Effect of Web-Based Intelligence Tutoring System on Students' Achievement and Motivation

Recep ÇAKIR [1]

[1], Amasya University, Faculty of Education, Department of Computer Education and Instructional Technology, Amasya, Turkey, recepcakir@gmail.com

http://dx.doi.org/10.17220/mojet.2019.04.004

ABSTRACT

This study aims to investigate the effect of Web-Based Intelligence Tutoring System on Students' Achievement and Motivation in the computer introduction course. For this purpose, an intelligent tutoring system called Office Master was designed and developed that can be reached on the internet. With this software, subjects are taught to students, are presented in audio, visual, and written form. A specific sequence of subjects was determined in the system. The system includes intelligence features for intelligent tutoring systems. Thanks to these features, when students start the lesson, their preliminary information about the subject is checked, and they can follow the subject from the required unit. In addition, students' logs are recorded in the system. A quasi-experimental design with the pretest-posttest control group was used as a quantitative research design to evaluate the effectiveness of the system. It was observed that the achievement of the students was significantly increased as a result of the application, and it was also concluded that the students were very motivated with the system when the results of the motivation survey were examined. It is recommended that similar systems should be applied in other courses so that the courses taught in universities will be more effective and efficient.

Keywords: *Web-based intelligent tutoring system, academic achievement, motivation*

INTRODUCTION

Recently, the development of technology led to the improvement of systems such as computer-assisted instruction (CAI) and Web-based instruction (WBI) and their use in educational processes. The aim of these systems is to create higher quality, effective and efficient teaching environments by increasing the effectiveness of the student during the teaching process. In parallel with this, visual and auditory materials such as animation, simulation, intelligent systems, interactive learning in a computer environment are started to be developed and used in education. One of these environments is the Intelligent Tutoring Systems (ITS) have been an efficient basis for the researchers of artificial intelligence in recent years, and these systems have proven to have an impact on training outcomes when properly designed (Noh, Ahmad, Halim, and Ali, 2012; Ma, Adesope, Nesbit, Liu, 2014; McCalla, 2000). Ma et al. (2014), in their study of meta-analysis, proved that the ITSs are effective tools in educational processes. ITS is defined as an educational system adapted for individuals, aiming to provide high quality and effective education and, for this purpose, creating an individual environment to students like one-to-one interaction with the expert educator, providing the necessary resources punctually, and presenting an environment in which applications are developed to prevent students from bothering in a heap of information (Brusilovsky and Peylo, 2003; Crockett, Latham, and Whitton, 2017). ITSs are adaptive training systems that use intelligent technologies to provide individual training (Crockett, Latham, and Whitton, 2017; Vaessen, Prins, and Jeuring, 2014). In fact, ITS is one of the

components of artificial intelligence and it is seen to be used in the education field, so its importance is increasing steadily. Artificial intelligence is defined as a scientific discipline that deals with the work of the machines that are conceived and designed by humans and that require intelligence to display intelligent behaviors (Akpınar, 1999; Nwana, 1990; Minsky, 1995). In this case, it is used to make decisions like people, to review situations, to make comparisons, to solve problems and to select relevant information. Studies in the field of artificial intelligence is ITS, which became an inevitable technology field after the introduction of the computer in education. Developments in CAI and artificial intelligence systems and the combination of CAI with ITS contributed to the formation of individualized flexible learning environments and had an impact the performance of students (Erdemir, 2015; Sani and Aris, 2014). In ITS, the individualization of a student's learning experience is provided by identifying emotional and cognitive states (Crockett, Latham, and Whitton, 2017). ITS, however, not only provides students with instruction materials but also provides a system that adapts to the students' abilities. Each student has different abilities and has different comprehension. Advanced students are less dependent on course materials and can learn new things faster than weaker ones. These varieties of student capacity suggest the introduction and use of ITS systems. The main feature of the software used in these systems is that they know what to teach, who to teach and how to teach (Akpinar, 1999; McLaren, Deleuw, and Mayer, 2011). Students who use this system are probably seeking less help than they need. In this way, the system can allow students to have more control and allow for special situations that vary depending on the situation and needs. Additionally, it will be able to provide more enabling feedback and, where necessary, to perform additional tasks. In short, these systems are designed according to the individual characteristics of the students and will be personalized. Keleş, 2007; McLaren, DeLeeuw, and Mayer, 2011). Moreover, web-based ITSs provide students with an educational process independent of time and space. Studies show that the integration of ITSs and web-based technologies are very useful for educational purposes (Keleş, Ocak, Keleş and Gülcü, 2009; Brusilovsky and Peylo, 2009; Mohamed and Lamia; 2018).

One of the biggest advantages of web-based ITSs is that the learner is independent of time and space (asynchronous). In this way, the learner can access information at any time and place. ITS is also designed to solve some of the problems of internet-based education. These problems can be summarized as follows:

• It is quite difficult to find the pages that fit the student level in the present knowledge stack as they arrive and to concentrate on the subject

• Pages are presented in a fixed order. There is no suitable and effective presentation for each student.

Considering these problems, it is aimed that the web-based ITSs provide a learning environment suitable for student's knowledge level. Clark and Mayer (2012) stated that students' learning speeds, knowledge levels, motivations, and learning strategies may differ from each other and that students need systems supplying their needs. ITSs are considered as systems that can supply the individual needs of students. In a well-crafted web-based ITS, the content can be custom-designed. In this system presented to students, a student is offered more opportunities thanks to multimedia materials such as animations, videos and moving pictures (Erdemir, 2015). Moreover, unlike classical CAI systems, ITS aims to provide a student with a learning environment that is suitable for the level of knowledge and with an easier, faster and effective learning. Web-based ITSs can provide students with unlimited access to effective and affordable personal courses anytime and anywhere. It proposes student-teacher learning environments, also includes software specifically designed to teach students one-on-one. Its course process is actually similar to the in-class course process and includes notes, examples, exercises, tips, and corrections. Furthermore, student participation will also be increased since the examples in the ITS are linked to daily life (Keleş, 2007). Studies comparing traditional CAI systems and ITS suggest that ITS increases learning quality and reduces learning time (Keleş and Keleş, 2017; Nkambou, Frasson and Gauthier, 1998; Sani, and Aris, 2014; Zhuhadar et al. 2016)

One of the most important features of web-based ITSs is that they are able to respond to the individual learning needs of students in pedagogical activities as much as possible. Students' understanding and perception of a specific subject in school are about how much teachers teach directly. The more the teacher gives the student, the better the students understand, and the faster the teaching, the faster students learn new topics. It is an important process to involve students in education. Therefore, it is important for students

to attend educational activities to understand what they are learning (Noh, Ahmad, Halim, and Ali, 2012). In this respect, ITS tries to define some characteristics that enable to achieve standards to suggest activities such as knowing how to respond to some of the students' actions. It improves learning speed by adapting to students (Davidovic et al., 2003). Web-based adaptive software that responds more to the individual needs of a learner in comprehension will also change the role of teachers. Intelligent software will reduce the teacher's routine workload by running multiple media and virtual media opportunities.

Recent studies on artificial intelligence and web-based ITS, which attracted attention in the relevant field, can be listed as follows;

• Keleş (2007) carried out a study titled “Artificial Intelligence and web-based ITS design, and an application in mathematics teaching during Learning-Teaching process”. For this study, an ITS called ITSMAT was developed. The research population consisted of 42 second-graders of the Department of Elementary Mathematics Teaching. With ITSMAT, it was aimed to teach the subject of “series” which is one of the subjects of mathematics course. As a result of the application, it was observed that the learning performance of the students learning with the classical method was 66% and the learning performance of the students learning with ITSMAT system was 90%.

• Erkoç (2008) conducted a study entitled “expert system modeling for education from the perspective of artificial intelligence”. The aim of the study was to develop an expert system that could approach the subjects from the perspective of artificial intelligence and could be used as a teaching material in teaching environments, as well as an expert in the evaluation of a teaching material. So, a web-based expert system was developed in the study and the questions were evaluated according to “yes” or “no” answers. As a result, the researcher stated that the cost of expert systems was high, and it could not always work 100% error free.

• Aktaş and Doğan (2011) developed a regulatory module application for web-based intelligent tutoring system called PROMATH. In addition to the four modules (user, instruction, information, and student modules) in the traditional ITS system, they developed the fifth module and called it the regulatory module. They included this module in PROMATH which they created with other modules. At the end of the process, it was observed that the regulatory module eliminated the static structures between the instruction and student modules.

• Dağ and Erkan (2004) aimed to improve the studies in ITS field in Turkey and to establish ITS infrastructure. They tried to create a system skeleton that can be applied to multiple courses in Visual Prolog Language. This application was implemented on the information field model, user model, and user interface model from ITS models. As a result, an ITS was developed which enabled students to learn more easily and effectively and included different course subjects.

• Erdemir (2015) aimed to determine the effect of the use of the internet-based intelligent tutoring system (IBITS) on academic success and the persistence of knowledge learned, for teaching the subjects of the work, energy and energy conservation in Physics-I course. As a result of the research, it was understood that Physics-I course, which was based on IBITS, enabled the teacher candidates to learn the unit of the work, energy and energy conservation and to comprehend the information effectively.

• Suebnukarn and Haddawy (2004) developed the COMET, a cooperative intelligent education system for problem-based learning in medicine. The developed system has a multi-mode interface that combines text and graphics to provide a rich communication channel between groups and students. In addition, the system is intended to be used as a guide for developing new scenarios. Later, human lesson strategies were applied in the cooperative intelligent education system. The results indicate that COMET is a usable system in medicine.

• Abu-Naser (2008), designed an intelligent tutoring system called CPP-Tutor to assist students in learning the C++ programming language and to provide an interactive learning environment. The system was using the cover and constraint-based student models and identifying the errors made by students by pattern recognition and giving feedback. The developed system provided the students with an interactive learning

environment and, at the end of the process, the students learned to programme in the C language more quickly and effectively than the students learning with traditional methods.

• Vaessen, Prins, and Jeuring (2014), for the course of introduction to programming, defined help search strategies in an ITS system and aimed to investigate whether the use of these strategies could be estimated with achievement scores. The results of the study were explained by five different strategies, three of which could be predicted with achievement scores.

• Latham, Crockett and McLean, (2014) conducted an experimental study with 72 university students. Their results show that the lessons taught according to the intelligent tutoring system developed to adapt to the learning styles during the course are likely to improve learning positively.

• Noriega, Ramírez and Ramírez (2016) tested their ITS evaluation module with a group of undergraduate students. The results show that the system is more efficient and effective than the computer exam and a traditional test.

• Crockett, Latham, and Whitton (2017) developed a speaker intelligent course system called OSCAR. This system is modeling the learning style of students who use natural language dialogue during the course to dynamically predict and personalize their special courses. The results show that OSCAR-CITS increased predictability and facilitated the discovery of relationships between behavior variables in the four learning styles for students using the system.

Studies show that, ITSs can successfully complete and replace other teaching methods, and provide strong evidence that these are available at all educational levels and in many academic courses. Ma, Adesope, Nesbit, Liu (2014), in their meta-analysis study, reported that the most frequently applied ITS features provided by student modeling are about the highly individualized task selection, command prompt, content submission, and impact of feedback on student achievement.

In this context, the aim of the present study is to design and development a web-based ITS enriched with the opportunities offered to students by considering the multimedia design products called Office Master, and to investigate whether the system affects the success and motivation of students for office programs.

System Design

Unlike the structure of traditional CAI systems and similar online systems, when the infrastructure of the ITS is created, the techniques to be used in tutoring are considered and designed as separate models. In The ITS consists of three components; these are the information area model, the user model, and the teaching model (Erdemir, 2015; Woolf, 2009). Then, the user interface model as the fourth component was added to these three components. (Al-jumeily and Strickland, 1997). All models that make up the system are in contact with each other (Figure 1).

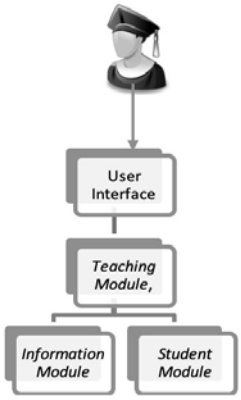

Figure 1. Main components of the intelligent tutoring system

Student module is the module where information about students is recorded. The situations such as students' characteristics, skills, prior knowledge, etc. are determined, and the system is designed and maintained accordingly. In this context, it can be called the most important module. This module is called the education process (Erdemir, 2015; Graesser, Conley and Olney, 2012). In this module, a student enters the system according to his/her personal characteristics and progresses within the system. Personalization based on student characteristics can be in the form of the personalization of content, materials, tests, or remarks. (Xu, Wang, and Su, 2002). A good student module must continuously collect long- or short-term information and make decisions about the educational content using this information. The student module covers both the user's knowledge and behavior. It acts as a guide system in achieving appropriate field information (Bülbül and Batmaz, 2006).

The information module is the module containing the field information to be taught and the educational information of the system. The information module must be in parallel with the information kept in the student module. In other words, when a student module is defined, the information stack suitable for that model should be easily presented to the user (Yong and Zhijing, 2003). Although this organization may seem a bit complex, it is important for the system to function at the expected level.

Teaching module is the structure that determines how education will be carried out by using information in the information module and student module. It makes decisions such as which subject to be started and which order to be followed in education, which questions to be asked, the error messages to be displayed, whether or not to show any tips (Doğan and Kubat, 2008). It is very important in terms of the use of a good strategy in the process of transferring information to students.

User interface module is the module that provides communication between the ITS and students. The main purpose of computer-assisted instruction is to communicate with students. Therefore, one of the most important components to focus on design is the user interface (Al-Jumeily and Strickland, 1997). Components that make up the ITS are represented by visual objects. The more useful and understandable this module is, the more motivated the student is, and the system can generate more reliable reports about both the student model and the orientation (Doğan and Kubat, 2008).

In ITS system created in this study, these components are combined into two parts as the administrator panel and the course panel. Only administrators have access to the administration panel, while both the students and the administrators can access the course panel.

ITS design is a difficult process and must include some characteristic features (Wu, & Lee, 1998; Marciniak, 2014). According to Karaci, Akyuz, Bilgici and Arici (2018), the features of ITSs may vary depending on requirements. However, for a system to be intelligent, it must have some features. Some of the intelligence characteristics used in this study are given below;

1. When students first enter the system, they take a test to detect their level. Their level is determined according to the score obtained from this exam and they are directed to the contents according to their level

2. Students are not allowed to move to the next section before they go to the content they are directed to.

3. Features such as the number of logins to the system by students, the duration of staying in the system, and their answers are recorded. Students who are deficient in course subjects are redirected to the related subject by preventing them from going to the end of the subjects.

4. When students complete a unit, they are directed to take the test related to the unit, and when they do not get enough score from the test, they are directed to repeat the subject and the system makes suggestions according to the situation. They are not allowed to skip to the next unit without having a sufficient score.

5. Students are given the opportunity to see the answers given in the inter-unit exam. The system leads students to content where questions that the student has made wrong

6. The student is monitored to follow all content within the specified period and the next unit is allowed to pass after the exam.

7. If students leave the subject or the system shuts down, they are redirected to the place where they stay when they log back into the system.

8. Students' taught about the system (exam results, duration of stay in the system, etc.) can be transferred to their teacher and students can make comments and communicate with the teacher.

In this study, a Web-Based ITS system has been developed considering the above mentioned features and its effectiveness has been examined.

RESEARCH METHOD

In order to investigate the effect of the web-based ITS, which was designed in the study, a quasi-experimental design with the pretest-posttest control group was used as a quantitative research design. Experimental methods are used to determine the responses of the subjects to the variable as a result of the application of the variables to the subjects under certain conditions and to determine the causative relationship between variables (Fraenkel and Wallen, 2006; Karasar, 2010).

In this study, a quasi-experimental design with the pretest-posttest control group was used to investigate the effect of ITS application on students' academic achievements and motivations. The experimental group students followed the course with ITS applications, while the control group students followed the course with activities and method-techniques appropriate to the related program. Besides this; after the application, the students who participated in the experimental group were interviewed and their thoughts about the application were analyzed.

Demographics about the students participating in the study is shown in Table 1.

Table 1. The number of experimental and control group students

	Male	Female	Total
Experimental	25	15	40
Control	13	27	40
Total	38	42	80

There are 40 students (15 males, 25 females) in the experimental group and 40 students (13 males, 27 females) in the control group.

Data Collection Tool

Achievement test: With the aim of measuring the success of the students with the achievement test, a test of 50 multiple-choice questions was applied. In the preparation of the academic achievement test, expert opinion was taken from the expert faculty members in the related field. Sixty multiple-choice question, prepared in accordance with expert opinions, applied to the 250 university students as a pilot work, the validity and reliability work was also done. As a result of evaluations, 10 questions with low distinguishing values were removed from the test in line with the expert opinions. The distinguishing levels of the remaining 50 questions were determined to vary between +0.65 and +0.38. The difficulty levels of the questions vary between 0.81 and 0.26, and the average difficulty level of the exam is 0.58. The Kuder-Richardson (KR 20) reliability coefficient of an achievement test is 0.76.

Motivated Strategies for Learning Questionnaire (MSLQ): The Motivated Strategies for Learning Questionnaire (MSLQ) was used to measure students' thought about ITS and whether this system influenced their motivations towards the course. The scale was developed by Pintrich, Smith, Garcia, and McKeachie (1991) and adapted to Turkish by Büyüköztürk, Akgün, Özkahveci and Demirel (2004), then applied to 852 university students to investigate the validity-reliability results. It consists of two dimensions as motivation

(31 items) and learning strategies (50 items). The motivation dimension consists of 31 items to measure students' goals for a course, value judgment, beliefs about success in the course, and concerns about the test in this course. The learning strategies dimension consists of 50 items that measure the use of cognitive and meta-cognitive strategies and resource management strategies (Pintrich et.al., 1991). Individuals mark their response on the seven grading Liker-type scales ranging from 1 (absolutely wrong for me" to 7 "absolutely true for me".

Intereview: Interviews were conducted with volunteer students to learn students' opinions about web based ITS application. Therefore, 4 students (2 males, 2 females) from the experimental group were interviewed about the application. In the interviews, the students were asked to evaluate the application about the positive and negative aspects of the intelligence tutoring system. With the semi-structured questions prepared by taking expert opinions, the students' in-depth thoughts about the system and process was analyzed.

Application

The ITS called the Office Master, was applied to the science teaching students of the faculty of education of the University. The second class of science teaching students has 4 hours course per week. During 14 weeks, a total of 56 hours education, 4 hours per week, were applied. It includes the teaching of Microsoft Office Word, Microsoft Office Excel, Microsoft Office PowerPoint, Microsoft Office publisher programs and the internet use, which constitute the curriculum of computer courses offered in the faculty.

The facilities offered to the students are enriched in the multimedia design products (audio, video, animation, interactive content, homework system, etc.) of the Office Master application.

Figure 2 shows the general scheme of ITS system.

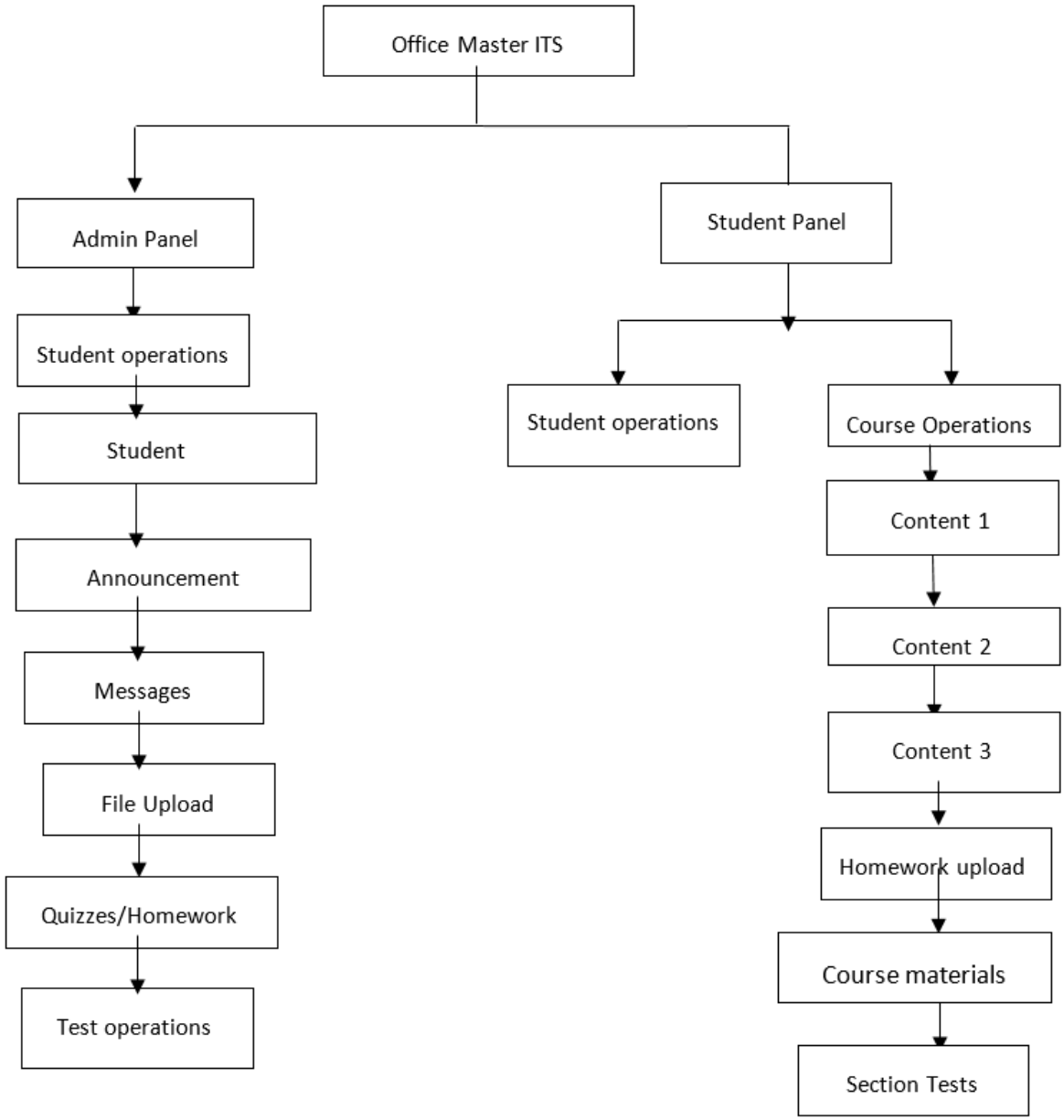

Figure 2. System diagram

In the admin panel, the authorized persons can see the records of students' registration, students' information and their levels (grade status, punishment status, homework and quiz grades). The student panel section consists of the information module and teaching module. In the student operations panel, students can see their course grades, status and quizzes, and can change the password. Students can follow the courses in the course operations section. When the students enter the system firstly, they are directed to the contents according to their exam result to determine their readiness. When students enter the first content, the other subjects are closed to them. The student must follow the contents (Flash animations, interactive content, videos, and additional materials) and learn the subject in the first section to be able to proceed to the next subject. Here, students can find random questions about the related content from the question pool formed by the teacher. If a student takes a grade above the determined grade, the next issue will be active for the student. If the student gets a grade below the determined grade, the section test will be locked until the student repeats the subject. The aim here is to enable the student to repeat the subject during this time. After watching the animation and videos prepared about the content, students perform a sample application accompanied by interactive content (simulations) prepared by the Captivate software. Students are required to complete all procedures to move to the next content. After the application of the course contents, students were given homework. At the end of the subject, students were given the end-of-term tests. At the end of a subject, another Office program was introduced. At the end of each unit, the

intermediate test was applied to the students through the system. After the test, the student who cannot get the previously determined score can repeat the subject and take the test again, then proceed to the next subject. Some screenshots about the Office Master intelligent tutoring system are given in Figure 3

Figure 3: Course page and materials

When the username and password are entered correctly, the student is redirected to the page in Figure 3. On this page, students can access the subject they want to learn by logging in from the menus on the left. On the right side, students see the added announcements. In the lower section, a student can upload the homework given by the system. When the “course materials" link is clicked, students see the materials that are allowed to be downloaded. For example, the Microsoft Excel page is shown. In the menu on the right side, students can solve the prepared test by clicking on the “sample test” link so that they can measure the level of information before going to the main test. Students can access the content prepared in Adobe Flash by clicking on the subject link under the main title. At the bottom of the course page, there are videos related to the subject prepared in Adobe Captivate program. Here, students can learn the subject they want to learn in visual and audio.

Although this system was applied in the experimental group, the students in the control group followed the course according to the traditional method. During the course of the control group, the teacher firstly gave the students information about the subject, and then made applications to improve the subjects. Test results of the experimental and control group were compared at the beginning of the period and at the end of the period.

FINDINGS

Before the application, the achievement pretest was applied to both the experimental group and control group students. The results are shown in the following table;

Table 2. Results of the achievement pretest scores of the experimental and control groups

Group	N	$\bar{x}$	S.D.	t	p
Experimental	40	45.83	10.51	0.74	0.46
Control	40	44.15	9.82		

There was no significant difference between the experimental and control groups according to the independent sample t-test results ($t(78) = 0.74$, $p > 0.05$). In this case, it can be said that the groups are equivalent in terms of academic achievement before starting to the application.

Table 3. Post-test results of experimental and control groups

Group	N	$\bar{x}$	S.D.	t	p
Experimental	40	84.28	6.24	4.56	0.00
Control	40	75.68	6.44		

At the end of the application, the mean score of the students' achievement was found as $\bar{x}$ = 84.28 for experimental group and as $\bar{x}$ = 75.68 for control group. This result shows that students' achievements increase in both groups after the application. It was observed that the scores of the experimental group students were higher than the control group students. Independent sample t-test was run to determine whether this difference was statistically significant. When comparing the t test, it was observed to differ significantly in favor of the experimental group which taught by intelligence tutoring system ($t(78) = 4.56$, $p < 0.05$).

In addition, according to the results of the motivation scale used to measure the students' thoughts about ITS and whether their motivations against the course were influenced by this system, it was observed that their thoughts towards ITS were positive and their motivation was high. Table 4 shows the results of the pretest and posttes of the motivation scale of the experimental and control groups

Table 4. The motivation scale results of experimental and control groups

Variables	Group	N	$\bar{x}$	S.D.	t	p
Motivation Pretest	Experimental	40	4,28	,68	0.31	0.77
	Control	40	4,24	,62		
Learning Strategies Pretest	Experimental	40	4,01	,73	0,40	0.94
	Control	40	3,99	,66		
Motivation Posttest	Experimental	40	4,89	,75	2.65	0.01
	Control	40	4,42	,77		
Learning Strategies Posttest	Experimental	40	4,44	,81	2.44	0.02
	Control	40	4,18	,78		

The pre-test mean scores of the control group students' motivation and learning strategies and the mean scores of the experimental group students' are close to each other. According to independent sample t test results, there is no significant difference between the experimental and control groups in terms of pretest mean scores in both sub-factors [for motivation; $t(78) = 0.31$, $p>0.05$, for learning strategies; $t(78) = 0.40$, $p>0.05$]. In this case, it can be said that both groups are equivalent to each other in terms of motivation and learning strategies before the application. On the other hand as for posttest scores; it is seen that the mean scores of the experimental group students is higher than the control group students. As it is seen in Table 3, the mean score of the experimental group for motivation sub-factor was 4.89 and control group score was 4.42. In terms of learning strategies, the mean score of the experimental group was 4.44 and the control group was 4.18. Independent sample t-test was run to determine whether this difference was significant. The result shows that, there was a significant difference between the experimental group and the control group in favor of the experimental group [for motivation; $t(78) = 2.65$, $p<0.05$, for learning strategies; $t(78) = 2.44$, $p<0.05$]

In addition, interviews were conducted with the students in order to learn the students' thoughts about the application in depth. Interviews were analyzed descriptively. During the interviews, the students expressed that they had learned very well by means of this system and that there was no subject they could not learn and that they had fun and enjoyed the lesson.

One of the students summarizes his thought in the following way;

"It was a different experience for us, we followed the application with amusement and interest. I think we finally learned everything. I think similar applications would be good in other courses"

Another student explains her thoughts as follows;

"We were surprised at first, the system was strange to evaluate and guide us. But then we learned all the things in a fun way. It was a nice experience for us"

According to the results of the interviews, students' opinions about the application are generally positive. Moreover, students made it clear that the implementation of similar systems in other courses will lead to more permanent learning.

DISCUSSION AND CONCLUSION

Web-based ITSs which enable students to see their deficiencies, provide instant feedback, suitable for different learning levels, alleviate teacher workload, and include applications for guidance to teachers, have been used in educational process recently. In this present study, the opportunities of the "Office Master" system prepared using a web-based ITS were presented to the students by the aid of media design products (sound, video, animation, interactive content, homework system, etc.). In this way, it is aimed to increase the retention of learning by using the system made up of contents that are prepared for allowing students to reach information at any time and place. Thus, it is also helped to increase the quality of education together with the developed ITS. In the web-based ITS, students were guided by the teacher, as in traditional learning environments, to create an individual learning environment or a real classroom environment. With the intelligent criteria used, a student is followed at every stage of the learning process and is guided to teach what to do. Because the system is web-based, students are able to enter the system at any time and wherever they want, find their own individual information, and take education in the way the system chooses. This system is student-centered and the student's progress in the learning process depends on their efforts.

The distinguishing characteristics of the developed system are as follows;

- It is an improved ITS for computer training.
- It has a user-friendly interface
- It was designed to proceed comfortably for users at all levels
- It facilitates communication between teacher-student and student-content
- It uses multimedia products to deliver the content
- It was designed according to the "Staging" principle used in the teaching principles and methods.
- It does not allow a student to move from one subject to another without learning a subject so that the subjects can be learned in depth
- Teaching materials can be easily updated by teachers when necessary.

There are similar studies in the literature. For example, Cabada, Estrada, and García, (2011), designed a mobile-based WEB 2.0 learning environment called EDUCA to systematically create adaptive and intelligent course systems. Its content creation is maintained by a community of users, including teachers and students. The system operates under a software that allows for the use of personalized learning material under cooperative and mobile learning environments. They tested the developed system on their graduate and undergraduate students. The students involved in the application have given a positive return on the interface of the system, the ease of creating intelligent teaching, the time to use the system, the time of intelligent teaching and the course organization. Similarly, Keleş, Ocak, Keleş, and Gülcü (2009) developed a web-based intelligent tutoring system called "ZOSMAT" for mathematics education. ZOSMAT's main structure consists of six components including the administration, question bank, student model,

content structure, expert model and user interface. They applied their system to the university students. As a result of the application, they concluded that ZOSMAT is a powerful tool to improve the learning performance of a student.

In the present study, the Web-based ITS called Office Master was implemented on 40 university students. The academic achievements of the students using the application were found to be statistically higher than the students who did not use this application. Similarly, the motivations of the students increased significantly. There are studies reporting that the intelligent internet-based teaching systems used in the education process increase students' academic achievement in different courses and contents (Erdemir, 2015; Karaci, Akyuz, Bilgici and Arici, 2018; Keles, 2007; Noriega, Ramírez & Ramirez; 2016; Pinkwart, Ashley, Lynch and Aleven, 2009; Vaessen, Prins, and Jeuring, 2014). Steenbergen-Hu and Cooper (2014) evaluated some research on the effectiveness of ITSs for university students by meta-analysis. Among the main findings, ITS shows to have a moderately positive impact on university students' academic learning. According to the researchers; ITS provides more effective results than traditional classroom instruction, printed text or computerized materials, computer-based instruction, laboratory or homework, and all other teaching methods and learning activities. Similary; Karaci, Akyuz, Bilgici and Arici (2018) conducted a study to investigate effects of Intelligent Tutoring Systems on academic achievement and retention. As a result of their implementation, they found that the academic achievement of the students using ITS had higher than the control group students who did not use this system.

Another result of the present study is that students who use the Web-based Office Master ITS system had higher motivations than students who did not use this system. Similarly, there are studies in literature related to motivations (Aleven, Roll, McLaren, and Koedinger, 2016; Duffy and Azevedo, 2015; Jackson and McNamara, 2013; Waalkens, Aleven, and Taatgen, 2013). Jackson and McNamara (2013) for example, conducted a study aimed at comparing the performance and motivation of an intelligent tutoring system based on a game on the 84 high school students. According to the results of the study, students in both environments demonstrated equivalent target performance in learning. But they concluded that they showed higher motivation in the game-based ITS. Similarly, according to the study of Diep, Zhu, Struyven, and Blieck (2016), the quality of LMS, when interacting with instructor expertise, in different blended learning conditions, has a significant influence on student satisfaction.

Furthermore, interviews conducted within the scope of this study support quantitative results. The students who participated in the application stated that they both had fun and attended the lesson more carefully. In this way, the students' motivation and achievement in the course may be increased thanks to the ITS application. Jacovina and McNamara (2016) states that one of the main motivations for the creation of technologies related to the ITS is to provide students with an individualized education and feedback, as well as, to train teachers. Therefore, these systems should be developed so that they can be easily integrated into classes and provide adequate support for teachers.

As a result, it was observed that students who took courses according to the intelligent web-based teaching system prepared in consideration of the individual learning characteristics of students increased their achievement and motivation in the course in a remarkable way. The studies on ITS will continue to increase in both developed and developing countries, although there are some problems, such as limited training time, curriculum constraints, limitations on pedagogical pairings (NYE, 2015). Therefore, it may be advisable for researchers to implement similar applications in other courses. In this way, students study their courses by learning all the subjects. This study can be seen as an important contribution to the field as it provides researchers with information about the application of web-based ITS design and its effectiveness. In this sense, future studies can be planned for the use of ITS in different subjects and courses.

REFERENCES

Abu-Naser, S.S. (2008). Developing an intelligent tutoring system for students learning to program in C++. *Information Technology Journal, 7* (7), 1055-1060.

Aktaş B. & Doğan N. (2011). PROMATH: Organizing module application for web based Intelligent tutoring system. *International Journal of InformaticsTechnologies. 4*(2), 25-33

Akpınar, Y. (1999). Zeki öğretim sistemleri. *Eğitim ve Bilim Dergisi, 23* (112), 35-39

Aleven, V., Roll, I., McLaren, B. M., & Koedinger, K. R. (2016). Help helps, but only so much: Research on help seeking with intelligent tutoring systems. *International Journal of Artificial Intelligence in Education,* 26(1).

Al-Jumeily D. & Strickland, P. (1997). *Designing an Interface on the Web for an Intelligent Tutoring System*, IEEE 23rd EUROMICRO Conference, Hungary, 158-162.

Brusilovsky, P.,& Peylo, C., (2003) Adaptive and intelligent Web-based educational systems. In:Brusilovsky, P.,Peylo, C., (Eds.). *International Journal of Artificial Intelligence in Education* 13 (2–4), Special Issue on Adaptive and Intelligent Web-based Educational Systems 159–172.

Bülbül H., & Batmaz, H. (2006). Web destekli ders çalıstırıcı tasarımı. *The Turkish Online Journal of Educational Technology–TOJET,5* (2), 84-88.

Büyüköztürk, Ş., Akgün, Ö. E., Demirel, F., & Özkahveci, Ö. (2004). Güdülenme ve Öğrenme Stratejileri Ölçeği'nin Türkçe formunun geçerlik ve güvenirlik çalışması. *Kuram ve Uygulamada Eğitim Bilimleri Dergisi, 4*(2), 207-239

Cabada, R.Z., Barrón Estrada, M.L., & Reyes García, C.A. (2011). EDUCA: A web 2.0 authoring tool for developing adaptive and intelligent tutoring systems using a Kohonen network. *Expert Systems with Applications, 38*(8), 9522–9529.

Clark, R. C., & Mayer, R. E. (2012). E-*learning and the science of ınstruction: proven guidelines for consumers and designers of multimedia learning*, 3rd Edition. John Wiley & Sons,

Crockett, K., Latham, A., & Whitton, N. (2017). On predicting learning styles in conversational intelligent tutoring systems using fuzzy decision trees. *International Journal of Human Computer Studies,* 97, 98–115.

Dağ F. & Erkan K., (2005) *Öğretim sistemleri için bilginin gösterimi: Web-Tabanlı bir Zeki Öğretim Sistemi örneği*. 1. Uluslararası Mesleki ve Teknik Eğitim Kongresi (MTET 2005), Marmara Üniversitesi, İstanbul, 5-7 Eylül, 2005.

Dağ F. & Erkan K. (2004). Prolog tabanlı zeki öğretim sistemi. *Pamukkale Üniversitesi Mühendislik Bilimleri Dergisi, 10*, 45-55.

Davidovic, A., Warren J., & Trichina E., 2003. *Learning benefits of structural example based adaptive tutoring systems*. IEEE Transactions on Education, 46(2), 241–251.

Diep, A. N., Zhu, Ch., Struyven, K., & Blieck, Y. (2016). Who and What contributes to student satisfaction in different blended learning modalities? *British Journal of Educational Technology*. 48, 473–489. doi: 10.1111/bjet.12431

Doğan, N. & Kubat B. (2008). *Zeki öğretim sistemleri için yeni bir bileşen: Düzenleyici Modül*. *Bilişim Teknolojileri Dergisi, 2* (2), 5-9

Duffy, M. C., & Azevedo, R. (2015). Motivation matters: Interactions between achievement goals and agent scaffolding for self-regulated learning within an intelligent tutoring system. *Computers in Human Behavior*, 52, 338-348. doi:10.1016/j.chb.2015.05.041

Erdemir M. (2015) *Internet tabanlı bir zeki öğretim sisteminin fizik eğitimine uyarlanması ve uygulanması. [Integratıon and application of an internet based intelligent tutoring system to physics education]* Unpublished dissertation. Gazi Üniversitesi, Ankara.

Erkoç, M. F. (2008). *Yapay zekâ perspektifinde eğitime yönelik uzman sistem modellemesi*. [*Modelling an instructional expert sytem perspective in artificial intelligence]* Unpublished Master Thesis, Marmara Üniversitesi, İstanbul.

Fraenkel, J. R., & Wallen, N. E. (2006). *How to design and evaluate research in education*. (6th ed.). New York: McGraw-Hill International Edition.

Graesser, A. C., Conley, M. W. & Olney, A.(2012). *Intelligent tutorıng systems, APA Educational Psychology Handbook* (3nd Edition) (Eds. Graham, S., Harris, K.), American Psychological Association, Washington.

Jackson, G. T., & McNamara, D. S. (2013). Motivation and performance in a game-based intelligent tutoring system. *Journal of Educational Psychology, 105*(4), 1036-1049.

Jacovina, E.J., & McNamara, D.S. (2016) *Intelligent tutoring systems for literacy: existing technologies and continuing challenges*. In: Atkinson, R. (ed.) Intelligent Tutoring Systems: Structure, Applications and Challenges. Nova Science Publishers Inc, NY

Karaci A., Akyuz H.İ,. Bilgici G. & Arici N. (2018). Effects of web-based intelligent tutoring systems on academic achievement and retention. *International Journal of Computer Applications 181*(16), 35-41

Karasar, N. (2010). *Bilimsel araştırma yöntemi*, Ankara: Nobel Yayınları.

Keleş, A. (2007). *Öğrenme-Öğretme Süresince Yapay Zekâ ve Web Tabanlı Zeki Öğretim sistemi tasarımı ve matematik öğretiminde bir uygulama*, *[Artificial intelligence and web based intelligent tutoring system design in learning-teaching process and an application in mathematics teaching]*. Unpublished dissertation, Atatürk Üniversitesi, Erzurum.

Keleş A, Ocak R, Keleş A, & Gülcü A (2009) ZOSMAT: web-based intelligent tutoring system for teaching-learning process. Expert Syst Appl 36(2):1229–1239

Keleş, A. & Keleş, A. (2017). BİDEMAT - Zeki Öğretim Sistemi, *Turkish Studies, 12*(6), 547-564.

Latham, A., Crockett, K., & McLean, D. (2014). An adaptation algorithm for an intelligent natural language tutoring system. *Computers & Education,* 71, 97-110. http://dx.doi.org/10.1016/j.compedu.2013.09.014

Ma, W., Adesope, O. O., Nesbit, J. C., & Liu, Q. (2014). Intelligent tutoring systems and learning outcomes: a meta-analysis. *Journal of Educational Psychology, 106*(4), 901–918.

Marciniak, J. (2014) Building intelligent tutoring systems immersed in repositories of e-learning content. *Procedia Computer Science,* 35, 541–550

McCalla, G. (2000). The fragmentation of culture, learning, teaching and technology: Implications for artificial intelligence in education research. *International Journal of Artificial Intelligence, 11*(2), 177-196

McLaren, B. M., DeLeeuw, K. E., & Mayer, R. E. (2011). Polite web-based intelligent tutors: can they improve learning in classrooms? *Computers & Education*, 56, 574–584. doi: 10.1016/j.compedu.2010.09.019.

Minsky, M., 1995. *Smart Machines. In Brockman*, J. (ed) The Third Culture. Simon & Schuster: New York.

Mohamed H. & Lamia M. (2018). Implementing flipped classroom that used an intelligent tutoring system into learning process. *Computers & Education 124*, 62-76

Nkambou, C. Frasson, & G. Gauthier (1998). A new approach to ITS curriculum and course authoring: The authoring environment, *Computers & Education , 31*(1), 105-130.

Noh, N.M., Ahmad, A., Halim, S.A., & Ali, A.M. (2012), Intelligent tutoring system using rulebased and case-based: a comparison. *Procedia - Social and Behavioral Sciences* 67(10), 454–463

doi:10.1016/j.sbspro.2012.11.350, ISSN 1877-0428

Nye, B. D. (2015). Intelligent tutoring systems by and for the developing world: A review of trends and approaches for educational technology in a global context. *International Journal of Artificial Intelligence in Education,* 25(2), 177–203.

Nwana S.N. (1990) . Intelligent tutoring systems: An overview. *Artificial Intelligence Review*, 4, 251-277.

Pinkwart, N., Ashley, K., Lynch, C., & Aleven, V. (2009). Evaluating an Intelligent Tutoring System for making legal arguments with hypotheticals. *International Journal of Artificial Intelligence in Education,* 19, 401–424.

Pintrich, P. R., Smith, D. A. F., Garcia, T. & McKeachie, W. J. (1991). *A Manual for the use of the motivated strategies for learning*. Michigan: School of Education Building, The University of Michigan. (ERIC Document Reproduction Service No. ED338122)

Ramírez-Noriega, A., Juárez-Ramírez, R., & Martínez-Ramírez, Y. (2016). Evaluation module based on Bayesian networks to Intelligent Tutoring Systems. *International Journal of Information Management*. *37*(1), 1488–1498 http://doi.org/10.1016/j.ijinfomgt.2016.05.007

Sani, S., & Aris, T., (2014). Computational intelligence approaches for student/tutor modeling: a review. In*: Proceedings of the 2014th International Conference on Intelligent Systems, and Simulation May 2014. p. 72-76.*

Steenbergen-Hu, S., & Cooper, H. (2014). A meta-analysis of the effectiveness of Intelligent Tutoring Systems (ITS) on college students' academic learning. *Journal of Educational Psychology,* 106, 331–347.

Suebnukarn, S., & Haddawy P., 2004. A collaborative intelligent tutoring system for medical problem based learning. *In: Ninth International Conference on Intelligent User Interface*, pp. 14–21. Madeira, Portugal

Xu, D., Wang, H., & Su, K. (2002). Intelligent Student Profiling with Fuzzy Models, *35th Annual Hawaii International Conference on System Sciences, IEEE,1-8*. http://doi.ieeecomputersociety.org/10.1109/HICSS.2002.994005

Vaessen, B. E., Prins, F. J., & Jeuring, J. (2014). University students' achievement goals and help-seeking strategies in an intelligent tutoring system. *Computers & Education*, 72, 196–208.

Waalkens, M., Aleven, V., & Taatgen, N. (2013). Does supporting multiple student strategies lead to greater learning and motivation? Investigating a source of complexity in the architecture of intelligent tutoring systems. *Computers & Education, 60*(1), 159 - 171. doi:10.1016/j.compedu.2012.07.016

Wu, A. K. W., & Lee, M. C. (1998). Intelligent tutoring systems as design. *Computers in Human Behavior*, 14, 209–220.

Woolf, B. P. (2009). *Building intelligent interactive tutors: Student-centered strategies for revolutionizing e-learning.* Burlington MA: Morgan Kaufman Publishers.

Yong, Z., & Zhijing, L. (2003). A Model of web oriented intelligent tutoring system for distance education. *Proceedings of the Fifth International Conference on Computational Intelligence and Multimedia Applications (ICCIMA'03*), 78-83.

Zhuhadar, Marklin L. S, Thrasher, E. & Lytras M.D. (2016) Is there a gender difference in interacting with intelligent tutoring system? Can bayesian knowledge tracing and learning curve analysis models answer this question? *Computers in Human Behavior (61*) 198-204.