



Development of a Moodle course for schoolchildren's table tennis learning based on Competence Motivation Theory: Its effectiveness in comparison to traditional training method

Junhua Zou^{a,b,*}, Qingtang Liu^a, Zongkai Yang^a

^a National Engineering Research Center for E-Learning, Huazhong Normal University, 152 Luoyu Road, Wuhan 430079, China

^b Educational Faculty, Hubei University, 368 Youyi Road, Wuhan 430062, China

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ABSTRACT

Based on Competence Motivation Theory (CMT), a Moodle course for schoolchildren's table tennis learning was developed (The URL is <http://www.bssepp.com>, and this course allows guest access). The effects of the course on students' knowledge, perceived competence and interest were evaluated through quantitative methods. The sample of the study consisted of 32 primary school students, who were randomly assigned to two groups, one of which used the Moodle course (Group M, $N = 16$) and the other one (Group C, $N = 16$) didn't, and the intervention lasted 6 weeks. The result showed that (1) students made significant learning gains and demonstrated statistically significant higher perceived competence by participating in the Moodle course, (2) there was no statistically significant mean difference in table tennis interest between the two intervention groups. These positive effects on knowledge and perceived competence suggest that Moodle can be used as a tool to supplement traditional motor learning.

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1. Introduction

Learning Management Systems (LMS) are having a significant impact on teaching and learning. LMS are web-based systems that allow instructors and/or students to share materials, submit and return assignments, and communicate online. Such e-learning systems are sometimes also called Content Management Systems (CMS), Virtual Learning environment (VLE), or Learning Support Systems (LSS). The purpose of this study is to explore the effects of Moodle (an open source LMS) on schoolchildren's table tennis learning.

Much research has focused on the adoption and continuance of use of LMS by students or instructors. Swan (2001) showed that three general factors—clarity of design, interaction with instructors, and active discussion among course participants—significantly influenced students' satisfaction. West, Waddoups, and Graham (2007) discussed several patterns explaining how instructors implemented Blackboard, a commercial CMS, by experimenting with individual features, facing both technical and integration challenges, and attempting to adapt Blackboard features to match their goals and practices. They gave explanations for why instructors either (1) embraced the tool and grew more dependent on it, (2) reduced their use of the tool to only some features, or (3) discontinued the tool and sought replacement options. Selim (2007) identified eight critical factors for acceptance of e-learning: instructor's attitude toward and control of the technology, instructor's teaching style, student motivation and technical competency, student–student interaction, course content and structure, ease of Internet access, infrastructure reliability, and university support.

A number of authors have focused on how instructors and students value various features and functions of the technology. Hanson and Robson (2004) found that both instructors and students responded more favorably to benefits of LMS that save time over those that improve learning. Parker, Bianchi, and Cheah (2008) reported that users indicated a preference for LMS tools that help manage materials and information for courses. Lonn and Teasley (2009) explored the uses and perceived benefits of using an LMS to support traditional classroom teaching as reported by instructors and students at a large American Midwestern university. The LMS examined in their study was based on

* Corresponding author. National Engineering Research Center for E-Learning, Huazhong Normal University, 152 Luoyu Road, Wuhan 430079, China. Tel.: +86 027 67868519; fax: +86 027 67867024.

E-mail address: Zoujunhua_000@sina.com (J. Zou).

Sakai which is an open source Java application (Sakai, [homesite](#)). They found that instructors and students valued tools and activities for efficient communication more than interactive tools for innovating existing practices.

Another major focus of LMS research has been the outcomes of the use of LMS. For example, Zhang, Zhao, Zhou, and Nunamaker (2004) reported improved academic outcomes for e-learning students. Chou and Liu (2005) pointed out that students in the VLE environment showed improved learning performance and satisfaction. McGill and Klobas (2009) reported that task-technology fit (the ability of the LMS to support students in the range of learning activities they engage in) had a strong influence on perceived impact of the LMS on learning.

LMS are relatively new and potentially very important ways of supporting teaching and learning. Given the limited research in relation to their adoption, use and impact, further research is needed to support their application to specific learning environments (e.g., organized sports).

1.1. Moodle

Moodle is a popular LMS. It is a free web application that educators can use to create effective online learning sites (Moodle, [homesite](#)). Moodle uses a modular design and user roles to give creators choices about what types of features they want on their individual course sites. Several authors have introduced how to use basic Moodle modules, including Assignments, Forums, Quizzes, Surveys, Chat rooms, and Workshops to develop a course (Cole & Foster, 2008; Rice, 2008; Rice & Nash, 2010).

Moreover, Moodle can easily be extended by using third party add-on plugins or some software technologies (such as Java applets). Many researchers have explored creative ways to build powerful and effective online courses. Stanford (2009) applied the NanoGong recorder plugin for second language teaching, which can be used by students to record, playback and save their voice in a web page. Martinblas and Serranofernandez (2009) used java applets in their Physics course, and they found that the online course helped students to reinforce their abilities and knowledge. Wild (2009) showed how to set up a Moodle course to support the teaching of Mathematics. He explored modules and plugins that enable frequently used mathematical activities. For instance, he used three plugins (Tex, jsMath, and ASCIIMathML) to generate complex mathematical notation.

In sport and physical activity settings, Harter's Competence Motivation Theory (CMT) has gained widespread acceptance. Based on CMT, powerful and effective Moodle courses for sports (such as table tennis) can be created.

1.2. Competence Motivation Theory

CMT is a theory of achievement motivation based on a person's feelings of personal competence (Harter, 1978, 1981). CMT posits that people will tend to engage in certain behaviors if they believe they are capable of executing those behaviors successfully. The model of competence motivation predicts that participants will gain intrinsic pleasure from experiencing themselves as competent when they try to master a task or activity (mastery attempts). If mastery attempts are successful and significant adults and peers respond with approval and reinforcement, they will experience increased perceptions of competence and control, positive affect, and motivation to continue demonstrating competence. The focus of this theory is the concept of perceived competence, which is an individual's self-assessment of his or her ability to accomplish the skills necessary to meet environmental demands. CMT specifies mastery attempts and includes constructs that are salient to the physical domain, thus, many studies have found support for this theory.

A number of researchers have focus on the sources of competence information and the influence of significant others (such as parents, coaches and peers) on perceived competence. (1) Horn and her colleagues identified 10 possible sources of competence information: (a) feedback; (b) self-comparison; (c) degree of skill improvement over time; (d) speed or ease of learning new skills; (e) amount of effort exerted; (f) enjoyment of or attraction to the sport; (g) performance statistics; (h) game outcome (win, lose); (i) achievement of self-set goals; and (j) game-related feelings (Horn & Amorose, 1998; Horn, Glenn, & Wentzell, 1993). (2) According to CMT, many authors have reported the role of significant others in affecting children's perceived competence. First, parents are especially important as transmitters of information about child's perceived competence through mechanisms of modeling, feedback, and reinforcement of performance (Babkes & Weiss, 1999; Harter, 1990; Rose, Larkin, & Berger, 1994). Second, quality and type of the coach's feedback are important influences on children's perceptions of ability (Allen & Howe, 1998; Amorose & Smith, 2003; Smoll & Smith, 2002). Finally, one's peers (such as teammate, classmates and close friends) are another powerful socializing agents. Social comparison to and evaluation by peers are important sources of information by which children judge how competent they are (Ullrich-French & Smith, 2006; Weiss & Stuntz, 2004; Weiss, Smith, & Theeboom, 1996).

Another major focus of research on CMT has been the effects of perceived competence on motivational and behavioral outcomes. (1) Several researchers have reported that participation motivation is strongly related to perceived competence (Klint & Weiss, 1987; Robert, Kleiber, & Duda, 1981). Weiss, Amorose, and Wilko (2009), Weiss, Bredemeier, and Shewchuk (1986) and Weiss and Horn (1990) concluded that children with higher in perceived competence demonstrated a more intrinsic motivation. (2) Many studies have uncovered the relationships between perceived competence and behaviors. Weiss et al. (1986) reported that perceived competence was strongly related its corresponding sport performance. Ulrich (1987) revealed that children's higher in perceived competence demonstrated superior motor performance (e.g., ball dribble, softball throw, broad jump). Weiss and Horn (1990) concluded that boys and girls who underestimate their perceived competence tend to be more likely to drop out of sports.

In youth sports, winning isn't everything, and the most important thing is participation by everyone. Most schoolchildren have little opportunities to participate in matches and tournaments at a competitive level. They participate in sports just to be physically active and keep healthy. According to CMT, children with higher levels of perceived competence are more likely to adopt a functional pattern of cognitions and affect, reflected by perceptions of personal control, higher global self-esteem, intrinsic motivational orientation, and higher positive affect and lower negative affect (Harter, 1978; Robert et al., 1981). Such cognitions and affect translate to achievement behaviors such as effort, persistence, continued involvement, and level, frequency, and duration of physical activity (Horn, 2008). Therefore, CMT is crucial for today's youth coaches and physical educators. Besides regular training, they can also increase children's participation through other methods (such as LMS).

1.3. Table tennis learning

Table tennis is the national pastime of China, and the biggest amateur recreational sport in China. The reasons for this popularity are (Wasserman, 1989): (1) The game is easily understood, (2) The equipment is inexpensive, (3) Young children and adults of both sexes can play together. (4) Playing regularly improves one's fitness. (5) Above all, like all other games, playing table tennis is a lot of fun.

More and more children can learn to play table tennis in China. In Wuhan, Hubei province, for instance, there are good facilities for playing table tennis. First, Sport School of Hubei and Sport School of Wuhan can provide professional training for table tennis players. Second, there are eight table tennis clubs which have excellent playing conditions. Finally, there are many table tennis halls in primary and middle schools.

Table tennis is a difficult motor skill. In table tennis, there are not only four basic strokes which form the basis of every shot – the forehand drive, the backhand drive, the forehand push and the backhand push (Kumar, 1999), but also many advanced skills: the block, the loop, the backspin chop, the lob, the smash, advanced serves and advanced return of serves. When children play table tennis, they have to coordinate the movements of the waist and hips with those of the knees and feet, and they often make many mistakes. The common errors are “the shots feel strained or erratic.” “the strokes have no power.” or “the children are off balance during the shot.” Moreover, the development of children's positive attitudes to table tennis is not easy.

1.4. Moodle, CMT and table tennis learning

Moodle is increasingly important and pervasive, however, its application have been more focused on education in universities and high schools, and on adult training in government and business organizations. Little attention has been paid to organized sports, such as baseball, basketball, tennis, or soccer. There is not a Moodle course for schoolchildren's table tennis learning, and no studies have been published on the effects of such a course on schoolchildren's knowledge, perceived competence and interest.

Imagine the things that table tennis coaches do in a gymnasium: explaining the rules, setting goals, demonstrating, detecting errors, and providing feedbacks. Moodle can do all these things online. Common features used in Moodle, such as Chat, Choice, Database, Glossary, Lesson, Wiki, Workshop and Quiz, aren't enough, but, as we will show later, we can use the latest technologies to create a Moodle course for schoolchildren's table tennis learning.

It is important to develop such a Moodle course based on CMT. First, the Moodle course can increase schoolchildren's knowledge of table tennis through text, image or video. It can enhance their understanding of table tennis. Second, the Moodle course can enhance children's perceived competence by technique animations, video feedbacks and standard Moodle modules (such as Forum and Wiki). Finally, schoolchildren who perceive themselves as competent can maintain greater interest in a particular skill domain (Robert et al., 1981). If the online course enhance schoolchildren's perceived competence, then it can increase their interest.

This study is unique in that it investigates the use of the Moodle course in an organized sports setting. It can provide insight into whether Moodle has positive effects on students' knowledge, perceived competence and interest for motor learning.

2. Method

2.1. Research design and participants

In this study, a randomized control-group pretest-posttest design was used. The independent variable of the study was the treatment (Moodle course); the dependent variables were knowledge, perceived competence and interest. Students were not allowed to change training program during the intervention. In this way, their training style (group session or private session), train frequency (sessions per week), coach, and duration of the training remained the same. The extraneous variables were controlled. Any differences in knowledge, perceived competence and interest were attributed to the Moodle course factor.

The research was conducted in a randomly selected table tennis training center located in Wuhan, China. The sample was 32 students, aged 7–12 years old. All of the students weren't professional players, and they get table tennis training at weekends. They possessed basic computer skills (e.g. Web browsing skills), which form part of this Moodle course. The participants were randomly assigned to two groups, one of which used the Moodle course (Group M) and the other didn't (Group C).

2.2. Materials

There are some challenges to create a Moodle course for schoolchildren's table tennis learning. Common features used in Moodle aren't enough. To provide high quality demonstrations and video feedbacks, the creators of the Moodle course not only need to have great knowledge about table tennis and Moodle, but also should master Adobe Flash Professional CS5, several related video and image processing tools, and the latest media player module for Moodle: moodle-mplayer (Moodle-mplayer, homesite). We have created such a Moodle course. The URL of the Moodle course is <http://www.bssepp.com>, and this course allows guest access.

2.2.1. Technique animations of world champion players

Although many researchers have found that instructors can facilitate skill acquisition for beginners by having them observe other beginners, a common guiding principle for demonstrating a skill is that the demonstrator should perform the skill correctly (Magill, 2004). Demonstration is most effective when the skill is a new one, and the more frequently a beginner observes a skilled demonstration, the more opportunity the beginner will acquire the movement pattern (Carroll & Bandur, 1990; Hand & Sidaway, 1993).

All actions in table tennis happen so quickly that children might have difficulties in observing what was occurring. In the Moodle course, we create two kinds of technique animations to provide children with opportunity to can manipulate the image by slowing down and advancing it frame-by-frame. (1) Slow motion animation (Fig. 1). This kind of animation is for beginning players. The slow motion animations allow children to see clearly that there are three general parts to each skill: preparation (getting into a starting position),



Fig. 1. Slow motion animation.

execution (performing the skill), and follow-through (recovering to starting position) (Hodges, 1993). (2) Frame-by-frame animation (Fig. 2). This kind of animation is for intermediate and advanced players. With a solid foundation of basic skills and concepts, table tennis players must learn how to connect groups of isolated skills. One of the best ways is to watch the professionals play table tennis in detail. The frame-by-frame animations allow children to step frame-by-frame (forward or backward) in Moodle course. The users of the Moodle course can use space bar, the left arrow key and the right arrow key as well as three buttons to play, step forward or step backward.

Before writing scripts, we have to do these things. (1) Download free table tennis videos of world-class players (e.g., Guott, homesite). (2) Convert video files into AVI format through Format Factory (Format Factory, homesite). (3) Split video files by using Solveig Multimedia Video Splitter (Solveig, homesite). This tool has the “Save All Segments” feature which easily saves all the fragments on timeline to separate files. (4) Convert AVI to GIF by Ulead GIF Animator (Ulead, homesite). To achieve the highest image quality, we set “Number of Color” to 256, and “Dither” to 100.

We use Adobe Flash Professional CS5 create slow motion animation and frame-by-frame animation (Flash Professional CS5, 2011). To get a slow motion effect, for example, we change the frame rate in Flash ActionScript 3, as shown in Fig. 3.

After the creation of animations, we embed the Flash content into Moodle. Embedding Flash content into Moodle requires knowledge of html and linking files to Moodle pages (Flash in Moodle, 2011). We use the embed tag, and the key is to specify the src (stands for the source of the content) parameter.

Technique animations of the Moodle course are designed to enhance students' perceived competence, interest and knowledge. (1) According to CMT, ease of learning new skills is a source of perceived competence (Horn & Hasbrook, 1986, 1987; Horn & Weiss, 1991). The users of the Moodle course can watch the best players in the world execute various strokes in great detail. Specifically, they can manipulate the animations by slowing it down or advancing it frame-by-frame. Thus, this block of the Moodle course can reduce children's difficulties in learning new table tennis skills, and facilitate their perceived competence. (2) As mentioned earlier, schoolchildren who perceive themselves as competent can maintain greater interest. Therefore, if technique animations can enhance children's perceived competence, they can enhance their interest. (3) Technique animations can help students understand the mechanical structure of all strokes. At the same time, the feature can help student know some table tennis rules, such as, “The server must throw the ball almost vertically up” and “The ball must be struck while it is dropping”. Thus, this feature can increase students' knowledge.

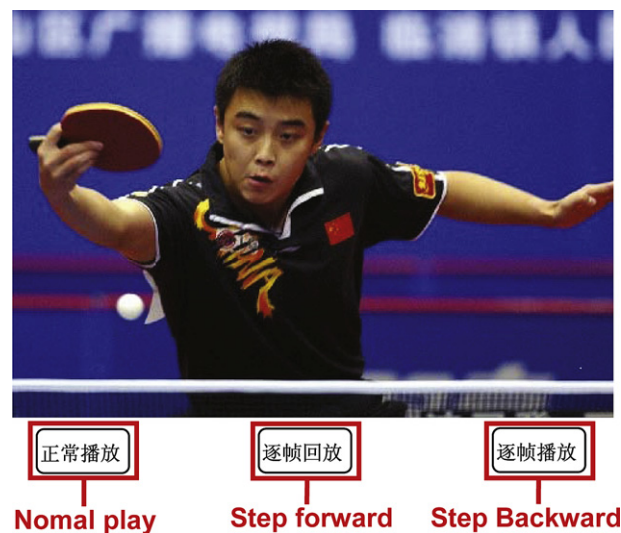


Fig. 2. Frame-by-frame animation.


```

this.stage.frameRate = 4;
function bs(event:MouseEvent):void
{
    this.gotoAndPlay(2,"场景 1");
}
backswing.addEventListener(MouseEvent.CLICK, bs);
function fs(event:MouseEvent):void
{
    this.gotoAndPlay(20,"场景 1");
}
forwardswing.addEventListener(MouseEvent.CLICK, fs);
function rc(event:MouseEvent):void
{
    this.gotoAndPlay(48,"场景 1");
}
recovery.addEventListener(MouseEvent.CLICK, rc);

```

Scene 1

Fig. 3. Scripts for slow motion.

2.2.2. Basic knowledge of table tennis

This Moodle course is for 7–12 years old children. Some of them are beginning to recognize Chinese characters. Thus, we use FLV videos to provide students with basic information of table tennis, including a brief history of the sport, equipment, racket grip, positions, rules (school edition) and spin. Obviously, this block of the Moodle course is also designed to facilitate students' knowledge of table tennis.


2.2.3. Video feedbacks

During the learning process of a motor skill, feedback is the positive or negative response that tells the learner how well the task was completed. There are two types of feedback: intrinsic and extrinsic. Inherent feedback is the sensory information that tells the learner how well the task was completed, and Moodle can do nothing about it. Extrinsic feedback is information that supplements or augments the inherent feedback (Magill, 2004). Extrinsic feedback has two primary functions. First, the feedback facilitates achievement of the skill. Second, it motivates the players to strive toward achievement of the skill.

We can use videos of children executing table tennis shots in Moodle to provide extrinsic feedback. Because video allows for pausing and replaying a performance at any point, schoolchildren and coaches can review the performance more thoroughly. Schoolchildren can compare their strokes to an expert performing the same skill. At the same time, coaches can give each child a more complete and effective diagnosis of his or her performance.

We can easily capture high-quality videos with digital cameras, but it's difficult to deploy and configure videos in Moodle. To provide video feedbacks, we use a feature-rich media player: moodle-mplayer, as shown in Fig. 4. This media player is an easy and flexible way to add video and audio to a web site. It supports playback of any format the Adobe Flash Player can handle (JW FLV Player, homesite).

Before setting up parameters for the module, the following things must be done. (1) Compress video files into Flash Video (FLV) format by Format Factory. To reduce the disk space and the bandwidth, we set "frame rate" to 25 frames per second and set "bit rate" to 768 KB Per Second. (2) Upload students' FLV videos the server. (3) Edit XML playlist files. A playlist is an XML file containing a list of videos to play which



2011- 06- 04	正手对攻 202 个
2011- 05- 22	正手对攻 180 个
2011- 05- 08	正手对攻 160 个

**Consecutive
160 forhands**

Fig. 4. moodle-mplayer for providing video feedbacks.

appear as a menu in the FLV player window ([Playlists with moodle-mplayer, 2011](#)). (4) Handle the problem about unreadable Chinese characters. Open the playlist.xml file and save the playlist in the UTF-8 format.

Video feedbacks of the Moodle course were designed specifically to facilitate students' perceived competence and interest. According to CMT, self-comparison and degree of skill improvement over time are sources of perceived competence ([Horn & Hasbrook, 1986, 1987; Horn & Weiss, 1991](#)). The users of the Moodle course can compare their performance with their past performance. They can observe their improvement online. For example, a girl made 40 consecutive forehand chops on May 21st 2011. A week later, she made 60 consecutive forehand chops. She made progress, and the Moodle course showed her progress. Thus, the feature of the Moodle course can enhance their perceived competence. At the same time, this feature can increase their interest provided that it can increase children's perceived competence.

2.2.4. Interaction

We use some standard Moodle modules to provide coaches, parents and students with an opportunity for online interaction. (1) Develop a quiz for table tennis rules. (2) Create a forum to discuss table tennis tactics. (3) Develop a choice to vote on the most favorite player. (4) Use a wiki to link to famous table tennis web sites in the world.

This block is designed to enhance students' perceived competence and interest, too. According to CMT, feedback is a source of perceived competence. For example, [Allen and Howe \(1998\)](#) showed that more frequent praise were related to higher perceived competence. In the Moodle course, coaches and parents can participate in many activities (such as discussion forums) to provide positive online feedbacks. Thus, this block can enhance students' perceived competence. In addition, if the block can facilitate schoolchildren's perceived competence, it can facilitate their interest.

2.3. Data sources

The instruments for collecting quantitative data included a basic knowledge test on table tennis, a perceived competence scale and an interest scale. To measure the knowledge of students, a Table Tennis Knowledge Test (TTKT) in Chinese was constructed by the researchers, based on Table Tennis in School Program ([Table Tennis Victoria and Table Tennis Australia, 2011](#)) and Instructor's Guide to Table Tennis ([USA Table Tennis, 2011](#)). The TTKT comprised 10 true/false and single choice questions on table tennis. The basic knowledge included the origin of table tennis, equipments, and rules of the game ([Table 1](#)). For this instrument, the alpha value was acceptable ($\alpha = .78$).

To measure the perceived competence and the interest of students, a perceived competence scale (Chinese version) and an interest scale (Chinese version) were adapted from Intrinsic Motivation Inventory (IMI) ([Intrinsic Motivation Inventory, 2011](#)). The IMI is a multidimensional measurement device intended to assess participants' subjective experience related to a target activity in laboratory experiments ([Deci, Eghrari, Patrick, & Leone, 1994](#)). It has been used in several experiments related to intrinsic motivation and self-regulation. The instrument assesses participants' interest, perceived competence, effort, usefulness, felt pressure and tension, and perceived choice while performing a given activity.

The perceived competence scale was presented in [Table 2](#). The scale consisted of 6 items. Of the 6 items, 5 items were positive and 1 item was negative. Positive items were scored using values ranging from 1 (totally disagree) to 5 (totally agree). Negative items were inversely coded. The maximum score for this scale was 30. The interest scale was presented in [Table 3](#). The scale had 7 items. Of the 7 items, 5 items were positive and 2 items were negative. Positive items were also scored using values ranging from 1 (totally disagree) to 5 (totally agree). Negative items were inversely coded. The maximum score for this scale was 35.

Researchers have tested the psychometric properties of IMI. The results demonstrated acceptable reliability and validity of this scale. For example, [McAuley, Duncan, and Tammen \(1989\)](#) reported that the alpha value was .78 for the interest subscale and the alpha value was .80 for the perceived competence subscale. They conducted a confirmatory factor analysis to examine the validity of the IMI and found strong support for its validity. [Tsigilis and Theodosiou \(2003\)](#) examined the temporal stability of the IMI (Greek version). They found that Intra-class Correlation Coefficients (ICC) were .61 for the perceived competence subscale, .86 for the interest subscale, and .70 for the overall scale. They concluded that the IMI provides a temporally stable measure, given that perceived competence has not been markedly changed. At the same time, the items in the two adapted scales (the perceived competence scale and the interest scale) were modified slightly. For instance, an item such as "I think I am pretty good at this activity" was changed to "I think I am pretty good at table tennis". In this way, the reliability or validity of the two adapted scales were not affected. The reliability of these two adapted scales was evaluated. For the perceived competence scale and the interest scale, the alpha values were .73 and .74, respectively. Thus, both the original and adapted versions were reliable and valid.

Table 1
TTKT for primary school students.

N	Question	Choice
1	What is the origin of table tennis?	A. China B. United States C. England D. Japan
2	What is the diameter of a table tennis ball?	A. 50 mm B. 38 mm C. 45 mm D. 40 mm
3	What is the height of a table tennis table?	A. 50 cm B. 76 cm C. 120 cm D. 100 cm
4	As the ball is not falling the server shall strike it.	A. True B. False
5	How high should the net be?	A. True B. False
6	The server must throw the ball up at least () cm.	A. 16 cm B. 10 cm C. 20 cm D. 30 cm
7	The server must throw the ball almost vertically up without imparting spin.	A. True B. False
8	The ball and the racket must be above the level of the playing surface throughout the server.	A. True B. False
9	A player shall score a point if his opponent touch the table with free hand while playing.	A. True B. False
10	What score does one player has to achieve to win the game?	A. 11 B. 21 C. 6 D. 15

Table 2
Perceived competence scale.

N	Item
1	I think I am pretty good at table tennis.
2	I think I did pretty well at this activity, compared to other students.
3	After playing table tennis for a while, I felt pretty competent.
4	I am satisfied with my performance at this task.
5	I was pretty skilled at this activity.
6	This was an activity that I couldn't do very well. (R)

2.4. Procedures

The study was implemented between May 2 and June 6, 2011. The treatment lasted 6 weeks. Ahead of implementation, we introduced the Moodle course to Group M, and every child in this group got a Moodle username and password. During the study, the Moodle course didn't allow guest access.

At the beginning of the study, the TTKT, the perceived competence scale and the interest scale were given as pretests to the children in both groups to measure their knowledge, perceived competence and interest. At the end of the study, the same TTKT and scales were implemented to both groups as posttests.

During the intervention, the schoolchildren in the Group C took part in table tennis sessions as usual. Except for table tennis training sessions, however, the students in Group M were asked to use the Moodle course, at least half an hour a day, two days a week. To ensure this, we used Moodle Reports feature (Live Logs, Activity Reports or Participation Reports) to check users' activities every Sunday night. We could get full reports of the activities of a particular student, or of all students for a specific activity. When we found that there were students who hadn't used the Moodle course according to our requirements, we immediately contacted their parents by phone. As a result, these students had to login to the site and participate in the activities in the course.

The children in Group M could use the Moodle course in several ways. (1) They could watch their own videos. We recorded videos of children displaying target skills (in Group M) at the end of each session. If he/she made more consecutive hits, we added his/her video to the Moodle course to provide an extrinsic reward on the basis of performance. For instance, two intermediate players hit 202 consecutive forehands on March 20th 2011, which were more than last time. In result, they could view this video in the Moodle course. (2) They were able to watch the best players in the world execute various shots in detail by technique animations. Specifically, they could manipulate the animations by slowing down and advancing it frame-by-frame. Because they could watch their own videos through the online course, they could also compare their performance to an expert performing the same skill. (3) They could view the instructional videos. (4) With the help of their parents, they were able to take the online quizzes, edit wiki pages, and participate in discussion forums.

2.5. Data analysis

To investigate the differences between Group M and Group C in terms of age, table tennis experience, and train frequency, an independent-samples *t*-test was performed.

To compare the two intervention groups and measure change with pretest and posttest data, three one-way analysis of covariance (ANCOVAs) were conducted with the type of intervention (Moodle course method and traditional method) as the independent factor, each of the three pretest scores (knowledge, perceived competence and interest) as covariates, and each of the three posttest scores as the independent factors.

All the analysis were performed using SPSS 15.0 for windows. Levels of significance were set at .05.

3. Results

3.1. Difference between group M and Group C in terms of age, table tennis experience and train frequency

The results showed that there were no statistics significant differences between Group M and Group C in terms of age [$t(30) = .93$, $p = .36$ ns], table tennis experience [$t(30) = .51$, $p = .96$ ns] and train frequency [$t(30) = -.81$, $p = .43$ ns]. The descriptive statistics were shown in Table 4.

Table 3
Interest scale.

N	Item
1	I enjoyed playing table tennis very much.
2	This activity was fun to do.
3	I thought this was a boring activity. (R)
4	This activity did not hold my attention at all. (R)
5	I would describe this activity as very interesting.
6	I thought this activity was quite enjoyable.
7	While I was playing table tennis, I was thinking about how much I enjoyed it.

Table 4

Difference between the two intervention groups in terms of age, table tennis experience and train frequency.

Variable	Group	N	Mean	SD	T value	d.f.	Significance
Age	Group C	16	8.88	1.54	.93	30	.36
	Group M	16	8.44	1.09			
Experience	Group C	16	1.80	.71	.51	30	.96
	Group M	16	1.79	.69			
Frequency	Group C	16	1.75	.68	-.81	30	.43
	Group M	16	1.56	.63			

3.2. Difference between group M and Group C in knowledge

Before conducting the ANCOVA, preliminary checks were performed to confirm that there was no violation of the assumptions of normality, linearity, homogeneity of variances and homogeneity of regression slopes (Pallant, 2007). After adjusting for TTKT scores in the pretest (covariate), there was a significant difference between the two groups on posttest scores on the TTKT [$F(1,29) = 207.03, p < .001$]. The results showed that the children that had used the Moodle course performed significantly higher in the TTKT posttest scores than those that had not. Pretest and posttest scores on the TTKT were presented in Table 5.

3.3. Difference between group M and Group C in perceived competence

Preliminary checks were conducted to ensure that there was no violation of the assumptions of normality, linearity, homogeneity of variances and homogeneity of regression slopes. After adjusting for perceived competence scale scores in the pretest (covariate), there was a significant difference between the two groups on perceived competence posttest scores [$F(1,29) = 137.08, p < .001$]. The results indicated that the children in Group M had significantly higher perceived competence than those in Group C. Pretest and posttest scores on the perceived competence scale were displayed in Table 6.

3.4. Difference between group M and Group C in interest

Before conducting the ANCOVA, preliminary checks were performed to confirm that there was no violation of the assumptions of normality, linearity, homogeneity of variances and homogeneity of regression slopes. After adjusting for pretest scores, there was no significant difference between the two groups on interest scores [$F(1,29) = 2.73, p = .11$ ns]. The results showed that there was no statistically significant difference in table tennis interest between the two intervention groups (Group M and Group C). Pretest and posttest scores on the interest scale were presented in Table 7.

4. Discussion and conclusion

This study evaluated the effects of a Moodle course on educational effectiveness, perceived competence and interest for schoolchildren's table tennis learning, as compared to the traditional method.

As discussed earlier, many researches have indicated that LMS have positive impacts on learning outcomes. For instance, Zhang, Zhao, Zhou, and Nunamaker (2004) found that in an e-learning environment that emphasizes learner-centered activity and system interactivity, remote learners groups outperformed traditional classroom students as measured by the test scores. Martinblas and Serranofernandez (2009) evaluated the improvement of the academic results derived from the use of Moodle course. The students who used Moodle regularly during the semester have obtained higher scores than the students who did not. The online course helped students to reinforce their abilities and knowledge. In line with these studies, this study showed that Moodle has positive impacts on educational effectiveness and perceived competence. (1) The schoolchildren achieved statistically significant learning gains by participating in the Moodle course. With an Internet connection, they could watch instructional videos and technique animations anywhere and anytime, therefore, they could acquire a comprehensive knowledge of table tennis. (2) The schoolchildren who used the Moodle course showed higher perceived competence than those who didn't. They could watch their online videos and judge their ability in table tennis by making comparisons to their past performance, thus, they could have a feeling of competence more easily.

Several authors have concluded that schoolchildren who perceive themselves as competent will maintain greater interest in a particular skill domain. For example, Robert et al. (1981) concluded that a child's feeling of competence in a particular domain is used to mediate their interest. However, this study showed that the Moodle course had no positive impact on interest. Two possible reasons are: (1) Perceived competence is just one factor that affects the development of interest. For example, Bergin (1999) discussed individual factors and situational factors that influence interest. The individual factors are belongingness (which includes cultural value, identification, and social support), emotions, competence, utility-goal relevance, and background knowledge. The situational factors include novelty, fantasy, humor, narrative and so on. (2) The participants were too young to take full advantage of the Moodle course. Because students from Grade 4 to Grade 6 have not enough time to get regular table tennis training, most participants were from Grade 1 to Grade 3. The mean age of the participants

Table 5

Pretest and posttest scores on the TTKT.

Test	Group	N	Mean	SD
Pretest	Group C	16	2.56	1.03
	Group M	16	2.50	1.03
Posttest	Group C	16	3.06	.77
	Group M	16	7.31	.88

Table 6

Pretest and posttest scores on the perceived competence scale.

Test	Group	N	Mean	SD
Pretest	Group C	16	18.19	1.87
	Group M	16	17.81	2.01
Posttest	Group C	16	18.13	1.59
	Group M	16	24.00	1.27

Table 7

Pretest and posttest scores on the interest scale.

Test	Group	N	Mean	SD
Pretest	Group C	16	17.31	2.75
	Group M	16	17.63	3.32
Posttest	Group C	16	18.56	3.29
	Group M	16	18.06	3.24

was 8.66 years. Although many Chinese input methods were available to enter Chinese into computers, it was quite difficult for them to input Chinese in Moodle pages. As a result, most participants didn't like to participate in some Moodle activities such as Forum, Wiki, and Quiz.

This study is of practical significance because participation in organized sports can have physical, mental and social benefits for children. First, sports help children develop and understand skills and strengths that they will need forever, such as agility, coordination, endurance, and flexibility (e.g., Raudsepp & Pall, 2006; Sollerhed & Ejlertsson, 2007). Second, sports can also be of value in promoting mental health (e.g., Bailey, 2006; Dotson & Ross, 1985). For example, Bailey (2006) stressed that sports have the positive effects on children's self-concept, self-esteem, anxiety, depression, tension and stress, self-confidence, mood and so on. Finally, organized sports can help teach kids important social and interpersonal skills, as well as teach them the value of hard work and persistence (e.g., Bailey, 2006; Dotson & Ross, 1985).

The present study has implications for organized youth sports. (1) Schoolchildren should fully utilize Moodle course to improve their skill level. First, Moodle could provide slow motion and frame-by-frame animations of world champion players. The users of the Moodle course can view isolated strokes of the best players in the world. By copying the experts, they can learn how to coordinate the movement of the arms, legs and torso. Even at home, they can do the shadow practice which means practicing the shots without the ball to improve the speed of the shots and footwork. Second, Moodle could provide video feedbacks. Schoolchildren could compare their movements to a professional player performing the same skill. They can improve their performance by self-analysis. Finally, Moodle provides schoolchildren the opportunities to develop a better understanding of the game. Knowing why a skill is performed in a certain manner is beneficial to the learning of new skills. For instance, spin is the reason why table tennis is very difficult to play. Children can facilitate their performance if they can understand how to use spin in table tennis. (2) Coaches and parents should not underestimate the educational value of Moodle. According to CMT, schoolchildren primarily participate in organized sports for intrinsic reasons such as enjoyment and sense of mastery that come from learning and improving skills. social reasons are also important, such as support from and positive interactions with significant adults (i.e., parents, coaches) (e.g., Harter, 1990; Rose et al., 1994; Smoll & Smith, 2002). Thus, coaches and parents should actively take part in Moodle activities (such as Forum, Wiki and Blog) to enhance schoolchildren's participation in organized sports.

This study showed that the Moodle course had positive effects on schoolchildren's table tennis learning. The online course increased their knowledge and perceived competence. It can, thus, be concluded that Moodle could be used as a tool to supplement traditional motor learning. To our knowledge, there are no published studies that examine the effects of a Moodle course on knowledge, perceived competence, and interest in an organized setting. This study will fill a gap in the literature. In addition, as mentioned earlier, CMT is strongly supported in the physical domain. There are links between perceived competence and motivational and behavioral outcomes. This study demonstrated that Moodle facilitated schoolchildren's perceived competence. For this reason, it opens up interesting perspectives of future research. It is needed to further investigate the impacts of Moodle course on students' motivation and actual performance.

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