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The Effects Of Intelligent Electronic Mentoring System (AKEDAS) Designed To Accommodate Learning Styles On Academic Development

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ABSTRACT

In this study, the results of a research aimed at analyzing the effects on the academic development of students utilizing a system designed by the authors to provide course materials and mentoring services based on the learning styles of students, called Intelligent Electronic Mentoring System (AKEDAS), is presented. AKEDAS, using expert systems-derived and rule-based knowledge presentation and artificial intelligence support, identifies the student, performs needs analysis, and automatically provides the types ofthe necessary teaching materials and the guidance necessary to meet the learning requirements. In this way, AKEDAS presents learning content that conforms to the student's learning style and the individual's cognitive knowledge level. If the system does not generate a solution or if the student requests support from a mentor, the mentor enters the loop. The research has been conducted in experimental scientificmanner, and the pre-test scores of the experiment and control groups have been observed to avoid meaningful differences. The experiment and control groups have displayed a homogeneous distribution at the start of the exercise. When the pre- and post-test scores, performed using success tests, are analyzed, a meaningful difference is observed in favor of the experimental group's post-test scores. In the process, the academic success rates of students have been observed to increase and to have more continuity.

Keywords: E-mentoring, intelligent electronic mentoring system, learning style, artificial intelligence, expert systems

INTRODUCTION

Affected by the advances in information and communication technologies, educational processes are now carried out through online support or an online base. The transfer of the processes to an online environment has allowed for mentoring services as well to be carried out outside of class and even the school. Moreover, with face-to-face mentoring being offered online, the concept of e-mentoring has emerged. Now students are able to receive mentoring services from teachers synchronously or asynchronously, without being confined to a location, and are able to benefit from teachers' experiences. In parallel, in today's educational mentoring, students' learning styles receive more attention. In this way, a more effective and efficient process is intended to be carried out.

Additionally, to expand the scope of such systems and to increase their availability, it is important to create widely-available and individualized systems, which are adaptable to the current technological infrastructure and meet students needs. In this way, it will be possible to create learning environments with consideration for differences of individual students, take advantage of diverse methods, and increase learning quality and to be able to carry out mentoring activities effectively and efficiently.

We are faced with the general opinion that in real life and in a classroom environment, teachers consider learning styles that are appropriate for themselves. Negative effects of this situation are attempted to be minimized through certain classroom activities or teachers' capacity for ad hoc decision making. However, in e-environments, teachers or system designers coming up with designs that are based on their own learning styles may lead to problems being experienced by students during the learning process. The considerationfor the match between students' learning styles and the educational style used in the system design presents a significant significance. Therefore, it can be readily stated that if the individual learning styles of students are taken into account when learning environments are being prepared, and if such systems adapt themselves to students, then learning can be achieved in a convenient and effective manner.

Learning Styles

There have been various definitions of the concept of learning style (Guild and Garger, 1998). It has been stated that there are different behaviors that indicate how an individual realizes learning and how the information that has been learned is put to use (Kolb, 1984). The individual's manner of using intelligence shows his or her learning style (Gregorc, 1979, cited in Taylor, 1997). Learning styles may also be considered to be indicators of how individuals perceive learning environments, how they enter into interactions with learning environments, and how they react to learning environments using their cognitive, affective and physiological attributes (Keefe and Ferrell, 1990). According to Peker (2003), learning style is "*the individual's perception and processing of information in an organized and sequential manner using his or her cognitive characteristics.*" Additionally, it can be considered to be a path that starts with the individual focusing on new and difficult information, and continues with information acquisition and its storage in consciousness (Dunn and Dunn, 1993). The topic of learning style has such perceptive dimensions as seeing, hearing, moving, touching, smelling and testing, reading and writing and establishing communication among individuals. These various perceptive dimensions emerge in individuals' interactions with their environments (James and Galbrait, 1985, cited in Ekici, 2003). Learning style may be acknowledged to develop as a result of the individual's personality, his or her relationship with the environment and experiences in the individual's educational life based on learning (Nunan, 1995). Learning styles are reflections of individual learning methods, existing knowledge and processes. Since knowledge acquisition is the goal in all learning styles, learning styles carry importance (Lahaie and Tittenberger, 2006).

At this point, how to decide what the individual's learning style is, or how this will be determined, needs to be resolved. It is observed that there are several models in literature for determining learning styles. One of the prevailing learning style models is Kolb's learning style model. Kolb (1984) defines learning style as the personally preferred method for learning. In Kolb's model, four learning styles have been determined based on the student's or the individual's perception-processing, and four learning profiles which correspond to these styles. In Kolb's learning style model, the individuals' learning styles are presented in the form of a continuum. There are four learning types within this continuum. These are: concrete experience, reflective observation, abstract conceptualization, and active experimentation. The learning paths that signify each learning style are distinct from each other. These are, "feeling" for concrete experience, "watching" for reflective observation, "thinking" for abstract conceptualization, and "doing" for active experimentation, respectively (Kolb, 1984;1985).

In this study, the Kolb learning style inventory has been used for the students in the experimental group. This inventory has been preferred as it is based on a more comprehensive experiential learning and development theory (DeBello, 1990: 203) compared to other tests for personality and learning styles.

Artificial Intelligence (AI) and Intelligent Educational Systems (IES)

Artificial intelligence systems are those that are able to think, act and reason like humans (Russell and Norvig, 1995). Systems that are created using artificial intelligence and advanced learning technologies are called intelligent educational systems. Intelligent educational systems are computer software used for designing what to teach, how to teach it, and whom to teach. In other words, it is computer software that uses artificial intelligence techniques, represents knowledge using intelligent educational systems, and interacts with the student (Clancey, 1987; VanLehn, 1988). Intelligent educational systems may be assessed to be the current state in the development of advanced learning technologies. Intelligent educational systems may be thought of as using computer software as an effective educational tool. As a matter of fact, in a study conducted in 2007, Karaosmanoğlu stated that academic achievement in physical sciences can be increased further using intelligent educational systems incorporating audio-visual media. In research conducted at the Carnegie Mellon University, traditional computer-aided educational systems were compared with intelligent educational systems.According to data obtained, intelligent educational systems were shown to increase the quality of learning by 43% while cutting time required for learning by 30% (Keleş, 2007). In a study conducted in 2011, Bahçeci has stated that intelligent educational systems have positive effects on the academic development of students. In research conducted at the Carnegie Mellon University in which traditional computer-aided educational systems were compared with intelligent educational systems, intelligent educational systems were shown to increase the quality of learning by 43% while cutting time required for learning by 30% (Frasson and Aimeur, 1998). The most significant factor in increasing quality of education is observed to be individualization of education by basing it on the student's level of qualifications.The roadmap for learning provided to the student by the intelligent educational system in response to the question "How can I learn?", as well as the infrastructure it provides based on pedagogical decisions, are important factors in the increase of quality (Beck et al., 2001). In assessments performed during the learning process, guidance for students accomplished by determining individual requirements based on answers given by students and the students' deficiencies, allow for deficiencies to be detected early on and accelerates learning processes (Hotomaroğlu, 2002:12-13).Aside from such positive aspects, IES incorporates such complex concepts as artificial intelligence techniques, expert systems, computer technologies and educational technologies.This makes the design and development of such systems costly in terms of time and effort required (Dağ and Erkan, 2004: 47-48).

E-mentoring

According to studies, mentoring has been determined to be a model and a support system for increasing the individual's success and contentment (Wanberg, Welsh, and Hezlett, 2003). Additionally, the importance of the features of the tools used in mentoring has been emphasized (Ensher, Heun, & Blanchard, 2003; Hamilton &Scandura, 2003; Miller & Griffiths, 2005). At this point, services are beginning to be offered that alleviate location and time limitations in interactions between mentors and individuals, and that allow interactions to be observed closely and to be collected for analysis. These mentoring services provided using information and communications technologies are concisely given the name "e-mentoring" (Knouse, 2001; Brescia, 2002).

E-mentoring contributes to the development of professional association without the limitations related to location and time. Additionally, its optional asynchronous nature allows for more careful communication required in the case of complex problems (Wade et al., 2001). Furthermore, having a large network of mentoring candidates in case of e-mentoring provides a specific opportunity.

E-mail, online discussion groups, online messaging and chat, video conferencing, blogs, wikis and file sharing are widely used tools for e-mentoring. In this way, technology aids in facilitating mentoring relationships (Powell, 2009). The tools used in e-mentoring are continuously being updated in parallel with advances in technology. Current mentoring services make wide use of Web 2.0 technologies (social networks, video podcasts, blogs, wikis, and online instant messaging tools). Computer technologies have affected the nature of social behavior and communicationsof individuals by providing new information sharing opportunities in education and learning (Tarbitt, 2006). With advances in mobile devices, such technologies allow a continued teacher and student communication. Therefore, it may be stated that the number of e-mentoring programs are gradually increasing in both the educational institutions as well as the business world (Fulop, 2002).

Powerful Aspects of E-mentoring

It may be readily stated that with computer-aided communications procedures, points of communication have spread throughout the world (Wellman and Gulia, 1999), and communities of individuals sharing their thoughts have become more accessible (Zimmer, 1997). Computer-aided communications also impact e-mentoring prominently, as the ease with which the mentor and the student can interact is a powerful benefit of e-mentoring. Another strong aspect of e-mentoring compared to face-to-face mentoring is its ability to minimize factors that can adversely affect the communication between the mentor and the student, including the demographical differences.

In e-mentoring, it is not only the student who gains. The mentor and the student are mutually affected by each other. The mutual harmony between the mentor and the student allows the process to be more effective.

It has been observed that the mentoring relationship is the most productive when the mentor and the student choose each other through a non-formal relationship based on respect. Associations such as face-to-face meetings which support close relationships facilitate such earnest mentor and student matching. However, in one-on-one and face-to-face meetings, there may be difficulties related to safety as well as being able to access the mentor’s support and recommendations. Such difficulties may be due to personal and interpersonal factors or due to the effects of the changing nature of the study (Özdemir, 2012).

Difficulties Associated with E-mentoring

A significant difficulty faced in e-mentoring is the possibility that interpersonal dynamics may lead to deficiencies in communication. Communication that is based on computers and communications technologies are frequently seen as unfriendly, one that does not support relationships in an effective manner. In such type of communications, the individual’s opportunities to convey his or her feelings to the other side or to be able to reinforce the message with verbal (tone of voice, etc.) and non-verbal (body language, etc.) communications techniques, are limited. This may lead to difficulties in transmitting or distinguishing.

Additionally, sustaining continuity of communications may be assessed as yet another problem. Dismissing a message or postponing responding to the message, is easier than ignoring someone in a face-to-face situation. Therefore, additional use of asynchronous tools and techniques is important in order to sustain the communication between the mentor and the student.

Mentoring is not an easy task. In order to form positive relationships with students and to establish an environment of trust, mentors may seek help from experienced mentors. It is not easy to implement mentoring as more than simple guidance counseling. Successful programs in this scope include steps such as standard screening and orientation training. The aim is for the students and the mentors who provide them with guidance to have long lasting associations (Holmes, 2006)

METHODOLOGY

Objective of the Study

The overall purpose of the research is to gauge the effects of the intelligent electronic mentoring system (AKEDAS), developed within the scope of the research, on the academic development of students. To reach this goal, an attempt has been made to ascertain whether or not there are differences in academic achievement and permanency of learning among two groups of students of the "Fundamentals of Information Technologies" class taught as part of the formal education system: a group supported by AKEDAS and the other taught using the conventional approach.

Subordinate Goals of the Research

The following are the subordinate goals that have been defined in line with the overall goal of the research:

1. Whether or not there is a difference in academic achievement between the group of students supported by AKEDAS (experiment group) and the group of students following the conventional approach (control group).
2. Whether or not there is a difference in permanency of learning between the group of students supported by AKEDAS (experiment group) and the group of students following the conventional approach (control group).

Hypotheses

The following hypotheses have been tested in line with the subordinate goals of the research:

Hypotheses relating to the first subordinate goal:

D1. There is no meaningful difference between the average pre-test and post-test scores of the two groups.
D2. There is no meaningful difference between the average post-test scores of the two groups.

Hypotheses relating to the second subordinate goal:

D3. There is no meaningful difference between the average scores of the groups for permanency of learning.

The Research Model

A pre-test and post-test experimental model including a control group has been used in the research. The effects of the intelligent electronic mentoring system, which is the independent variable and provides environments that fit the learning styles of students , on the dependent variable, academic achievement and permanency of learning, has been determined.

G1	R	O1	X	O2
G2	R	O3		O4

G1 = Experiment Group (student group included in the AKEDAS-supported learning process).
G2 = Control Group (student group included in the conventional learning process).
R = Randomness in group formation.
O = Measurement, observation.
X = The level of the independent variable.

The Research Process

The research carried out is presented below:

As examination of the Figure 1 indicates, the research is carried out in four basic phases. In the planning and preparation phase, literature review, development of data collection tools, design and publishing of AKEDAS, and creation of materials suitable for learning styles werecompleted. In the beginning phase, the experiment and control groups were established, system user information have been processed, the orientation process for the students of the experimental group and the mentors have been carried out, and the groups have been given a general achievement test prior to the implementation phase. In the implementation phase, the experiment group has been administered an online styles inventory, a learning and mentoring process has been carried out in accordance with the styles determined, and module achievement tests have been given before and after each module which constitute each learning pack. The control group as well has been subjected to a similar process, excluding participation in AKEDAS. In the final phase, the groups were given a general achievement test, and a learning permanency test was given three months afterwards.

Limitations

This research has the following limitations:

1. Limited to an 8 week study involving 60 10th grade students enrolled in the Information Technologies Section at a vocational high school in the Middle Eastern part of Turkey during the 2010-2011 spring semester.
2. Limited to three topics corresponding to the modules of the “Fundamentals of Information Technologies” class; namely: “Installation of Operating Systems”, “Operating Systems Features”, and “Networks”.
3. Limited to the intelligent electronic mentoring system used in the study.

Population and Sample

Secondary school students within the formal education system constitute the study population of the research. The sample for the research is comprised of 60 10th grade students enrolled in the Information Technologies Section at the ElazığGazi Technical and Industrial Vocational High School. In order to achieve randomness in the makeup of the experimental and control groups, students' access to computers and the internet, their preference for activities they are interested in participating, and pre-test scores have been taken into account.

An important consideration when establishing the groups was for students to have access to computers and the internet when away from school. An analysis of Table 1 shows that there are 40 students who own computers and have access to the internet. Face-to-face meetings were held with these students, and considering also their requests for participation, the experimental group of 30 students was established.

The rate for students with computerand internet access was observed to be sufficient. Additionally, data on students' opinions on the environment in which they would like to participate were gathered.It was determined that the idea of being in contact with their mentors outside of school appealed to students and that they wanted to take part in the experiment group as they felt that additional resources would help increase their achievement in class.

Another measure utilized to achieve randomness in experimental and control groups was pre-test scores for students. The arithmetic averages and standard deviations for the pre-test scores of the groups are shown in Table 2.

To test the randomness of the pre-test scores of the groups, one-way analysis of variance has been conducted. As seen in the table, no meaningful difference was observed with respect to the average of the pre-test scores of the groups at the .05 level. It can be stated that the groups bear similar qualities with respect to pre-test scores.

Due to the limitations in student numbers, it has not been possible to perform cluster analysis. The distributions of the groups with respect to classes and type of education are shown in Table 3.

As seen in Table 3, two groups of 30 students were established from the 10th grade students of the Vocational High School and Anadolu Technical High School (15 students from each class for each group).

Data Collection Tools

Two types of measurement devices were used to collect research data. The first, aimed at determine the learning styles of the students taking part in the experimental group, is the learning styles inventory developed by Kolb (1985), and for which studies have been performed by Aşkar and Akkoyunlu (1993) for its adoption in Turkey.

The second is the general achievement test to determine the overall achievement levels of the class as well as their permanency of learning, along with the modular achievement tests prepared separately for each module of the "Fundamentals of Information Technologies" class as part of the research. The achievement test was comprised of 43 questions in line with the goals of the "Installation of Operating Systems", "Operating Systems Features" and "Networks" modules.

General Achievement Test

The achievement test has been used both as a pre-test to determine the students' base levels prior to starting the program, and as a post-test to measure their gains following completion of the program. Additionally, to determine permanency of learning, it has been offered to both the experiment group and the control group three months after the completion of the eight-week program.

157 people took part in the achievement test development process. The arithmetic average of the achievement test has been determined as ($\overline{X}$) 32.73, its standard deviation as (SD) 7.43, its degree of average difficulty as (P) 66, and its reliability as (KR-20) .81. The difficulty values for the achievement test questions vary between .44 and .87. According to this, it can be stated that easy and difficult questions are included in the test. Considering that the ideal average test difficulty is .50 (Tekin, 2000), it may be argued that the test has mean difficulty with the intended average level of difficulty.

Module Achievement Tests

For the modules within the scope of the research, separate module achievement tests were prepared. The module achievement tests included 15 questions and have been used both to determine the students' bases levels prior to starting the module, and to measure gains following the completion of the module.

FINDINGS AND DISCUSSION

Findings and Discussion Relating to Learning Styles

The answers received for the learning styles inventory offered to the students in the sample group were analyzed according to the norms of the Kolb (1985) learning styles inventory to determine the learning styles of the students. In determining learning styles, the interaction of the scores for learning ability is of relevance. The arithmetic average and standard deviation for the students' learning ability scores have been presented in Table 4.

Analysis of the table indicates that students use active experimentation ability when for perceiving information. In processing information, it was observed that they use both reflective observations and active experimentation at levels close to each other, but that their active experimentation abilities are more dominant. The learning style for each student has been determined based on their learning ability scoresThe frequency distribution and percentages of the learning styles for students are presented in Table 5.

An analysis of Table 5 shows that half (50%) of the students participating in the research are located in the first type of learning style (converging), and nearly one third (30%) are located in the third type (Assimilating). The fourth type (accommodating) is determined to be at 20%. It should be noted that that no students have learning styles matching the second type (diverging). In studies carried out by Dinçer (2008) and Demirci (2009) as well, the number of students located in the second learning type is observed to be significantly low.

Findings Related to the First Subordinate Goal

"The general achievement test", "Module I Test", "Module II Test", and "Module III Test" weregiven twice to the experiment and control groups as pre-test and post-test. In line with the related hypotheses, the necessary statistical processing wascarried out for the student scores. The findings and interpretations for the achievement tests according to these hypotheses are presented below.

Hypothesis 1: *There is no meaningful difference between the average pre-test and post-test scores of the groups.*

The results of the dependent groups' t-test performed to test Hypothesis 1 are presented in Table 6.

In both experiment and control groups, meaningful differences have been observed between pre-test and post-test scores in favor of the post-test. At the same time, while the pre-test scores of the two groups are in close range of each other, the experiment group's post-test scores being higher than the control group's post-test scores is noteworthy.

The results of the dependent groups t-test performed relating to the scores of the module achievement tests are presented in Table 7.

Examination of the table shows that meaningful differences may be observed between pre-test and post-test scores for the module achievement tests in favor of post-test scores for both of the groups. However, while for both groups pre-test score averages for all three modules are in close range of each other, when the post-test score averages for the modules are examined, it becomes obvious that the experiment group's post-test score averages are higher than the post-test score averages of the control group.

In face of this data, it is observed that the success levels for both students benefiting from AKEDAS and students following the conventional educational have been affected in a positive manner. However, there a meaningful difference was observed between pre-test and post-test scores for both groups in favor of the post-test results, and Hypothesis 1 has been rejected.

Hypothesis 2: *There is no meaningful difference between the average post-test scores of the two groups.*

The independent groups t-test results performed to determine whether or not meaningful differences exist between the groups' general achievement tests post-test scores, are presented in the following table.

As shown in Table 8, a statistically meaningful difference between the groups' post-test score averages at the level of $p<.05$ (P=,002) was observed (t=6,488). Following the post-test administration of the general achievement test for students of the experimental group ($\overline{X}$ =34,47) and the control group ($\overline{X}$ =26,97), a score difference of 7,5 has been observed in the arithmetic averages in favor of the experiment group.

The results of the independent groups t-test performed to determine whether or not meaningful differences exist between the post-test score averages for the module achievement tests for the groups are shown in Table 9.

Examination of Table 9 shows that meaningful difference exists among the groups' module achievement tests post-test score averages. In the groups' modular achievement tests post-test score averages, variances in favor of the experimental group are observed.

Findings Related to the Second Subordinate Goal

The third hypothesis of the study is that *"there is no meaningful difference between the average scores of the groups for permanency of learning"* and has been incorporated into the second subordinate goal. To test Hypothesis 3, the permanency of learning test achievement scores of the students was compared.

However, between the end of the program and the permanency test, student attendance in both the experimentand control groups had undergone some change. At the beginning of the next academic year following the 3 month academic summer recess, one student in the experiment group had requested a transfer to a different school, and two students in the control group did not pass the class. Therefore, the permanency test could be offered to 29 students in the experiment group and 28 students in the control group. The permanency test score averages for the groups and the independent group's t-test results are shown in Table 10.

Examination of Table 10 shows that as a result of the permanency test achievement scores t-test results, meaningful differences between experimental and control group students' permanency test scores were revealed [$t = 8{,}825$; $p < 0{,}05$]. It is observed that the experimental group's permanency test achievement score average is higher than that of the control group.

CONCLUSIONS AND FUTURE DIRECTIONS

Intelligent electronic systems are becoming widespread as a result of the current advances in technology including the internet. To expand the scope of these systems and increase their availability, it is important to make widely available individualized systems that are able to utilize the existing technological infrastructure to better meet student needs. Creating environments that support learning and forming mentoring systems, which take into account the learning styles of students with respect to individual differences, will allow learning quality to improve.

As part of the research, the experiment and control groups' academic achievements were measured and determined to be homogeneous at the start of the study. An analysis of all post-test scores obtained through the process and at the end of the process revealed results in favor of the experimental group. This finding was in parallel with the result of the research conducted by Keleş (2007). These results are the outcome of the system's ability to provide new learning materials by taking into account the student's learning style, and its ability to allow the student to communicate with his or her peers and the mentors easily. In his study on motivation in e-learning settings, Hodges (2004) suggests that communication and feedback between student and teacher have positive impact on learners' motivation.It may be stated that because the intelligent electronic mentoring system has been stripped of several factors that could negatively affect the communications between the mentor and the student, it is more advantageous compared to traditional mentoring.

Additionally, because the students benefitting from the system were exposed to such a system for the first time, their level of interest has been high. At the same time, being able to communicate with their teachers outside of the school environment, and being able to benefit from the knowledge and experience of different teachers, as well as being able to communicate with peers in an online environment have increased students' interest in the class. This supports the results obtained by Savaş (2006) that in web-based learning environments, mentor-student interactions may contribute positively to student motivation. From a different viewpoint, Keller and Suzuki (2004) assert that multimedia-supported instructional contents in elearning settings have positive effects on learner motivation. This issue is supported by many studies in the literature (Cameron, Banko, ve Pierce, 2001; Jenkins, 2001; Law vd., 2009; Karahanna, 2000; Reeveve Jang, 2006; Grolnickve Ryan, 1987; Grolnickve Ryan, 1989; Grolnick, Ryan, veDeci, 1991; Chen ve Jang, 2010).

Individualized education that has been provided by taking into account the learning styles of students has been observed to generally have positive reflections on students' learning experience. It wasbelieved that learning materials prepared with different learning styles in mind have contributed to the success rate obtained in the study. It was observed that taking into account the learning styles of students is important in continuing this success rate. At the same time, it is important for teachers assigned to the e-mentoring system to carry out activities in a continued and timely manner in order to have the students stay a part of the program. With respect to the effectiveness of the system, it wasobserved that the time to remedy technical problems in the operation of the system will have an effect on the students' attendance to the system.

When the results of the permanency test administered three months following the completion of the program have been examined, an outcome in favor of the experimental group may be observed. Additionally, the success level of the experimental group where learning was carried out using the AKEDAS is higher than the success rate of the control group that participated in traditional training. This outcome reveals the importance of mentoring activities realized through AKEDAS, as well as the importance supporting learning materials provided by taking into account the learning styles of students.

RECOMMENDATIONS

Recommendations for the design of intelligent electronic mentoring systems:

- Determination of user-friendliness of the system designs with respect to mentors and students (style of writing, functionality and ease of use).
- With respect to design and development of e-learning environments; specification of optimum system requirements and the screening differences reflected on the system and the users.
- For intelligent electronic mentoring systems to become widespread, it is important for teachers to be involved in the process. For teachers who have an important role in the functionality of the system; determination of their technical deficiencies with respect to preparation and use of the system, specification of in-house training activities that

may contribute to their professional development and to provide incentives for participation in such training.

- Evaluation of supporting programs used in the design of the system with respect to design and system operability.

Recommendations for new research related to intelligent electronic mentoring systems:

- Studies should be carried out with respect to the effects of intelligent electronic mentoring systems on educational costs.
- Application of such micro level studies on wider scale and larger groups to determine impact on successful execution.
- In addition to educational materials prepared respecting diverse learning styles and aside from the learning content presented by the system that is appropriate for the student's learning style, providing the students access over the system to learning content that is appropriate for other learning styles as well to contribute to their academic development
- Determining the availability level of the students at the start of the program and evaluation of this level with respect to system effectiveness.
- Effects on the students of the possible differences in educational methods of the mentors supporting the system (with respect to their academic and vocational aspects).
- Impact of the communication between mentor and student established using intelligent electronic mentoring systems on the student.
- Impact of intelligent electronic mentoring systems on the interest, motivation and perception levels of students benefiting from the system.

It is recommended that AKEDAS, which is currently being used only for one class, be applied to other classes (physical sciences, mathematics, social sciences, foreign language instruction, etc.) and research conducted to compare the affects of the system on student achievement rates on a per-class basis.

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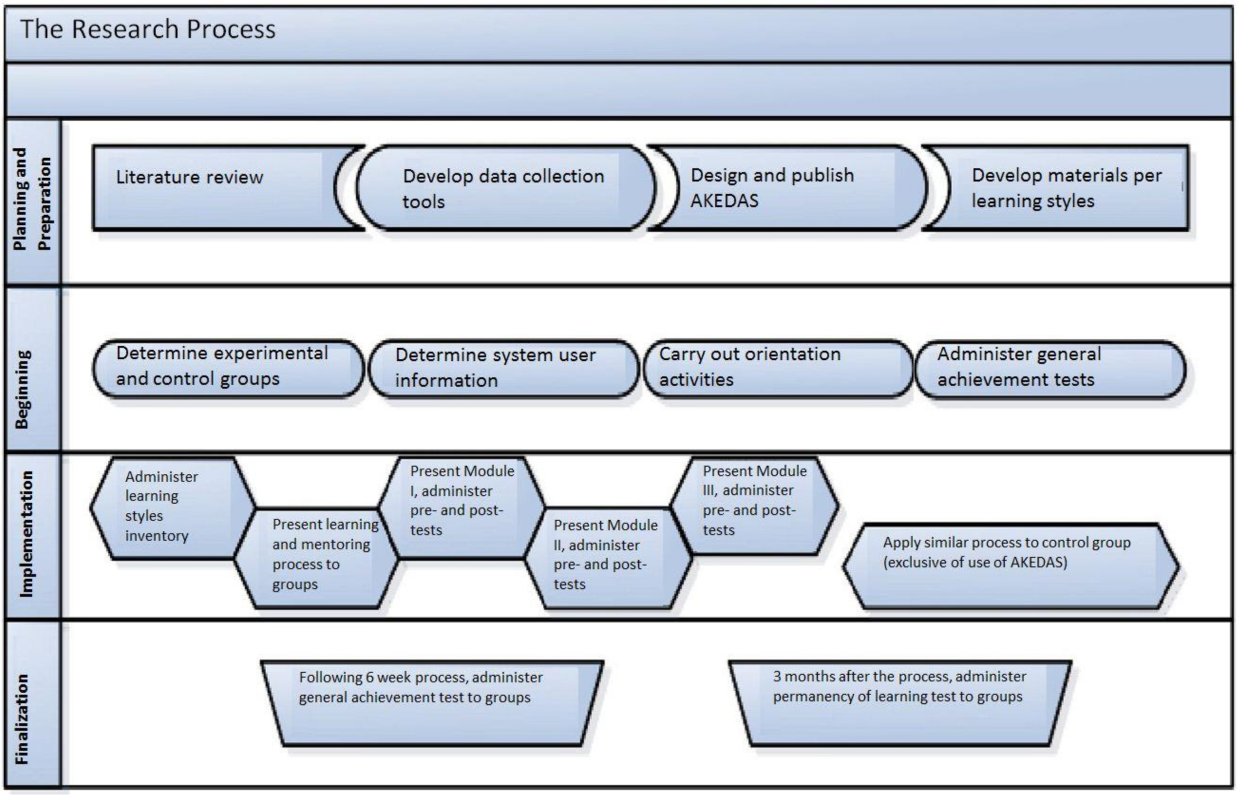

Figure 1. The Research Process

Table 1. Students with computer and Internet access

	Computer		Internet	
	Number of Students	**Percentage**	**Number of Students**	**Percentage**
Available	50	83,50	40	65.66
Not available	10	16,50	20	34.34
Total	60	100.00	60	100.00

Table 2. Arithmetic averages and t test analysis results for experimental and control groups

Group	N	$\overline{X}$	SD	t	p
Experiment	30	10,43	3,78	-,479	,634
Control	30	10,63	3,82		

Table 2. The distribution of the students comprising the sample

Section	School Type	Class Size	Control Group	Experiment Group
Information Technologies Section	Vocational School	30	15	15
	Anadolu Technical School	30	15	15
Total		60	30	30

Table 4. Arithmetic average and standard deviation for learning ability scores

	N	$\overline{X}$	SD
Concrete Experience (CE)		21,17	6,70
Reflective Observation (RO)		26,93	8,10
Abstract Conceptualization (AC)	30	28,60	8,62
Active Experimentation (AE)		32,00	10,32
AC-CE		- 7,43	10,47
AE-RO		-5,70	10,46

Table 5. Percentages and frequencies for students' learning styles

	f	*Percentage*
Students Using the Converging Learning Style	15	50
Students Using the Diverging Learning Style	0	0
Students Using the Assimilating Learning Style	9	30
Students Using the Accommodating Learning Style	6	20
Total	**30**	**100**

Table 6. The results of the dependent groups t-test related to the general achievement pre-tests and post-tests given to the groups

Groups		**N**	$\bar{X}$	**SD**	**t**	**p**
Experiment	General Pre-Test	30	10,43	3,78	-78,79	,000
	General Post-Test		34,47	3,90		
Control	General Pre-Test	30	10,63	3,82	-18,85	,000
	General Post-Test		26,97	4,99		

*p< .05

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Table 3. The results of the dependent groups t-test related to the module pre-tests and post-tests administered to the groups

Groups	Module	Test	$\overline{X}$	SD	t	p
Experiment N=30	I	Pre-Test	3,63	1,51	-29,398	,000
		Post-Test	12,33	1,15		
	II	Pre-Test	4,10	1,15	-32,794	,000
		Post-Test	12,66	1,39		
	III	Pre-Test	3,63	0,85	-24,908	,000
		Post-Test	12,53	1,59		
Control N=30	I	Pre-Test	3,67	1,47	-14,28	,000
		Post-Test	8,93	1,64		
	II	Pre-Test	3,97	1,16	-16,69	,000
		Post-Test	9,10	1,67		
	III	Pre-Test	3,53	0,97	-22,32	,000
		Post-Test	9,47	1,61		

*p<.05

Table 8. General achievement test post-test score averages and the t-test results for groups

Post-Test	Groups	N	$\overline{X}$	SD	t	p
General	Experiment	30	34,47	3,9	6,488	,000
	Control	30	26,97	4,99		

*p<.05

Table 9. Module achievement tests post-test score averages for groups and the t-test results

Post-Test	Groups	N	$\overline{X}$	SD	t	p
Module I	Experiment	30	12,33	1,15	9,532	,000
	Control	30	8,930	1,64		
Module II	Experiment	30	12,66	1,39	8,976	,000
	Control	30	9,100	1,67		
Module III	Experiment	30	12,53	1,59	7,412	,000
	Control	30	9,470	1,61		

*p<.05

Table 10. Permanency test achievement scores average for the groups and the t-test results

Groups	N	$\overline{X}$	SD	t	p
Experiment	29	29,97	4,54	8,825	0,000
Control	28	20,07	4,14		

*p<.05