievement. Data for the study were gathered through various ways: textual information from discussion forums, students' assignment, final project, and final reflections. These data resources were coded and used for data analysis. Examples of codes used for qualitative data are listed in Table 2.

Table 1. Example of unit assignments.

| Task | Example |
|---|---|
| Reading and sharing (group tasks) | Please identify two examples related to Ergonomics resources provided by academic libraries. Summarise the content and important concepts you have obtained from the resources. |
| Ergonomic analysis (individual task) | Take a child at your home as a case example to conduct ergonomic analysis:<br>(1) Analyse the child's body stature, such as height, lengths of elbows, forearms, the upper body, thighs, and legs, and etc.<br>(2) Measure his/her computer working conditions, such as height, width, and depth of the chair, the distance between the floor and the keyboard.<br>(3) Observe how he/she is working with the computers.<br>(4) Evaluate the ergonomic problems for the young computer user.<br>(5) Make ergonomic suggestions for improving his/her working condition. |

## Results

### *Qualitative analysis of students' learning*

In the study, the Web-based learning session lasted for 12 weeks. Since integration of Web-based materials into the curriculum was new to all students, they experienced the feelings of novelty. However, uncertainty about their learning also was revealed from their reactions. Along with the Web-based learning process, students' motivational problems were identified as listed in Table 3. Appropriate instructional adjustment was made to meet students' motivational needs. Details about the motivational adjustment are described below.

Table 2. Examples of codes used for qualitative data.

| Source of data | Code number | Example | Description |
|---|---|---|---|
| Group discussion and feedback | Discussion forum – Group # – Lesson unit # – Message # | Dis-1-CTS-23; Fbk-1-CTS-23 | Message (or feedback) from discussion forum in group 1, topic CTS (Carpal Tunnel Syndrome), message No. 23 |
| Expert forum | Expert discussion forum – Message # | Exp-23-13 | Message No. 23 from discussion forum No. 13 |
| Online announcement | Online announce – Message # | Anno-23 | Message No. 23 from online bulletin board |
| Open-ended online comments (given twice) | Online open-ended responses from Student # (last two digits of ID) | Opn1-Std23 | Online open-ended response No. 1 from student No. 23 |
| Assignments (five) | Assignment in specific topic for Group # | Ass-CTS-Grp2 | Assignment for CTS from group 2 |
| Final project | Final project for Group # | FinP-Grp2 | Final project from group 2 |
| Final reflections | Final reflection for Student # | FinR- Std23 | Final reflection from student No. 23 |

Table 3. Motivational problems and instructional adjustment.

| Motivation problems | Motivational adjustments |
|---|---|
| Attention | |
| Novelty effect was only observed in the first few weeks. 'The content area was not interesting as expected' (Opn1-Std51). | Use of multimedia to regain students' interest. Controversial issues for debate were also arranged (Anno-71). |
| Online class attendance did not concern some groups of students (from online attendance record). | Reminding of online class attendance was frequently posted on bulletin board (Anno-22, 45, 58, 64, 73). |
| Students had attention problems on what needed to be done in specific learning period. 'Unlike face-to-face meeting, I had problems in attending to each learning task' (Opn1-Std51). | Reminding of learning tasks was posted at the beginning of each learning unit. Verbal rewards were used frequently to those quick respondents (Anno-20, 39, 63). |
| Students attributed their attention problems to the form of asynchronous interaction. 'Knowing that we have plenty of time to learn in a Web-based class, we paid less attention to the specific learning time' (Opn1-Std84). | Students were encouraged to be self-directed and to learn actively. 'You should monitor your own learning' (Anno-52). Synchronous discussion was also used in the 4th, 8th and 11th weeks. |
| Relevance | |
| Students felt some of the content was new and many terms were unfamiliar to them. 'A lot of unfamiliar materials were involved in the lesson' (Dis-3-CTS-17). | Encouraging students to understand the content by reorganising what they read so that they could get acquainted with the materials they read. |
| Inappropriate experiences, such as weak theoretical-grounded folk prescriptions were related to the class due to uncertainty about the content (Exp-2-6). | Clarification about learning tasks and activities was provided. Appropriate resources for medical treatment concepts were emphasised. |
| Use of discussion forum was found irrelevant to learning content (a few irrelevant chats in every group). | Feedback about keeping students on the right track was given as a reminder. |
| Web-based interaction was not a preferred way of interaction by some students. 'I am not accustomed to chat for course-related content' (Dis-8-CTS-48). | Related students' experiences with other online chat activities (e.g. MSN chat). |
| Confidence | |
| Students were uncertain about how they would be evaluated in the Web-based learning. 'Knowledge we explored was so extensive that I had problems preparing for the exam' (Opn2-Std 60). | Assessment was adjusted to cope with students' effort and involvement. Research project was used instead of final exam for performance assessment (Exp-13-32, 79). |
| Misunderstandings from students' own self-exploration results were observed, especially when learning from the foreign websites (Dis-4-ERGO-7; Dis-7-CVS-07). | Specific guidance toward individual students was provided (Dis-4-ERGO-08, 18; Dis-7-CVS-08, 09). |
| Students express their uncertainty about the use of Web-based resources for assignments and research projects. Copying and pasting Web-based information was observed (Ass-CTS-Grp4, 5, 6, 7, 8, 9, 10; Ass-RSI-Grp5, 6, 8). | Feedbacks toward students' uses of references were provided. 'Copying and pasting is not allowed in preparing your assignment' (Fbk-1-CTS-44). 'Reorganise the content and interpret what you learned' (Fbk-2-RSI-84). |

Table 3. (*Continued*).

| Motivation problems | Motivational adjustments |
|---|---|
| Satisfaction | |
| Students complained of too much learning effort for preparing the course. 'Too much work!' (Opn2-Std 03, 62, 76); 'Lack of time!'(Opn2-Std 77). | Encouragement of students' learning was provided frequently. 'Learning requires investment of time' (Fbk-8-CVS-56); 'You have explored a very valuable area' (Fbk-4-ERGO-78). |
| Some students preferred having face-to-face opportunity. 'Not seeing class members made me feel insecure about the course' (Opn2-Std 10). | Face-to-face meetings were arranged. |
| Two students dropped out due to failure to participate in class activities and failure to submit assignments regularly. | Frequent reminding and additional attention was paid to less involved students. |

*Attention*

To cope with attention problems, new video clips for emphasising ways to enhance the usability of facilities and workplaces were added to the content of the learning website during specific course sessions. Activities such as debate of controversial issues in planning ergonomic and accessible facilities were arranged. With these adjustments, students were able to attend to the features of the Web-based learning mode.

> The instructor's involvement and concerns about the class attendance and use of various activities were all important to sustain our attention. (FinR-Std37)
>
> Different modes of learning made learning more interesting. (Opn1-Std19)
>
> Realistic experiences caught my learning attention. (FinR-Std10)
>
> Discussion and work on assignment allowed me to attend to the important issues. (FinR-Std81)

Although the syllabus was provided on the website, most students required frequent reminding of their weekly tasks. Faced with students who were less self-motivated, frequent reminding and reporting of every student's learning progress from the course became an essential routine to keep students' attention on the course activities in the first few weeks.

> Most of us were passive learners. The instructor's frequent reminding helped keep our attention on the important issues to be learned. (Opn1-Std33)
>
> From online discussion, I also learned to attend to what I learned, and what others learned. (Opn2-Std25)
>
> The use of an assignment in each lesson unit helped me actively attend to the important concepts. (Opn2-Std69)

*Relevance*

To cope with relevance problems in inappropriate use of experiences and concepts, immediate feedback was used for clarifying students' misconceptions. Learning tasks and activities were explained in each course unit to keep students' discussion relevant to learning objectives. Appropriate resources for medical treatment were also re-emphasised (Exp-2-6). For those who were not accustomed to chat for course-related content, experiences such as MSN Chat relevant to students' daily life were referred to (Fbk-8-CTS-48). Most students revealed positive feelings toward Web-based learning as an innovative learning experience that they had never had before.

> I appreciated its flexibility in learning time. The content was relevant to our daily life and very useful for people like us, heavy computer users. (FinR-Std95)

> My interest in the course was to learn something I felt important. (FinR-Std39)

From the process of interacting with the instructional materials, students gradually developed personal and professional relevance (library services) to the learning content.

> After reading the cases, I noticed that I had the same problems when working with the computer for a long period of time. For my own eyes' health, I should attend to the CVS problems. (Dis-3-CVS-122)

> We must evaluate the idea of accessible library in a more practical way. Most libraries prohibit animals, how could they possibly serve people with visual impairment? (Dis-5-ACCESS-101)

*Confidence*

Students' major confidence problems came from their feelings of uncertainty concerning the use of a Web-based learning approach in fulfilling traditional class requirements. The more they have access to a wide variety of resources and information, the more they felt uncertain about what to prepare for the exams. Frequent guidance and encouragement was given to increase students' confidence and to meet individual students' needs. Appropriate use of references in their assignments and research project was also given. Confirming their performance assessment was consistent with their effort in learning tasks, students felt more meaningful and more confident about their own learning.

> I personally agreed with using projects and assignments to replace exams. Focusing on what I am interested in, I felt I could control my own learning. (Exp-25-3)

> Spending time in searching, evaluating, and organising the information, we become familiar with the materials, and confident about what I had actually learned. (Exp-29-4)

Higher-order thinking and reflection skills revealed students' understanding of the cases, use of gathered information, and application of knowledge in a realistic situation.

> To design for accessibility, we must be realistic about the safety management. The importance of accessibility is not just an issue of 'yes or no', but more an issue of whether making it meets the need of the target users. (Dis-3-ACCESS-23)

From students' self-exploratory learning reflection, more frequent feedback was given and taken between the instructor and students. Since students constantly experienced direct interaction with Web-based learning materials and resources they found, they anticipated more immediate reactions from the instructors to confirm their learning.

> We got frequent feedback from the instructor. Through the frequent online feedback, I felt I was supported in my personal needs. The discussion process was helpful in clarifying misconceptions and sharing valuable information. (FinR-Std22)

> I felt more confident that I had learned something. (FinR-Std37)

> The interaction among our group was also a good way to make us feel more confident about our own learning. (FinR-Std54)

> Through interaction, the variation among individuals' interpretations reached an agreement. (FinR-Std16)

> When preparing the assignment, exchanging ideas with others made me feel more confident. (FinR-Std69)

*Satisfaction*

Students' satisfaction came from their feelings of acquiring important knowledge from the course. All of the groups presented and organised their report in a research paper format. Two of the group took more proactive actions in providing suggestions for supporting an ergonomic environment (FinP-Grp1, 8). Students' final scores also indicated that all students achieved their instructional purpose (with the exception of the two students who dropped out).

Along with the process of learning, responses to students' progress were made regularly. Additional attention was given (through both online and face-to-face contacts) to students lack of involvement. Verbal reward was also given for affirming students' effort. From the discussion forum, students observed their own progress in their own exploration and idea exchange.

> The instructional materials are useful and practical to our life and our future work. (FinR-Std10)

> The process of interaction made learning an enjoyment. We learned from each other through actively responding to what we found. (FinR-Std95)

> We also learned how to negotiate and work in a group. (FinR-Std81)

Although some students complained about the time and effort spent on preparing the assignments and the research project, most students appreciated the value of the interaction process with the instructor and peers.

> Too much work. (Opn2-Std03, 62, 76)

> Preparing a research paper was a challenging task for us. Most of us had no experience in conducting research. However, accomplishing the task made us feel like we had really achieved something great. (FinR-Std22)

> The more we learned, the more we found it of great worth. (Opn2-Std62)

Table 4. Number of postings in each discussion forums.

| Group | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Expert | Chat | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. of posts | 237 | 397 | 282 | 146 | 108 | 201 | 108 | 351 | 258 | 172 | 67 | 18 | 2345 |

> Great achievement came from learning what we needed. (FinR-Std69)
>
> It was an innovative way of learning. I enjoyed learning the useful content. (Opn2-Std19)
>
> Unlike what we had experienced before, we had to have a thorough understanding of the materials we gathered, and put them together in a more organised way. The online activity we participated in helped us to nurture the intended knowledge and skills. We are satisfied with what we learned and accomplished. (FinR-Std96)

### *Quantitative analysis of students' learning*

From the online disclosures, a total of 2345 messages were posted on the discussion column within the 12 weeks of the Web-based learning session. On average, each student posted 58.63 messages, ranging from eight to 259 (data from the 40 students who finished the course). Fourteen students posted more than 100 messages throughout the Web-based course.

Students' discussion activity in the asynchronous interaction somewhat related to the task assigned in each lesson unit. A similar pattern was observed within each two-week course unit (Figure 1). In each new learning unit, few students initiated the discussion. As more and more postings joined along, a discussion cycle reached a peak, at which group members were actively sharing and negotiating ideas. Fewer postings were obtained during the last few days of each discussion cycle when groups reached an agreement about their unit assignment (Figure 1).

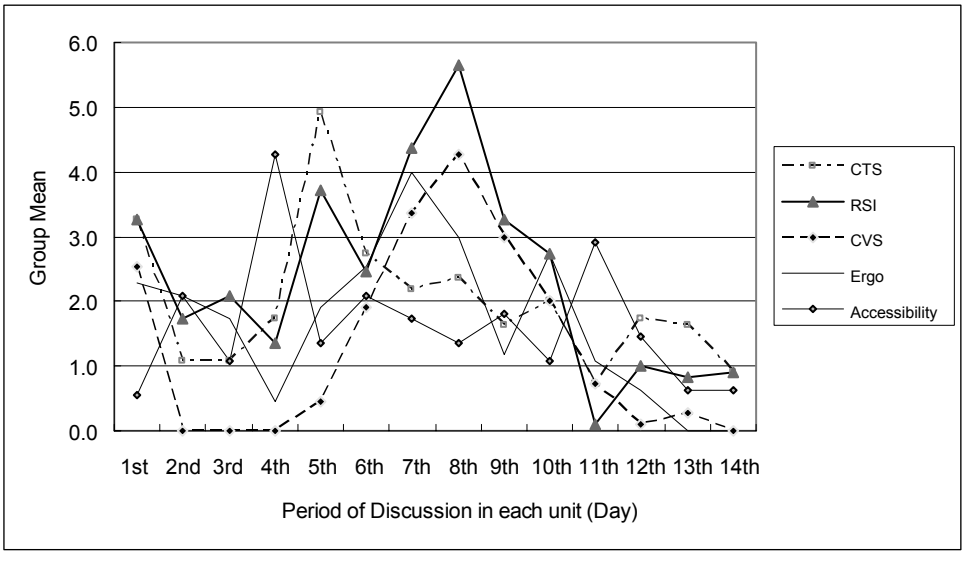


Figure 1. Average group posts for each lesson unit. Each discussion cycle reached a peak on a specific day when group members were enthusiastically sharing and negotiating ideas.

Table 5. Assessment of students' performance.

| Task | Mean score | SD |
|---|---|---|
| CTS assignment | 80.895 | 15.886 |
| RSI assignment | 81.158 | 15.414 |
| CVS assignment | 78.513 | 9.889 |
| ERGO assignment | 79.308 | 16.002 |
| ACCESS assignment | 73.667 | 19.811 |
| Mid-term exam | 64.103 | 13.898 |
| Final project | 85.898 | 4.689 |
| Final score | 75.231 | 7.503 |

Students' performance was evaluated by their assignments, mid-term, and final project (Table 5). Their final scores were obtained from various assignments, including CTS (10%), RSI (10%), CVS (10%), ERGO (10%), ACCESS (10%), mid-term exam (20%) and final project (30%). The mean score for each assignment, mid-term, and final project is listed in Table 5. A Spearman correlation analysis conducted between students' final scores and the number of their postings indicated a marked degree of correlation ($r = 0.608$, $p < 0.001$) (Table 6). Most students were positive about the course.

## Discussion

The positive correlation between students' final scores and the number of their postings revealed that students who were more involved in the Web-based discussion were more likely to perform better in the course. The interchange of ideas from students' online discourse might result in cognitive engagement and better learning achievement among students. Consistent with the notions that several motivational approaches have been addressed in the literature (DeLong et al., 2004; Mayer, 2001), the study concludes that students' learning achievements relate to their level of involvement. In the study, Keller's Motivational Model was used as a framework for analysing motivational problems focusing on 'Attention', 'Relevance', 'Confidence', and 'Satisfaction'. To cope with motivational problems among students, instructional adjustment was made, and strategies corresponding to the ARCS Motivational approach (Keller, 1983, 1987; Small et al., 2004) were used. Observed from this study, motivational indications based on ARCS are summarised in Table 7.

The Web-based interactive learning approach offered students a new learning experience that most of them had not experienced before. Although at the beginning of the course, students were not confident about their learning, all (with the exception of two who dropped out) students achieved their learning tasks and fulfilled the course requirements by the end of the course. In spite of the notion that teachers' use

Table 6. Correlation between performance and number of postings.

| Pearson correlation | Number of postings |
|---|---|
| Final score | $r = 0.608$; $p = 0.000$*** |

***$p < 0.001$.

Table 7. Motivational indications summarised based on ARCS Models.

| Attention | Relevance |
|---|---|
| • Different modes of learning<br>• Real-life experiences<br>• Peer reminding<br>• Feelings of instructor's involvement<br>• Discussion and work on assignment<br>• Reminding from the instructor | • Appropriate resources<br>• Accustomed communication mode<br>• Flexible learning time<br>• Personal importance<br>• Accustomed experiences<br>• Feelings of usefulness |
| Confidence | Satisfaction |
| • Reflection from learning materials<br>• Assessment of learning through organisation<br>• Interest and involvement in given tasks<br>• Getting familiar with learning resources<br>• Interactions with peers for sharing thoughts<br>• Exchange of ideas | • Learning materials useful and practical to life and future work<br>• Achievement of learning objectives<br>• Achievement of challenging tasks<br>• Verbal reward for affirming effort<br>• Enjoyment of interactive messages from others<br>• Feelings of learning-needed knowledge |

of motivational strategies should be tied to internal motivators (McCombs & Miller, 2006), this study found external motivators such as frequent reminding and incentives were still needed to keep students working hard during the course. Both internal and external motivation might facilitate positive learning outcomes and lead to rewarding experiences internally. It is pivotal to understand the role of rewards in sustaining productive task engagement (Williams & Stockdale, 2004).

In the Web-based Computer Ergonomics course, students were positive about the motivational instructional design and the electronic interaction–tools to encourage their learning motivation. From their self-exploratory online interactive approach, students learned required knowledge. Visualising their own learning progress on the Web impacted feelings of achievement among students. As addressed in the literature, students obtain feelings of self-efficacy and motivation from their task performance (referred to as enactive mastery), vicarious experiences, verbal persuasion, and their physiological reactions or states (Alderman, 2004; Margolis & McCabe, 2006). Consistent with this notion of motivation, several phenomena were observed in the current study. Students recognised their own success from accomplishing the tasks and were offered an opportunity to observe peer groups modelling a task on the Web. Students also obtained online feedback from their instructor about the information they interpreted and evaluated, which, in turn, affected their self-efficacy. The Web-based learning offered students experiences that they had never had before. They reacted positively toward the self-pacing and appropriately challenging experiences.

## Conclusion

The results of this study have yielded rich, descriptive data that offers a glimpse into a relatively unexplored area of research – the motivational aspects of a Web-based ergonomic learning case. From the motivational design approach, a Web-based learning course was developed and implemented. The ARCS Motivational Model was used as a set of criteria to analyse students' motivational problems in a Web-based learning setting. Unlike a face-to-face learning setting, Web-based instruction has its limitations in promoting learning motivation. Even with a well-designed lesson, ongoing

analyses of motivational problems at the implementation stage are always needed. In the study, several adjustments were made during implementation. The results of the study provide a case for promoting a motivational implementation of Web-based learning. Future research on the motivational aspects of Web-based learning might include the following: a large-scale replication of this study among other Web-based learning settings; follow-up exploration of certain findings, such as self-efficacy among learners; and effectiveness of the motivational strategies in helping students develop intrinsic motivation.

In conclusion, the study identified motivational problems with a Web-based learning setting. For students, appropriate challenges and opportunities to support their learning motivation are important. The results of this study provide implications for planning and designing motivational learning environments. However, for increasing students' involvement and confidence in a Web-based learning setting, on-going analysis of students' motivation is even more essential to guarantee motivational learning outcomes.

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## Note

1. See http://blue.lins.fju.edu.tw/~lin/mediser/nsc/index.htm

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