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Students' Opinions On Artificial Intelligence Based Distance Education System (Artimat)

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Abstract

In literature review, it is stated that students face a number of difficulties while they learn the concepts and the relationships between them in mathematics education, and that they often have difficulty in mathematics education. Therefore, mathematics educators have a consensus on developing problem-solving skills of students and that it should be the primary objective of the education. For this reason, the aim of this study is to assess the artificial intelligence based distance education system called ARTIMAT, designed to develop mathematical problem solving skills, in terms of the conceptual competence, the ease of use and students' contribution to the problem solving process. For this purpose, the application was tested with 59 students in 10th grade of an Anatolian High School in Trabzon. Firstly, every student was equipped to use the system individually and later, opinions of the students were taken through structured interviews. In the evaluation of the findings by the study, it was generally concluded that the system fulfilled the needs of the students and was successful.

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1. Introduction

The main aim of mathematics education is to impart mathematical knowledge and skills that are required in daily life to the individual, to teach him problem solving and to bring him a way of thinking that handles matters using a

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problem solving approach. For this reason, problem solving skills take an important place among the mathematical skills (De Corte, 2004). Problem solving retains an important place in the overall objectives of mathematics courses; this issue is therefore at the centre of mathematics curricula at multiple levels from primary school. Indeed, NCTM standards indicate that problem solving skills are needed primarily in mathematics teaching (NCTM, 2000). In many studies within this framework, students are shown to encounter a number of difficulties in understanding the concepts that problems include and the relations between them while they are solving problems (Vicente, Orrantia & Verschaffel, 2007; Chiu and Klassen, 2008). For this reason, problem and the structure of problem solving, and increasing the success in problem solving is an issue studied by many educators and psychologists (Cai, 2003). In addition to many teaching methods, applications using computer technologies retain an important role in these studies.

It is emphasized in the new mathematics curriculum that students can build up their mathematical knowledge in accordance with the nature of a constructivist approach, which is adopted by the program, using the software provided in an interactive way (Ministry of National Education, Committee Presidency of Teaching and Training, 2006). Of course, programmability and availability of the software are also associated with the chosen topic. As a computer does not have the human ability to think and make decisions, it is generally used for issues which are possible in terms of viability. Motion problems have an important place among the topics of mathematics curricula related to problem solving due to the fact that they contain questions of different types, the use of different solution methods and non-routine problems. Therefore, presentation of motion problems by an expert system in a way that provides students with live problem solving processes will be a useful example in the field.

In the light of data provided, the purpose of this study is: the evaluation of the expert system called ARTIMAT, which was prepared to develop problem solving skills of students, in terms of conceptual proficiency and ease of use with students' opinions.

2. Material and Method

2.1. Student module

Student Module is the module in which the user can watch the lecture on the subject, can access the problem solving system or can have a test exam when he logs in. Firstly, the user logs in to the system via a Moodle interface. The user who logs in to the system via a Moodle interface calls up the lecture page, designed problem solving web page or test exam page. The data of the user who calls up the page is forwarded to the page that pops up by Moodle.

The user can use the lecture page, or can enter the problem solving system, or can use the test exam independently of one another. If the user logs in to the Problem Solving System and starts to work initially with a moderate random question from the pool of questions that are grouped according to the level of difficulty, the system makes routings according to the level of the user. The system makes this routing by asking the user sub-problem questions for every step of the process and compares the answers of the user in each step with its own results. If the user gives a correct answer for a sub-problem, the system directs the user one at a time to the next step until finding the final result. If the answer is wrong, it wants the user to give a new answer, alerting with a message that is appropriate for his answer. If the user gives a wrong answer again, the system asks an easier question after ascertaining that the question is too hard for the level of the user. The difficulty level of the questions increases as long as the user correctly answers the questions and decreases if the user gives wrong answers to them. The user can leave the system at any stage.

2.2. Data collection tools

The implementation, which was conducted in order to evaluate the system, was carried out with 59 students in 10th grade in an Anatolian High School in Trabzon.

The system was implemented for two groups for three weeks for two hours in each week in a computer lab and in a way that each student used his/her computer alone and written interview forms were prepared in order to get opinions and thoughts of the students about the system.

3. Findings

3.1. Student Interviews

Each student's opinions and thoughts about the system, which they used for 6 hours in total, were compiled without discriminating grade and gender and results obtained from these were given on the basis of interview questions below.

1. Question: Which one of the features of the system did you like most/least?

Features that were liked in students' answers were determined as:

- Providing individual learning
- Being a more instructive system which is easier to remember
- Providing the identification of the problem
- Solving systematically the question step-by-step with different methods
- Trying different solutions courtesy of the system
- Being easy to use
- Visual design
- Feature that students can add photos by creating their own profiles
- Students being able to communicate with each other via the system

Features that were not liked in students' answers were determined as:

- Being unable to move directly to the result
- The obligation to follow the steps
- Losing time as there is a different solution

2. Question: Was the system helpful for your problem solving process? Can you explain?

Students stated the positive sides of the system as follows:

- It shows what should be done in the process of problem solving
- It helps students think about the solution of the problem
- It increases the knowledge about the solution of the problems
- It strengthens the feature of judgment
- It contributes to the understanding of the problem
- It makes it easier to solve the problem when the user is familiar with using the system
- It warns when the wrong solution is selected
- It develops the habit of systematic problem solving

3. Question: Did you like the visual design of the system? What are your thoughts in terms of improvement?

Students stated in the positive opinions that:

- The system is useful, can be accessed quickly and conveniently and its design is simple at the same time
- System deficiencies that students would wish to see improved
- System should be made livelier with animations on the subject
- Page colour should be changed
- More colourful mathematical symbols should be used in the system
- Warnings for students should be more obvious

4. Question: Did the system change your point of view on problem solving? (Positive/negative)

Students stated in their answers that:

- They can see at which point they have made errors as they have solved the problems step by step
- It helps to understand the question better in a practical way, which they normally try to do mentally without writing the data, by writing in the system
- Possibility of making a mistake decreases as they progress step by step to solve problems through the system
- The system makes students to think over the problem instead of solving problems with formulas by heart
- Solving problems step by step helps them to do operations more accurately

- Solving problems in the computer environment makes the problem solving process more enjoyable
- Solving problems in the system provides better learning although it takes longer
- The system is useful for the development of the human brain as it provides students with the chance to use different solution methods for students in problem solving and it can differentiate the monotonous types of question solving

5. Question: What features of the system are the easiest to use? Can you explain?

The majority of the students reported that the system is easy to use in general. In addition, they gave the following answers:

- Given and desired, which are the first phase of the solution of the problem, are written
- It is easier to see in the table what the given and the desired are
- Students can communicate with each other via the system
- Problem solving steps can be selected

6. Question: Are there any sections that you had difficulty with when using the system? What are they? Can you explain?

Responses from students focus on certain points. It is very important for students to use the system easily and efficiently. It is possible with the feedback to develop the system accurately and efficiently. Although it has been said that the system is generally easy to use according to the responses, the following difficulties have been indicated:

- Doing operations step by step seems complicated
- I find it hard to choose the solution method
- I have difficulty in transferring the operations to the computer
- I find it hard to place the data

7. Question: What are your opinions and suggestions about the system?

General answers of the students are as follows;

- The system is successful and interesting. It makes the solution more fun
- The system has been designed well, and funny features relevant to mathematics such as games and jokes can be added
- Intelligence and skill games and music can be added. It should be developed for other types of problems such as pool, percentages and so on
- Actually, it is a nice system, but we attach importance to the result, not to the phase. It will be better if it is result-oriented
- The system is nice, but phases should be facilitated
- The main page of the system can be better
- The system should include direct access to the solution

4. Conclusion

In this study, the evaluation of the expert system called ARTIMAT, which was prepared to develop problem solving skills of students, in terms of conceptual proficiency and ease of use with students' opinions has been done.

With the help of the findings from student interviews, it has been concluded that students used all the features of the system and were satisfied with them, the system contributed to the problem solving process in various aspects and it developed students' points of view for problem solving in a positive direction but they experienced time concerns due to their habit of going directly to the result as they were exam-oriented.

The majority of the students indicated that the system was easy to use in general. It has been concluded from the findings obtained about the difficulties (which students encountered while using the system) that students were result-oriented and they found it hard to accept a different system as they solved test questions with paper and pencil for the examinations. With the help of responses given, it has been concluded that the system is successful in general but it can be made more useful by doing some revisions in terms of design.

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