The 6th East Asia Regional Conference on Mathematics Education

CERTIFICATE OF ATTENDANCE

This is to certify that

Chongyang Wang

China

had participated in

The 6th East Asia Regional Conference on Mathematics Education
17th - 22nd March 2013, Phuket, Thailand

Maitree Inprasitha

Maitree Inprasitha, Ph.D.
Chair
Local Organizing Committee
The 6th East Asia Regional Conference on Mathematics Education

EARCOME 6
THAILAND 2013

The 6th East Asia Regional Conference on Mathematics Education

CERTIFICATE OF ORAL PRESENTATION

This is to certify that

Chongyang Wang

China

had presented the paper entitled

"Fun School" for Primary Mathematics Based on Flash

The 6th East Asia Regional Conference on Mathematics Education
17th - 22nd March 2013, Phuket, Thailand

Maitree Inprasitha

Maitree Inprasitha, Ph.D.
Chair
Local Organizing Committee
The 6th East Asia Regional Conference on Mathematics Education

6th East Asia Regional Conference on Mathematics Education (EARCOME6)
17-22 March 2013, Phuket, Thailand (This part is for LOC use only. Please do not change this part.)

"FUN SCHOOL" FOR PRIMARY MATHEMATICS BASED ON FLASH

Chongyang Wang

School of Education Science, East China Normal University

cy_wang5258@163.com

As an important resource of multimedia teaching, the courseware has been widely applied in modern classroom teaching. Any education reform is inseparable from the help of learning theories, with the courseware catching up with the educational reform. With a theoretical view analyzing the design of mathematic courseware from 3 learning theories, this research tries to find the balance of the goal achieved and learners' interest kept, using the courseware containing the fraction operation as an example to design an interesting mathematic courseware to improving the understanding of operation thought and enthusiasm of calculations of pupils.

Keywords: Elementary School Math; Fun Teaching; Courseware Made by Flash; Fraction Operation.

INTRODUCTION

With the rapid development of modern information technology and the constant education reform deeply, multimedia has struck deep roots into the fields of modern teaching, which has an unique advantage over the traditional teaching. Multimedia teaching is media collections including the contents and objectives of teaching, based on the multimedia technology and the traditional teaching methods, so as to serves the teaching better (Xu, X. , 2006). It makes full use of the audio-visual channel and achieves a unity of immediacy and abstraction, optimizing the teaching process, which is widely used by many excellent teachers in daily teaching (Wang, X. ,2005).

As a key component of the multimedia instruction, it is hard to classify the courseware. It can be classified as teaching-assisting courseware and learning-assisting courseware in learning types, and demo courseware, instrumental courseware, exercise courseware, test-courseware, game-based courseware, simulated courseware, etc in patterns of manifestation (Yuan, K. 2006).

Although the multimedia teaching has promoted for many years, and spread out with a great achievement, many problems are still existing in design and application. For example, some courseware put too much emphasis on the multimedia form that it affects the normal teaching, while other courseware reflect the textbooks blindly and mechanically, ignoring the cognitive process (Sun, F. 2012). Mathematics is an

subject abstract, with the help of intuitive perception understood. However, too much attention on visual display will not only enable the learners to remember, understand, master and apply the knowledge, but also lower their thinking level, which is not helpful for the development of the learners` thoughts.

With an analysis of the 3 learning theories, this research aims to find the balance of the goal achieved and learners' interest kept, using the courseware containing the fraction operation as an example to design an interesting mathematic courseware to improving the understanding of operation thought and enthusiasm of calculations of pupils.

THEOTICAL DIRECTIONS OF MATHMATIC COUREWARE DESIGN

The behaviourists value the connection of Stimulation and Reinforcement, they consider the mathematics learning as a process of trial and error. They believe that the aggrandizement is the key to success in learning, thus the mathematical learning needs a large number of exercises, and the motivation sources from the external rewards (Zhang, J. & Tang, F. ,2005). Withal, the behaviourists stress the individual teaching and timely feedback, The courseware laid the stronger theoretical foundation to directing the design of the exercise courseware, individual coaching courseware and game-based courseware.

The cognitionists, however, see learning as a process of insight and understanding, they think aggrandizement is not essential for learning. How to light the flame to study and how to find the connection between the known and the unknown becomes the key point of them. They will learn becomes the concerns of cognitionists. Cognitionists stress the learners` motivation and their interest, emphasize the understanding of concepts, so it shows a great guidance to those courseware which contain lots of new concept and proposition.

Constructivists claim that learning is a process for the students to construct their own knowledge system actively, so they pay more attention on the environment construction, where the learners can discover, propose and solve the problem. Constructivism has a higher requirement of the learners' thinking level, so it is suitable for us to design the task-based courseware, in which the learning task is overall, exploratory, and needs to be fulfilled in a situation.

Each theory germinates in chronological, and influences one another and they will develop together under this situation. And which theory learning theorists prefer depends on what kind of learning they study. Every learning theory has its special scope. Learning is a multi-type, multi-level and complex activity which is easily influenced by many factors, so obviously we cannot expect an almighty theory or model to solve the all problems, but should adopt and organize according to the practical demands. Like Utema and Newby (1993) have suggested that (Januszewski, A., & Molenda, M. , 2010), we can apply the idea of behaviorism to the learners with lower cognitive level, specializing the cognitive methods for those learning tasks involved more cognitive process, and use the constructivism approach to the high cognitive level and more complex tasks.

COURSEWARE DEVELOPMENT TOOLS

Up to now, we have a lot of multimedia courseware development tools, and many investigations have been carried out on the usage situation. A survey data to 32 secondary schools of Anhui, Shandong and Jiangsu provinces in 2011 shows that PowerPoint reaches a supreme frequency of utilization among the multimedia courseware developing softwares, followed by the Geometer's Sketchpad, Z + Z platform, Word, and the usage of Flash is the least(Li, X., & Liu, Z., 2011). In April of the same year, a survey of Hohhot corroborated this view(Duan, X., 2011) but a statistic of the chemical courseware on an education website(Yan, X., 2003) shows that the usage of Flash in chemical courseware is 66% which is much higher than the PowerPoint`s (21%). It may be related to teachers' IT literacy because Flash is a professional animation software requiring higher IT knowledge, however, further investigations are needed for a more conclusive interpretation for this conjecture.

But it is no denying that Flash has a great potential to develop as mathematics courseware production. As a mature product of Adobe, it takes the streaming media technology and the vectoring technology as its core technologies. It supports playing while downloading, which makes it very suitable for network sharing. The vector graphic is not only of high quality but also small in size compared to files generated by other tools such as PowerPoint and Authorware. For example, the same contents with, the Flash files can be tens or hundreds times smaller than others. In addition, some Flash files are unrestricted by the production environment. The file .swf can be directly played by the browser, and the files .exe can run directly over win98 operating system, which has a great advantage over other development tools. In addition, the interactive function of Flash can bring the courseware flexibility by the Action Script Language, realizing the bilateral transmission of the information between the user and the courseware, which makes up for the defects of information unidirectional transmission in the traditional coursewares, providing the user opportunities of participation. There are two language versions to choose, AS2 (ActionScript2.0, AS2) and AS3 (ActionScript3.0, AS3). AS2 is a process-oriented programming language and it is recommended as the choice for the simple interactions and programming novice.

Based on this, this study chooses Flash and AS2 as the courseware development tool.

THE DESIGN OF "FUN CLASS" IN PRIMARY SCHOOL MATHEMATICS

Fraction operation is an important topic in primary mathematics. As a kind of operation knowledge, fraction operation is considered as the most abstract and complicated content and most of pupils often run into problems here(Zheng, Y., 2010). The learning of fraction is the real starting point where it is difficult for the students in learning mathematics(Bulgar, S., 2003). Those who do not master it cannot tackle it well in mathematic learning especially in fraction applied problem in the future(Wang, J., 2011). Therefore, the courseware is designed based on the content of the fraction operation.

Teaching objective, Learners analysis and Teaching content

The cognitive objective is that the students can understand the meaning of fraction operation, and the algorithm of fraction operation; the technical objective demands of students the ability in working out the four arithmetic and the mixed operations; the objective of the affective aims to develop a habit of checking whether the calculations can be reduced, as well as keep the confidence and interest towards mathematics.

The students learn fraction arithmetic in Grade five and Grade six. According to Jane Piaget's stages theory of cognitive development, children, from 7 to 12 years' old, their thinking level reaches the stage called concrete operation. From 12 to 16, children's thinking level reaches the stage called formal operation. Generally, children`s age in Grade five and Grade six ranges from 11 to 13, so they are in the transition period from concrete operation to formal operation. Children in the stage of concrete operation need specific things to do the operation, while children in the stage of formal operation can distinguish content from form, making inference with the hypothesis. Before learning fraction arithmetic, students have learnt concepts and the basic properties of fraction. Referred to the organization of the courseware content, we should not only pay attention to their learning experiences, but also the differences of their thinking development level as well. Affected by factors such as physiology, psychology, social culture and so on, there are group generality among learners, individual differences as well. Some students may have entered the formal operational stage, so they can think logically and abstractly without practical experience. However, there are still some students only understanding them well by virtue of visualized things. we must take consideration these two kind of students' original ability and needs, using the courseware to make up the disadvantage of collective teaching that it can't give consideration to individual teaching.

Table 1 Teaching contents

Teaching Content	Presentation of Appearance	Theoretical Basis	Remarks
The background materials required in the new knowledge learning	Pictures & words	Cognitionism	The development of mathematical thinking is the repeated applications of "reflexive abstraction"(Piaget, J., 1997), the background materials which can help learners prepare the basis .
Creating the situation, posing the problems and demonstrating	Animation	Constructivism & Cognitionism	To understand the meaning of the algorithm depends on a specific situation in which the learners can not only obtain the meanings but also where and

the operation principle			when to use them(Li, H., 2010).
Summarizing the algorithm	Animation	Cognitionism	Visual presentation is beneficial to the mathematical understanding, but the timely integration is also indispensable
Exercise for consolidation	Interaction	Behaviourism	Procedure is the typical characteristics of the operative knowledge, so some appropriate exercise will not only gain the learners the operation skills （Gong. Z, 2006）, but also can be used as an evaluation method.

Courseware Design

The operation is abstract, which is difficult to get the pupils` concentration. Therefore the courseware is designed into three modules: Fun Classroom, Arena, Animation Hall, which are used to impart the knowledge, exercise and entertainment. The courseware structure is shown in figure 1.

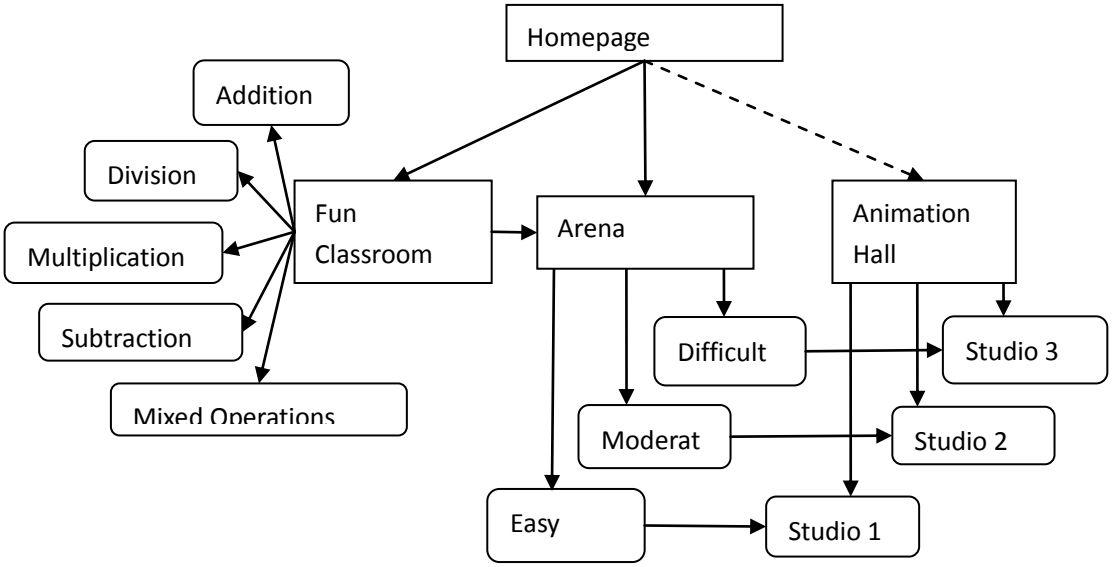

Figure 1. Structure of the courseware

The "fun classroom" module

"Fun Classroom" is a teaching module, which draws lessons from the demonstrational courseware. It consist of five progressive units, "Addition of Fractions", "Division of Fractions", "Multiplication of Fractions", "Subtraction of Fractions" and "Mixed Operations of Fraction". Learners can choose the learning units themselves via the navigates. Each unit contains four sub-modules, Knowledge Review, Visualization Understanding, Abstract Summary and Exercises: Knowledge review helps prepare the basic knowledge for the new learning; Visualization

Understanding creates a situation by animations in which the problems can be discovered, posed and solved, and the operation principle can be explained; Abstract Summary helps the learners conclude the algorithm of the fraction by an animation performed by the lovely match guys; the exercise module consists of 3 simple exercises, and it is designed to strengthen the understanding of the algorithm, the learners can get the immediate feedback once they submit the answers or seek help, thus the learners can get their right answers be strengthened and the elicitation if they get wrong answers. So that we can ensure the learners can always obtain a positive timely feedback and reduce the error rate to a minimum. This module can also be used by teachers in the classroom as a preheating or a supplement out of the regular classroom teaching.

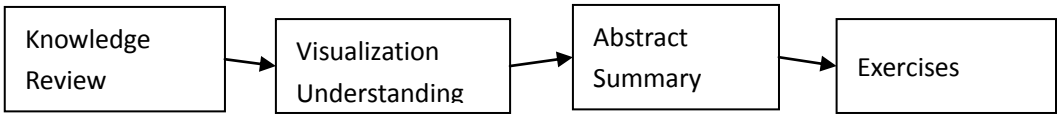

Figure 2. The flow chart of the “Fun Classroom” module

The “arena” module

“Arena” is an exercise module drawing on the scoring pattern from the test-courseware and the form of game-based courseware. This module is graded into three levels in order of difficulty, which are “tiny shrimp”, “big fish” and “E-hero”. In this way learners can both experience the possibility to success and understand the efforts they need to pay, leading them motivation and determination to overcoming the challenges. According to the incentive mechanism, after each level, the eligible can obtain a password as a reward, with which the player can enter the corresponding studio of the “Animation Hall”. The specific flowchart is shown in figure 2.

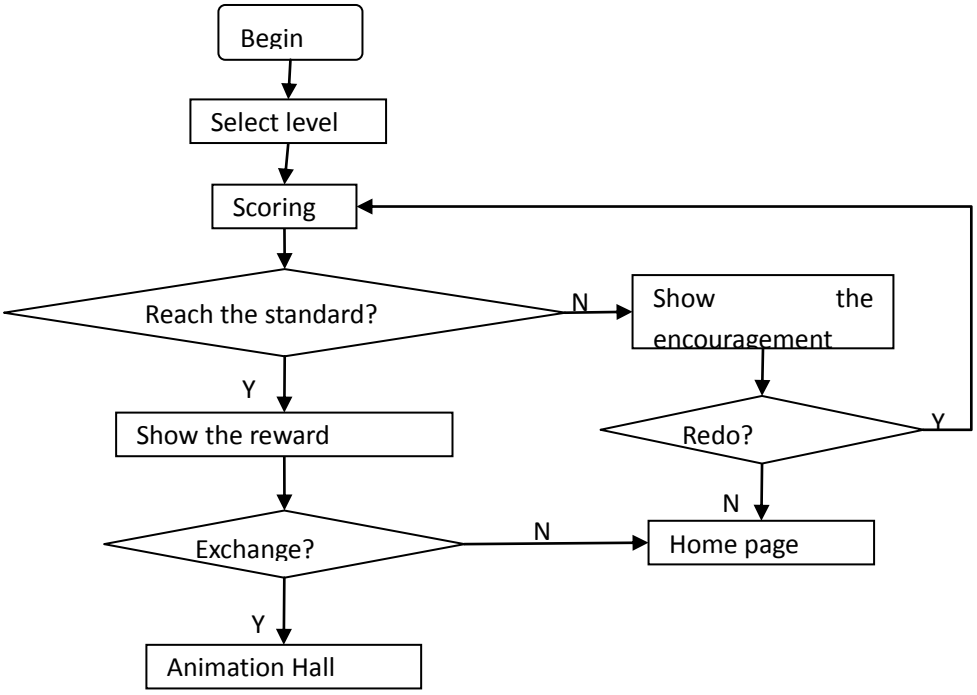

Figure 3. The flowchart of the “arena” module

The "animation hall" module

"Animation hall" is a reward module composed of three studios, and each studio contains a short animation about the campus. The player needs to input the password they got in "Arena", after the authentication they can enjoy the animation.

DISCUSSIONS

Though the reform and development of education needs learning theories, the development of learning theories is not a linear process, which one theory takes place of another. No single source of theory is adequate to provide a basis for a good courseware, each of the theory has its certain values to commend it. Theories themselves can't be described better or worse, only the standard application or not.

In this research, Flash is used to develop a courseware which contains the fraction arithmetic. With the recognition of the fun principle and features of the pupils, the courseware contains three modules: explanation, quiz and entertainment It will help pupils learn in fun animations, consolidate in games, and mobilize their enthusiasm through the awards after each game.

On how to balance the teaching objectives and the learners` interests while designing a courseware, suggestions gives as follows:

Firstly, while choosing the guide theories, we should recognize applicable range of learning theories and characteristics of the subjects; Secondly, multimedia courseware should always be oriented by the teaching objective, and is based on the learners feature and the knowledge types, instead of a summary of teaching material and multimedia; Finally, when it comes to the role definition, the courseware is an instrument for teaching and learning. It can't replace direct interaction between teachers and students.

References

Xu, X. (2006). Advantages and present conditions of the multi-media teaching and countermeasure. *China Science and Technology Information, 1,* 97, 101.

Wang, X. (2005). Theory of teaching: the psychology oriented. Shanghai: Shanghai Education Press.

Yuan, K. (2006). Research of multimedia courseware classification. Journal of Southwest Agricultural University (Social Science Edition), 4(4), 284-287.

Sun, F. (2012). A study on the strategies of information-processing in multimedia courseware. China Educational Technology, 3, 81-84.

Zhang, J., & Tang, F. (2005). A survey on the behaviourism in mathematical education of primary school and middle school. Journal of Leshan Teachers College, 20(12), 33-35.

Januszewski, A., & Molenda, M. (2010). Educational technology: A definition with commentary.

Li, X., & Liu, Z. (2011). An investigation on the usage situation of the mathematic courseware tools in middle school. Journal of Teaching and Management, 7, 67-69.

Duan, X. (2011). The study of teaching for mathematics understanding in the support of information technology. Liaoning Normal University.

Yan, X. (2003). Design and study of the series Flash courseware on inorganic chemistry in the chemical basis of professional vocational course. Nanjing Normal University.

Zheng, Y. (2010). Fraction teaching and mathematical thinking. Xiao Xue Jiao Xue, 5, 4-6.

Bulgar, S. (2003). Children's sense-making of division of fractions. Journal of Mathematical Behaviour, 22, 319-334.

Wang, J. (2011). Develop the sixth grade students` computing power of fraction and how it affects the students` ability of solving fraction applied problems. East China Normal University.

Piaget, J. (1997). The principles of genetic epistemology. Beijing: The Commercial Press.

Li, H. (2010). The theory of mathematics Teaching. Fujian: Fujian Education Press.

Gong, Z. (2006). *A study on understanding levels and teaching and learning strategies of operation of rational numbers*. Southeast University.