E-LEARNING EXPERIENCE
WITH ARTIFICIAL INTELLIGENCE SUPPORTED SOFTWARE:
An International Application on English Language Courses

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ABSTRACT

Nowadays, artificial intelligence supported e-learning scenarios are widely employed by educational institutions in order to ensure better teaching and learning experiences along educational activities.

In the context of performed scientific studies, positive results often encourage such institutions to apply their intelligent e-learning systems on different types of courses and report advantages of artificial intelligent in especially education field. It seems that the future of education will generally depend on important, multidisciplinary research areas like artificial intelligence. At this point, this study aims to report obtained findings regarding to usage of an artificial intelligence based e-learning software in English language courses. In this sense, the e-learning software has been used for one term in three different countries: Turkey, Italy, and Romania. As an international perspective for their intelligent, e-learning software and the approach, the authors are satisfied with the positive results.

Keywords: e-learning, artificial intelligence, cognitive development optimization algorithm, computer education, intelligent software system.

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INTRODUCTION

Current era of educational studies is highly associated with developments and improvements in the digital world. In other words, computer oriented technologies has an important role on shaping the function of education in improving teaching and learning experiences. Today, e-learning is widely used for reaching to desired educational outcomes in different educational conditions (Monahan *et al.*, 2008; Trelease, 2015; Van Nuland, & Rogers, 2015; Ruiz *et al.*, 2006; Wang, 2013; Wilson *et al.*, 2007; Yoo, & Huang, 2015).

As general, individuals are aware of new practical ways on reaching to desired information faster and sharing it with all over the world, thanks to computer oriented educational approaches, methods, or techniques.

Of course, also recent revolutionary communication technologies like Internet have an important role on making all of these changes and developments possible. In addition, rise of artificial intelligence field in almost every field is also another remarkable subject that should be taken into consideration. As a digital method of simulating human thinking/behaviors and natural dynamics, the artificial intelligence field is a strong research trend that will shape the world in the future. Even today, it has been widely used for multidisciplinary purposes in order to obtain better application/solution approaches in certain problems.

When it is examined in the context of educational studies, artificial intelligence based approaches are often preferred in order to develop more effective, advanced e-learning systems. When we examine the related literature, it is possible to find many scientific studies that have been performed in the sense of using artificial intelligence oriented approaches, methods, or techniques for educational purposes (Bulut Ozek et al., 2013; Conati et al., 2015; Graesser et al., 2005; Hernández - Del - Olmo, & Gaudioso, 2013; Hooshyar et al., 2015; Nespit et al., 2014; Jain et al., 2014; Walia et al., 2015; Wang et al., 2015; Wiggins et al., 2015). It is clear that employment of artificial intelligence in education has given many advantages to teachers and researchers and enabled them to solve many teaching/learning oriented problems or unclear issues, thanks to mathematically and logically advanced solution ways.

Today, educational institutions often prefer designing artificial intelligence supported e-learning scenarios and applying them in different courses or educational activities in order to improve teaching and learning experiences. Day by day, more emphasis is given on teachers' and the students' role on educational activities and their situations changing dynamically along a typical process. Even employment of emotion-aware, intelligent approaches has been reported recently in the related literature (Harley et al., 2015). Generally, findings of performed scientific studies point positive results, which is a sign for that the future of education will be based artificial intelligence, too.

In the context of the related explanations, this study aims to report obtained findings regarding to usage of an artificial intelligence based e-learning software in English language courses. Learning a foreign language is often found by students as a difficult educational task/activity, so more emphasis for applying such an intelligent e-learning approach was given for courses on learning English. Briefly, the e-learning software has capable of evaluating students' learning performances in order to improve their experiences. In this sense, a hybrid evaluation system, which was formed by an artificial neural network and cognitive development optimization algorithm, is included under a web based e-learning software system. Actually, the e-learning software in this study is a new version of a formerly developed system/approach, which was used by the authors for a while in e-learning activities. Because of early obtained positive results, the authors still continue to perform new scientific studies over the software system. The most recent research approach is employment of the software in international conditions. In this sense, the software has been translated into some new languages along with new updates and used in some countries for specific courses.

The remaining content of this paper is shaped as follows: The next section focuses on the artificial intelligence approach employed under the e-learning software. Following to that, the third section provides more information about the intelligent, e-learning software and explains the performed educational activities briefly. After the third section, application and evaluation works performed for English language course given at three different countries are explained in detail and finally, the content ends with a brief discussion on conclusions and future works.

AN ARTIFICIAL INTELLIGENCE APPROACH ON E-LEARNING

The e-learning software, which was designed and developed by the authors have an intelligent mechanism for improving students' learning experiences. At this point, the main objective of this mechanism is to determine appropriate digital materials that will be viewed along a possible e-learning activity process. In order to ensure that, two different artificial intelligence techniques: artificial neural networks and cognitive development optimization algorithm have been used in order to form a hybrid evaluation approach under the e-learning software. More details regarding to the intelligent evaluation approach can be expressed briefly as follows:

> ➢ Artificial intelligence based evaluation mechanism is able to determine which material will be viewed next according to students' learning levels. In order to achieve this mechanism, each digital course material (lecture notes, exams, quizzes...etc.) have some importance points with the category tags defined by teachers.

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- Along their e-learning activities, students can gain or lose some success points by viewing the provided digital materials. As it can be understood, different success points are gathered by the software in order to obtain learning level values for each student.
- Categories related to the e-learning materials and learning level types for students are same values, which are typically subjects associated with the course given. So, it is possible for the teacher to define a new learning level type and also a new material category at the same time.
- By taking the related explanations above, we can say that determining the most appropriate material depends on matches among low learning levels and categories meeting with these levels.
- In order not to affect flow of the paper negatively, technical details for the employed artificial intelligence techniques have been omitted. At this point, only some essential information on the intelligent evaluation mechanism of the hybrid system can be expressed as follows:
- As it was expressed before, the hybrid evaluation mechanism is formed by two techniques called as artificial neural networks and cognitive development optimization algorithm respectively. At this point, cognitive development optimization algorithm is used for training the artificial neural network model, which is able to adjust itself for giving appropriate outputs for received input values. Briefly, the artificial neural network model has inputs, which are automatically updated according to active digital materials that are viewed by students to gain success points. The model then can determine output values according to different learning level types by evaluating input values received each time. General structure of the artificial neural network model can be changed by teachers according to desired educational set-ups. Readers, who want to have more detailed about the artificial neural networks technique are referred to (Elmas, 2003; Basheer, & Hajmeer, 2000; Fyfe, 2005; Mäkisara *et al.*, 2014; Schmidhuber, 2015; Tino *et al.*, 2015; Yegnanarayana, 2009).
- Artificial neural network model is trained with training data set stored in infrastructure of the e-learning software. This data set can be updated with additional data sets given by teachers. As default, teachers are able to feed the model with examples of learning level output values according to different success point scenarios for the digital materials provided over the software.
- Cognitive development optimization algorithm, which is a new artificial intelligence based optimization algorithm developed by the authors, has the function of training the artificial neural network model. In the context of training process, algorithm particles are employed as weight and bias values of the artificial neural network. At this point, the model is trained by using the Mean Square Error criteria focusing on differences between obtained and desired output values.

Cognitive development optimization algorithm is a typical swarm intelligence based optimization algorithm. In order to have some information about fundamentals of swarm intelligence, readers are referred to (Blum, & Groß, 2015; Blum, & Li, 2008; Bonabeau *et al.*, 1999; Garnier *et al.*, 2007; Hinchey *et al.*, 2007; Kennedy *et al.*, 2001; Mishra *et al.*, 2015).

➢ The intelligent evaluation mechanism on evaluating students' learning levels and determining digital materials is done as follows: After a training session, the artificial neural network gives outputs for each student's performance on the viewed materials. After gathering success points gained via several materials on a specific course subject, it is then possible for the software to determine if a student is successful enough or not on learning the related course subject. According to this criterion, the intelligent evaluation mechanism then chooses the most appropriate material that will be viewed next on the e-learning software interface.

➢ While choosing the most appropriate material that will be viewed next, category regarding to the lowest learning level value is considered and a random material from that category has been chosen. At this point, high priority is given on the materials having low number of views and low importance points. It is possible for a digital material to have more than one category tags but it can be still chosen by the system to be viewed; if the objective student has low learning level value about it. On the other hand, the system can act randomly to make choice; in case of equalities among materials.

E-LEARNING SOFTWARE AND EDUCATIONAL ACTIVITIES

As it was also mentioned in introduction sentences of this paper, the intelligent e-learning software reported in this study is a new version of a formerly developed system/approach, which was used by the authors for e-learning activities in computer programming oriented courses. Because of obtained positive results, the authors have done some updated in order to fit the software to different kinds of courses. For international purposes, it has been also translated into different languages. In order to have enough idea about the software, it is better to focus its interfaces and performed educational activities over the related interfaces.

Interfaces of the E-learning Software

Briefly, the e-learning software is a web application, which has an easy-to-use, practical interface. Because of its highly flexible design, the software can be run easily over PCs, laptops, and also mobile devices. For e-learning scenarios, the software comes with three types of interfaces to which users can reach by using their own username and password.

Firstly, the admin interface is for managing the data regarding to user profiles and adjusting some software system options. The second interface, teacher interface provides all necessary components in order to enable teachers to form their own courses, upload digital materials, create exams/quizzes, define importance points, learning level-category types, and also track students over the system. Figure 1 shows a screenshot from the teacher interface.

Figure 1.
A screenshot from the teacher interface.

The third interface: student interface is for enabling students to view defined courses reach to provided e-learning materials. Generally, student interface has an effective design, which employs simple controls to perform everything in order to ensure a simple but effective enough e-learning experience. In this context, the Figure 2 shows a screenshot from the student interface.
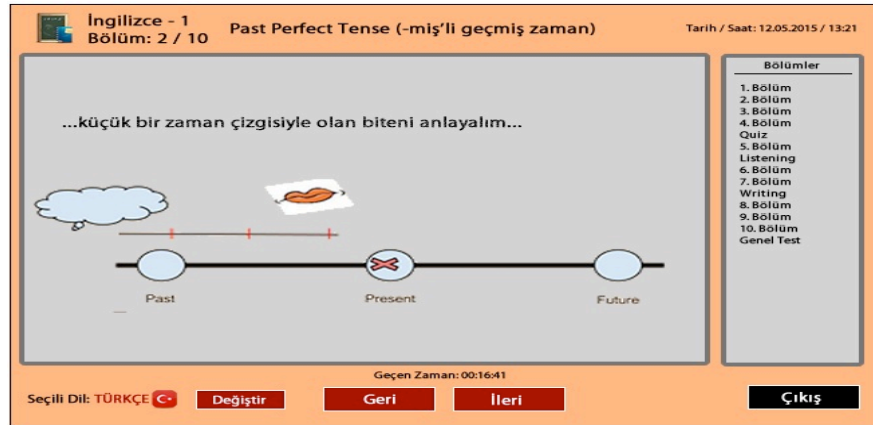

Figure 2.
A screenshot from the student interface.

Educational Activities over the Software

By taking the related interface for students and teachers, main educational activities that can be performed over the intelligent- e-learning software can be expressed briefly as follows:

➢ Over the student interface, it is possible to view provided courses and the rest of digital materials associated with these courses. Students generally view any type of material that can be uploaded by teachers. While some digital materials viewed over the interface are simple, text-based lecture notes, some other ones are for enabling students to gain success points. In addition to that materials, created exams/quizzes are used within students' learning activities, too. Interactions occurred between a student and the material may result to gaining or losing some success points, which will be used by intelligent evaluation mechanism. So, it is important for students to use the software in order to experience effectiveness of the artificial intelligence approach better.

➢ Teachers take place in the other side of the e-learning process experienced via the intelligent e-learning software. Teachers are allowed to form their courses, upload their course materials and perform any other activities regarding to management of intelligent evaluation mechanism of the software. In more detail, a teacher can revise intelligent evaluation function, define learning/category types, and also view students' performances along an educational time period.

➢ A representative schema for educational activities performed by students and teachers over the software interfaces is shown in Figure 3.
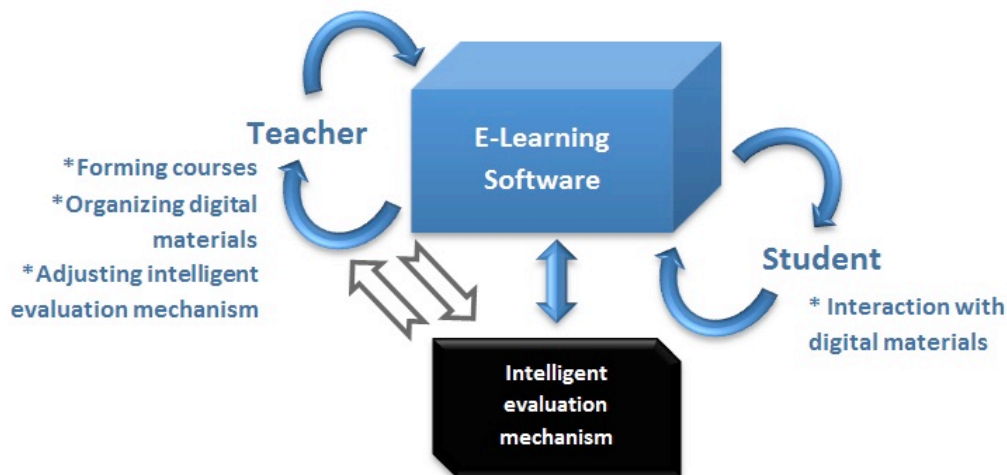

Figure 3.
A schema for educational activities performed by students and teachers.

EVALUATION

In the sense of study objectives, the intelligent e-learning software has been used for English language courses given at universities from three different countries: Turkey, Italy, and Romania.

In order to achieve that, a total of 180 students from Usak University, University of Bologna, and University of Oradea (60 students for each university) has taken part in two different evaluation works.

The students have been enabled to use the e-learning software in their native languages: Turkish, Italian, or Romanian.

Experimental Evaluation Work

In order to perform the experimental evaluation work, experimental and control groups for each university were formed with attendance of the related students in English language courses.

In more detail, 30 students for each university took part in the experimental group whereas other remaining 30 ones were in the control group. In addition to the face-to-face lectures performed for one term, the students in the experimental group have used also intelligent e-learning software in order to improve educational process.

On other hand hand, the students in the control group have taken only traditional face-to-face lectures along the related time period.

At the end of the one term, students' success grades for English language courses have used as findings of the experimental evaluation work. Students' success grades have been calculated by summing 40% of the visa examination grade and 60% of the final examination grade. Students with success grades equal to 60 or below have passed the course(s).

In order to have balanced conditions, the groups have been formed by taking students' past academic achievements into consideration.

Furthermore, same course materials have been used for the courses given at the related universities.

Briefly the English courses were based on essential grammar subjects and the related teaching/learning activities in the context of reading passages focusing on these subjects.

Table 1. provides the findings from the experimental evaluation performed for the related courses.

Table 1.
Findings from the experimental evaluation work.

University/Country	Group	English Language Course Passed/Total Students	Mean	Median	Standard Deviation
Usak University /Turkey	Experimental	24/30	72,65	75,00	12,28
	Control	18/30	66,00	71,00	14,57
University of Bologna/Italy	Experimental	27/30	78,33	80,00	11,85
	Control	23/30	69,68	71,20	12,32
University of Oradea/Romania	Experimental	26/30	77,65	81,15	13,49
	Control	21/30	69,05	73,70	12,99

Findings obtained via experimental evaluation work show that usage of intelligent e-learning software has improved students' academic achievements in English language courses.

According to the obtained results, we can also express that the software is appropriate to be used by students with different nationalities even the software interfaces are in same design and function features.

In addition to the evaluation work on academic achievement situation, it is also important to focus more on students' ideas about the employed software and the applied educational process. So, another evaluation work has been performed by the authors.

Student Survey Work
At the end of the courses, a student survey work has been performed in order to receive feedbacks from students, who used the intelligent, e-learning software (experimental groups).

In this way, it has been aimed to determine if the students were satisfied with the software and the experienced educational process. The survey included a total of 10 statements, which are about educational effects of the software and experiences regarding to the one-term English language courses.

The students have been wanted to give response for each survey statement according to the Likert Scale; as 1: "I totally disagree, 2: "I disagree", 3: "No opinion", 4: "I agree", and 5: "I totally agree".

The survey has been provided in three different languages according to the objective universities. Table 2. provides the student survey statements and the obtained responses.

Table 2.
Student survey statements and the obtained responses.

No	Statement	Responses[1,2,3]				
		1	**2**	**3**	**4**	**5**
1	"I enjoyed this educational process."	TR→0 IT→0 RO→0	TR→1 IT→2 RO→1	TR→1 IT→2 RO→2	TR→6 IT→6 RO→4	TR→22 IT→20 RO→23
2	"I have improved my academic achievement in the English language course, thanks to this educational process."	TR→0 IT→0 RO→0	TR→2 IT→2 RO→1	TR→2 IT→3 RO→1	TR→8 IT→9 RO→7	TR→18 IT→16 RO→21
3	"It was generally easier to understand English Grammer subjects, thanks to this approach."	TR→0 IT→0 RO→0	TR→0 IT→2 RO→0	TR→2 IT→1 RO→1	TR→3 IT→5 RO→7	TR→24 IT→22 RO→22
4	"I want to take part in such educational process again."	TR→0 IT→0 RO→1	TR→1 IT→1 RO→1	TR→3 IT→4 RO→2	TR→6 IT→4 RO→7	TR→20 IT→21 RO→19
5	"This approach should be employed for also some other courses."	TR→0 IT→0 RO→0	TR→0 IT→2 RO→1	TR→4 IT→1 RO→1	TR→10 IT→9 RO→8	TR→16 IT→18 RO→20
6	"I liked digital e-learning materials provided over the software."	TR→1 IT→0 RO→0	TR→1 IT→0 RO→3	TR→2 IT→3 RO→3	TR→4 IT→6 RO→4	TR→22 IT→21 RO→20
7	"The e-learning software generally focused on grammer subjects that I have problems with."	TR→2 IT→1 RO→2	TR→2 IT→3 RO→3	TR→2 IT→3 RO→4	TR→8 IT→7 RO→10	TR→16 IT→16 RO→11
8	"I didn't like the usage of e-learning software."	TR→21 IT→20 RO→25	TR→8 IT→7 RO→4	TR→1 IT→2 RO→1	TR→0 IT→1 RO→0	TR→0 IT→0 RO→0
9	"The e-learning software was effective at ensuring educational conditions."	TR→1 IT→0 RO→0	TR→1 IT→0 RO→1	TR→2 IT→1 RO→3	TR→7 IT→9 RO→3	TR→19 IT→20 RO→23
10	"The e-learning software used in this process was not easy-to-use."	TR→22 IT→19 RO→21	TR→6 IT→7 RO→5	TR→2 IT→4 RO→3	TR→0 IT→0 RO→1	TR→0 IT→0 RO→0

1 Total respondents: 30 for each university / country

2 Likert Scale: 1: "I totally disagree", 2: "I disagree", 3: "No opinion", 4: "I agree", 5: "I totally agree"

3 TR: Turkey (Usak University), IT: Italy (University of Bologna), RO: Romania (University of Oradea)

When we examine the Table 2. it can be seen that the students from the experimental groups of different universities/countries are satisfied with the e-learning process and the employed intelligent, e-learning software.

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CONCLUSIONS AND FUTURE WORK

In this study, application of an artificial intelligence supported e-learning software in English language courses and the obtained results have been explained briefly.

As an international approach, usage of the software in different countries with translated versions have enabled the authors to understand better about success of the e-learning software and its intelligent evaluation mechanism on improving e-learning experiences.

The process has also enabled the students to experience an alternative way of learning English language, thanks to an intelligent e-learning software system, which is able to determine the most appropriate digital e-learning material according to each student's learning levels.

Obtained results from two different evaluation works show that the intelligent e-learning software is effective enough to provide better learning experiences and enable students to learn English better. The results also show that students from different countries/universities were satisfied with the employed software and enjoyed the educational activities.

Furthermore, they have improved their academic achievements in the sense of English language courses. Eventually, the e-learning software and its artificial intelligence based evaluation approach have been effective enough to receive positive results.

Although this study is a typical future plan after positive results received with the first version of the software, the authors still have same level of motivation to use the intelligent e-learning software in different types of courses. Additionally, there are also some plans to translate the system into more languages and thus, test it in different countries with even different conditions.

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