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# OPINIONS OF MATHEMATICS TEACHER CANDIDATES TOWARDS APPLYING 7E INSTRUCTIONAL MODEL ON COMPUTER AIDED INSTRUCTION ENVIRONMENTS

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*The purpose of this study was to determine opinions of mathematics teacher candidates towards applying 7E instructional model on computer aided instruction environments. The descriptive case study model was used in this study. The sample of the study consists of 52 mathematics teacher candidates which were selected randomly from Eskişehir Osmangazi University Department of Elementary Education students. Data were collected by "Applying 7E Instructional Model on Computer Aided Instruction Environments" questionnaire and a demographical form. The findings of this study have been evaluated within mean, standard deviance, maximum and minimum values as dependent to the descriptive case study model.*

Key Words: teaching mathematics, computer aided instruction, 7e instructional model

## INTRODUCTION

The Constructivism, itself, is the most distinct approach which constitutes the tramlines of the new mathematics curriculum in Turkey. Within the curriculum, both about the vision and also learning areas go along with the constructivism approach, or its synonymous "cohesive instruction". For instance, the principle "All the students can learn mathematics." basicly lines up with this approach. The practicability of this principle both can be under debate of another study and also can be heartening in terms of curriculum vision. These circumstances are frequent in math lessons with emphasis on a student-centered understanding.

For a long time, the traditional math instruction of "definition-formula-example-practice-exercise" has been easy for teachers but for the students it has

been boring and difficult. The learning cycle suggests problem solving-exploration-guesswork-justification-association-generalization make teachers more facilitator and a guide to student experiences (Baki, 2006). This loop action –making teacher "guide"- is also encountered as different instructional designs in teaching science and math concepts. Students should be provided fine learning environments for questioning their own experiences for developing math concepts and creating their own knowledge (Çepni, Akdeniz and Keser, 2000). Amongst cohesive instructional approach models, the 5E Instructional Model or "Learning Cycle Model" (Karplus and Thier, 1967) is one of those models coming up with this purpose. Recently, the 5E Instructional Model, is one of the most important models that is associated with cohesive learning theory which is applied with different operational steps during learning-teaching process. This model has been evolved by Bybee, leading BSCS (Biological Sciences Curriculum Study) project and used in other applications related to the project. Afterwards, this model has turned into "the 7E Instructional Model", suggested by Eisenkraft (2003), which is about transferring knowledge laying stress on previous schemas of knowledge.

**The 7E Instructional Model**

5E Instructional Model, also suggested as a curriculum design (Saguaro Project, 2001) has begun to be called as 7E Instructional Model, with additions turning to good purpose related to conceptual teaching process. This model takes shape enlarging the engage phase with "Elicit" phase and adding "Extend" phase to Elaborate and Evaluate phases. Hierarchy of the model is shown in next section.

*Elicit*

In this phase the main aim is to emerge past experiences about learning and create a strong background for other phases. Beginning by only engaging the new issues with the oldies can be thought deficient in supporting the thinking abilities. For that, we should revive old information and learning experiences.

*Engage*

First, by drawing attention to the lesson, students are engaged to think about the topic and ask their own questions. Typical activities related to this phase are asking a question, defining a problem and mind storming in adverse cases.

*Explore*

In this phase students have the reasoning opportunity about the key concepts required for exploring schemas and knowledge. Students should be encouraged for diverging from the main problem and reasoning for creating their own schemas.

*Explain*

Managing scientific concepts related to the topic is important in this phase. Student should have mind structure in order to give alternative answers to the questions about topic. And by the time they develop new thoughts within their observations in the explore phase, new concepts can be presented.

*Elaborate*

In elaborate phase, students think more in-depth on things they learn and apply them on different cases. They test ideas with details and explore even additive connections. Providing sympathy for lessons and diversifying student understandings are critical behaviors for a teacher in this phase.

*Evaluate*

Learning cycle model creates specific opportunities for teachers in determining the evolution in thinking levels of the students and also evaluating their learning rates. For instance, evaluation elements like concept maps, projects and summary reports about the topics can be used along traditional assessments like quiz forms.

*Extend*

The aim for adding a new phase to elaborate and evaluate phases is to show the teachers that applying some traditional and modern assessment ways is not the last process and underline the importance of the different applications for transferring information (Bransford, Brown, and Cocking, 2000).

**Computer Aided Math Instruction and 7E Model**

"There is a common assumption that softwares suitable for lessons are always convenient. It is also said that they make mathematics quite apparent. Softwares should not only be able to show outcomes of a great number of calculations they should also show the mathematical mechanism and the process that the solution of the problem is created" (Tall, 1986). With this last sentence,

adapting 7E instructional model -which centralize exploration in concept learning- to computer aided math instruction can be suggested. 7E model, categorizes knowledge as past, routine and things should be extended. Students do not get knowledge just the same as teacher gives. In contrast they build it themselves (Bodner, 1986, 1990). Taking computer mechanism into consideration, giving weight to similar constructivist processes in teaching and also combining it with computer support can be thought as a suitable approach. These circumstances can also be another part of a field work analysis on error messages that softwares give within "justification" and "contraction" phases of constructivist thought.

Whereat 7E instructional model is not a very early one there are limited works on combining the model with computer aided instruction (CAI). Initially, this thought did not get further interest except a suggestion defining a hierarchy related to the application of 5E model and came into question with SAGUARO Project in 2001. In a good few studies, we observe a comparison between CAI and the 7E model, not a combination. In a study, a comparison between 7E model and CAI is made and according to the findings teacher candidates' attitudes towards physics lessons are not affected by learning methods.

Alongside this study there are also studies intended for applying CAI and 7E Model together. For example, in a study called "Developing Computer Aided Materials in Genetics and Applications Within 7E Instructional Model", activities are presented with the combination of the model and the learning method (Saka and Akdeniz, 2005). According to the findings obtained from activities conducted on participants, positive changes detected at levels of candidates show that combining these two elements of mathematical process has a positive effect on teaching genetics concepts. The study ends with suggestions to the biology teachers that they should detect students misunderstandings about different topics of biology and create computer aided materials that are suitable for these topics.

A good few recent studies show that constructivist learning theory has a respectable standing in formalizing learning environments. Researches conducted in Turkey are mostly intended for the description of the theory and developing materials but they do not have acceptable and reliable data in accordance with research results. In the study called "An Assessment on Cohesive Learning Environments with Multiple Research Approach" (Akdeniz and Keser, 2002), Constructivist Learning Environment Survey According to 5 E Model (CLESAF) was used. Assessment works in learning environments are

generally conducted in order to look for answers to these questions: "Learning what?" and "Learning how?". The basic mechanism of this study is to determine how the activities, that are prepared intended for 5E model are applied and the process that is spent on creating the activities. The essential part of the evaluation process is to make a survey that scales students attitudes and apply model with dependence to the phases correctly. According to the findings, CLESAF, has the property that can be suggested for all cohesive learning environments. Under these circumstances, the determination of teacher candidates' general opinion towards a new application in teaching mathematics becomes an important part of the studies.

**Importance of the Study**

Technology has a respectable standing in this information age. The integration of technology with lessons becomes more essential increasingly. The development in technology affects both education system and also activities applied in educational environments. For this reason, more scientific studies and applications are required for integrating new technologies and curriculums to the system. It is normal to hope that teacher candidates, who are also hoped to have significant positive attitude towards educational technology should have been aware of new curriculum approaches. To this end, it is important to determine which parts of the lessons the CAI materials will be integrated. The opinions of teacher candidates should be determined prior to implementation of the auditory and visual materials.

**Purpose of the Study**

The purpose of this study was to determine opinions of mathematics teacher candidates towards applying 7E instructional model on computer aided instruction environments. The following questions were tried to answer in the study with dependence to purpose.

1) What variability is there in mathematics teacher candidates' opinions towards applying 7E instructional model on computer aided instruction environments according to the "gender" variable?

2) What variability is there in mathematics teacher candidates' opinions towards applying 7E instructional model on computer aided instruction environments according to "frequency of computer usage" variable?

3) What variability is there in mathematics teacher candidates' opinions towards applying 7E instructional model on computer aided instruction environments according to "computer ownership" variable?

4) What variability is there in mathematics teacher candidates' opinions towards applying 7E instructional model on computer aided instruction environments according to "affinity to educational softwares" variable?

5) What variability is there in mathematics teacher candidates' opinions towards applying 7E instructional model on computer aided instruction environments according to "Computer Aided Math Instruction Lesson Score" variable?

**METHOD**

This study is basically a descriptive research and includes a methodology based upon descriptive case study model. This model is based on an approach purposing to describe a situation in the same way that has happened in the past or is happening now (Karasar, 1999).

The sample of the study consists of fifty-two mathematics teacher candidates, selected randomly, attending Eskişehir Osmangazi University, Department of Elementary Education, in the second term of 2006-2007 educational year. TABLE-1 shows characteristically information about the sample:

Table 1. Characteristically information about the sample

| | *f* | % | | *f* | % |
|---|---|---|---|---|---|
| **Gender** | | | **Computer Ownership** | | |
| Female | 33 | 63,5 | I have a computer | 32 | 61,5 |
| Male | 19 | 36,5 | I do not have a computer | 20 | 38,5 |
| **Questionnaire Score Groups** | | | **Affinity to Educational Softwares** | | |
| Low | 0 | 0 | Low | 21 | 40,4 |
| Medium | 25 | 48,1 | Medium | 31 | 59,6 |
| High | 27 | 51,9 | **Computer Aided Math Instruction Lesson Score** | | |
| **Frequency of Computer Usage** | | | AA | 10 | 19,2 |
| Every Day | 24 | 46,2 | BA | 11 | 21,2 |
| Sometimes In a Week | 15 | 28,8 | BB | 12 | 23,1 |
| Once a Week | 13 | 25 | CB | 19 | 36,5 |

Table 1 shows that female percentage is more than male percentage, most of the sample (75%) often uses computer, more than half of the sample have a

computer (61,5%), affinity to educational softwares is generally at medium level, candidates are generally successful in Computer Aided Math Instruction Lesson and almost half of them (51,9%) have quite positive opinions about applying 7E Instructional Model on computer aided math instruction environments.

**Collecting Data and Analysis**

In order to determine teacher candidates' opinions towards applying the 7E instructional model within computer aided instruction, literature was scanned related to the study. By taking authority opinions into consideration, thirty of the sample was presented a rough questionnaire including twenty-six items and a demographical form prepared by researchers. With the consistency test questionnaire was made ready to use for the sample. In questionnaire, there were five choices as "strongly agree", "agree", "neutral", "disagree" and "strongly disagree". This choice had values from 1 to 5. The score system for a positive opinion statement was "from 5 to 1" and for a negative one it was "from 1 to 5". The general score system is separated to three groups (26-60, 61-95, 96-130) but these groups reduced to two because there were not any participants having a score between 26 and 60. The Cronbach-Alpha coefficient related to reliability analysis of the questionnaire has been determined as 0.65 and this value make the questionnaire reliable. The variables of the demographical form are gender, frequency of computer usage, computer ownership, the affinity to educational softwares and their Computer Aided Math Instruction lesson score in signary system. The findings of the study have been evaluated within mean, standard deviance, maximum and minimum with dependence to the descriptive case study model.

**FINDINGS**

In this section, there are findings and remarks with respect to teacher candidates' opinions towards using 7E model within computer aided mathematics instruction with the variables of the demographical form.

Table 2 indicates questionnaire scores related to teacher candidates' opinions towards using 7E model within computer aided mathematics instruction with "gender" variable:

Table 2. Questionnaire Scores of gender groups

| *Gender* | *N* | *Questionnaire Score (Average)* | *Std. Deviation* | *Minimum* | *Maximum* |
|---|---|---|---|---|---|
| Female | 33 | 94,9697 | 13,2157 | 75 | 124 |
| Male | 19 | 94,5263 | 15,3889 | 64 | 128 |

When Table 2 examined, it was observed that in the sample females are in predominate group, average questionnaire scores for male and female were found almost equal and they were at high level.

In Table 3, questionnaire scores related to teacher candidates' opinions towards using 7E model within computer aided mathematics instruction are shown with "frequency of computer usage" variable:

Table 3. Questionnaire Scores of frequency groups of computer usage

| *Frequency Groups* | *N* | *Questionnaire Score* | *Std Deviation* | *Minimum* | *Maximum* |
|---|---|---|---|---|---|
| Every Day | 24 | 97,4583 | 15,8525 | 64 | 128 |
| Sometimes In a Week | 15 | 92,6000 | 10,2664 | 78 | 110 |
| Once a Week | 13 | 92,4615 | 13,7998 | 75 | 124 |

The average questionnaire scores for these three groups were close at number and they were at high level. Duly, the maximum of "every day" group has the highest score at questionnaire score collocation. Even so, there are participants (N:13) whose questionnaire scores were at high level and they were at "once a week" group.

Table 4 gives information about questionnaire scores related to teacher candidates' opinions towards using 7E model within computer aided mathematics instruction are shown with "computer ownership" variable.

Table 4. Questionnaire Scores of computer ownership groups

| *Computer Ownership* | *N* | *Average Questionnaire Score* | *Std. Deviation* | *Minimum* | *Maximum* |
|---|---|---|---|---|---|
| Have a computer | 32 | 95,0000 | 14,7560 | 64 | 128 |
| Do not have a computer | 20 | 94,5000 | 12,7753 | 75 | 124 |

When Table 4 examined, it is observed that thirty two participants saying they have a computer and twenty do not, have almost the same questionnaire scores.

The one who had the highest questionnaire score in the sample does not have a computer. In Table 5, questionnaire scores related to teacher candidates' opinions towards using 7E model within computer aided mathematics instruction are shown with "affinity to educational softwares" variable:

Table 5. Questionnaire Scores of affinity groups to educational softwares

| *Affinity* | *N* | *Average Questionnaire Score* | *Std. Deviation* | *Minimum* | *Maximum* |
|---|---|---|---|---|---|
| Low | 21 | 92,1905 | ,5478 | 76 | 110 |
| Medium | 31 | 96,5806 | 16,1137 | 64 | 128 |

As seen in Table 5, average questionnaire scores were high where affinity to the educational softwares was at Low and Medium level. Participants noting affinity "Low" had a high average questionnaire score, as contrary to the expectations. Table 6 gives information about questionnaire scores related to teacher candidates' opinions towards using 7E model within computer aided mathematics instruction are shown with "computer aided math instruction lesson score" variable.

Table 6. Questionnaire Scores of CAI lesson score goups

| *Score Groups* | *N* | *Average Questionnaire Score* | *Std. Deviation* | *Minimum* | *Maximum* |
|---|---|---|---|---|---|
| AA | 10 | 90,8000 | 14,4360 | 76 | 114 |
| BA | 11 | 95,6364 | 10,0823 | 79 | 112 |
| BB | 12 | 98,5000 | 16,2340 | 64 | 124 |
| CB | 19 | 94,1053 | 14,3793 | 75 | 128 |

As seen in Table 6, CAI lesson scores of the sample are nearly at high level. The one who had the highest questionnaire score had a "BB" from CAI lesson.

## CONCLUSION AND RECOMMENDATION

Teacher candidates' opinions related to using 7E model within computer aided mathematics instruction are positive. To determine the levels; mean, standard deviation, range, maximum and minimum values of the questionnaire scores were calculated. Taking these values into consideration, teacher candidates' scores takes place over the unstable and this shows that opinions are positive.

Teacher candidates' opinions lean high level in both two genders, all frequency groups of usage, both computer ownership groups, two affinity groups and all CAI lesson score groups. Especially, teacher candidates whose affinity are at

low level have high questionnaire scores, showing that they are willing to apply this model within environments based upon computer aided mathematics instruction.

It is obvious that teacher candidates are interested in computer aided instruction but they seem a bit confused about which phase or phases of 7E instructional model they would like to apply it into. To prevent this case, teachers of the future should be made more interested in various approaches related to basic instructional models. They should gain experience within real environments including these approaches. So they can be more capable of applying these models.

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