



The Impact of Pedagogical Agent on Learners' Motivation and Academic Success¹

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Abstract: *Pedagogical agent is generally described as educational programs that guide, motivate learners while encouraging them during learning by providing feedback. The tasks (informative, guiding, or friend, etc.) and types (human-like, cartoon character, audio, text, etc.) of these modules can be classified based on various variables. Although computer-assisted instruction software is commonly used as a teaching material, research on modules integrated on such programs is scarce. Studies in the field have revealed that such computer-assisted instruction programs increase motivation of learners. In order to keep motivation levels high, these programs need to be adopted depending on the individual needs. Therefore, it can be beneficial to integrate software designed that can be personalized. In this respect, the present study was conducted with secondary school students to identify the impact of pedagogical agent on learners' academic success and motivation. For the purpose of the study, four groups were formed. The first group received education via fixed pedagogical agent, the second group had the option to choose among several pedagogical agents, the third group received the education without pedagogical agent and finally the last group received the same education through traditional (non-computer) way. This four-week program was introduced to students via MS Excel program and the data was gathered as pre- and post-test method. The findings have revealed that interfaces impacted motivation and accordingly academic success in a positive way. As a result of the study, it is suggested that learners should be provided programs that can be personalized depending on learners' needs and preferences.*

Keywords: pedagogical agent; computer-assisted instruction

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Introduction. Continuous changes in social structures combined with the fast and dramatic developments in technology has a significant impact on education. Today, these impacts make it crucial for education systems to become constructive. In line with this, an education center is shaped based on learners rather than the content matter. Increase in information access and the demand for education requires consideration of individual differences in any educational setting and necessitates adapting educational practices according to learners' individual needs.

Diversity of tools, which enable us to make designs according to individual features, has been increasing by technology. Today, computers, which are accepted as the most effective communicational and individual instruction tool, are the widely preferred tools for this usage (Yenice, Sumer, Oktaylar & Erbil, 2003).

Teaching aids, which were developed by Skinner, one of the pioneers of Behavioral Approach, has undertaken the pioneering role of computer assisted instruction software (CAI) by taking shape through technology. In addition to this, instruction designers, who focused on application and practice methods between 1960 and 1970, started to use computers in designing educational games and applications in 1990s (Cognition and Technology Group at Vanderbilt, 1996; Mayer, 1988; Mayer, Schustack & Blanton, 1999).

The use of computers as instruction aids in education has provided individuals not only more effective education, but also more enjoyable and attractive instruction (Alessi & Trollip, 2001; Beale, Kato, Marin-Bowling, Guthrie & Cole, 2007; Dincer, 2006). As a result of successful designs, computers have been used in every field of education increasingly and this situation has led to a new model called CAI. CAI, whose one of the aims is individualizing instruction; enables students maintain their instruction on computers in line with their skills independently of time, place and/or teacher (Arslan, 2006; Kocasarac, 2003; Simsek, 1999). CAI designs have been accepted as an inevitable element of instruction by involving all of the multi-media systems after constructivism has been accepted in the field (Bozkurt & Sarikoc, 2008).

As a result of integrating CAI software (CAIS) with instructional programmes, related literature state that students, who are supported by teachers, do not experience much difficulty in using these softwares, however students face various problems due to inadequacy of guidance services, lack of motivation, low self-efficacy, lack of interest while using CAIS, which undertake instructional function (Allbeck & Badler, 2003; Atkinson, 2002; Baylor, 2002; Baylor & Kim, 2003, 2005; Baylor, Shen & Huang, 2003; Kim, Baylor & Reed, 2003; Lester, Towns, Callaway, Voerman & Fitzgerald, 2000; Moreno, Mayer, Spires & Lester, 2001). In CAI environments, the problems mentioned above mainly stem from students' feeling themselves alone and unprovided social learning environment (Akyuz, 2012). In CAI, modules, which can form interaction, reach information about, give feedback, arrange environments according to students and hinder students' feeling of isolation are needed to provide social learning environment (Akyuz, 2012; Kizilkaya & Askar, 2006).

In order to resolve the limitations mentioned above, pedagogical agents have been developed and combined with educational software programmes since the second half of 1990s. Pedagogical agents have been

inevitable elements of CAIS, which have been widely used since they provide interaction between users and computers; because pedagogical agents can be presented to students in different forms involving human-like characters, animations or audio-texts. Furthermore, features gestures and empathetic behaviors can also be added to pedagogical agents.

The term 'pedagogical agent' is used for different goals and functions in every discipline, so it is defined disparately in different disciplines (Yilmaz & Kilic-Cakmak, 2011). In computer sciences, pedagogical agent is defined as features of autonomy, reactivity, mobility, activeness, cognitive skills (Brenner, Zarnekow & Wittig, 1998), and social trait features like emotion (Wooldridge & Jennings, 1995). Agents, which are called pedagogical agents in the literature of international educational sciences, are generally defined as modules, which ease social learning in instructional softwares (Chan, 1995), guide students (Clark & Mayer, 2003; Moreno, 1999), support motivation and give feedback (Salim, Marzuki & Kasirun, 2007). These pedagogical agents, which are considered from various perspectives regarding their tasks and types, have been classified in different categories in the literature.

Regarding their designs, pedagogical agents, which are classified in different forms, such as human-like, audible, text-based, gestures, cartoon characters regarding their designs, have been classified as smart, assistant, information, rater, pedagogical, advisor and expert regarding their functions (Yilmaz & Kilic-Cakmak, 2011). When the related literature is examined, the number of those classifications increases. However, pedagogical agents are generally considered in two main groups, design/presentation forms and tasks while they are classified.

Pedagogical agents can be classified under three sub groups, such as visual, audible and textual (text-based) regarding presentation forms (Atkinson, Mayer & Merrill, 2005; Dehn & van Mulken, 2000; Gulz, 2004; Kizilkaya & Askar, 2006; Reategui, Polonia & Roland, 2007; Unal-Colak & Ozan, 2012; Yilmaz & Kilic-Cakmak, 2011).

Visual agents are in the form of:

- Human-like (a real human image or animating a real human image by drawing).
- Cartoon film character (animating a cartoon film character or a shape/figure).
- Gestures (Using human gesture images or drawings).

Audio agents only includes the guidance of a person (by talking) at the background. On the other hand, textual agents involve guiding users by providing sentences or words.

Pedagogical agents vary highly in terms of their tasks; however they can generally be classified (Chan, 1995; Veletsianos, 2012; Yilmaz & Kilic-Cakmak, 2011, 2012);

- Smart agents (agents, which can learn by using artificial intelligence and respond to users).
- Guide agents (agents which inform users about the usage of software).
- Subsidiary agents (agents which provide clues to users about the topic and questions)

Although smart agents are the most effective agents today, subsidiary agents – with cartoon film character – are frequently preferred in educational softwares. Because there are several difficulties in designing, coding and application of smart agents.

A lot of learning theories' effects underlie educational agents having different features, being designed according to various learning environments (Esgin, 2010). Cognitive load theory justifies presenting information in operative memory by paying attention to excessive loading situation. If the information is not presented by relating it with more than one source, attention disintegration, which is one of the multimedia design principles, emerges (Kalyuga, Chadler & Sweller, 1999). The reason for this situation is that the individual forms cognitive load while he-she is looking into the relation between two different information, because the individual needs to keep the information in running memory.

In addition to Cognitive Load Theory, Binary Coding Theory (Paivio, 1991) and Multimedia Theory (Mayer, 2001) have also been used in multimedia design. According to Binary Coding Theory, information is processed in two channels; verbal and visual. The information, which is processed together in both channels, is recalled more easily compared to the information which is processed by using only one channel. On the other hand, in Multimedia Theory, which is the extended form of Binary Coding Theory, the student processes the written and verbal information in the verbal channel; and he/she processes the information, which he/she obtained from the pictural and visual materials, in the visual channel. Besides these theories, designs are also realized by using social learning theories which pay attention to human-computer interaction.

Studies in the related literature have generally examined the effects of the usage of educational agents, which are based on the above mentioned learning and social interaction theories, on a variety of dependent variables, such as *academic success* (Baylor & Kim, 2009; Bickmore, Pfeifer & Orlow, 2009; Buisine & Martin, 2007; Chen, 2012; Hong, Chen & Lan, 2014; Lin, Atkinson, Christopherson, Joseph & Harrison, 2013; McQuiggan & Lester, 2007; Mumm & Mutlu, 2011; Rodicio & Sanchez, 2012; Meij, 2013; Veletsianos, 2012; Wang, Johnson, Mayer, Rizzo, Shaw & Collins, 2008; Yilmaz & Kilic-Cakmak, 2012), *motivation* (Baylor & Kim, 2009; Buisine & Martin, 2007; Chen, 2012; Lim, Leichtenstern, Kriegel, Enz, Aylett, Vannini, Hall & Rizaao, 2011; Lin, Atkinson, Christopherson, Joseph & Harrison, 2013; Osman & Lee, 2014; Prendinger, Ma & Ishizuka, 2007; Roper, Gomez, Carrasco & Leon, 2012; Meij, 2013; Xu & Wang, 2006), *satisfaction* (Bickmore, Pfeifer & Orlow, 2009; Johnson, DiDonato & Reisslein, 2013; Kim & Wei, 2011; Mayer, Johnson, Shaw & Sandhu, 2006; Mumm & Mutlu, 2011; Wang, Johnson, Mayer, Rizzo, Shaw & Collins, 2008), *performance* (Lim & Reeves, 2010; Lin, Atkinson, Christopherson, Joseph & Harrison, 2013; Plant, Baylor, Doerr, & Rosenberg-Kima, 2009; Meij, 2013), *appreciation* (Brave, Nass & Hutchinson, 2005; Hubal, Fishbein, Sheppard, Paschall, Eldreth & Hyde, 2008; McQuiggan & Lester, 2007), *joy* (Hong, Chen & Lan, 2014; Perez-Marin & Pascual-Nieto, 2013), *interaction* (Bickmore, Pfeifer & Orlow, 2009; Serenko, 2007; Veletsianos, 2012), *self-sufficiency* (Kerly, Ellis & Bull, 2008; Plant, Baylor, Doerr, & Rosenberg-Kima, 2009). Almost every study concluded that the usage of educational agents has had a positive

effect on the variables mentioned above. Only few studies (Chen, 2012; Lin, Atkinson, Christopherson, Joseph & Harrison, 2013; Osman & Lee, 2014) stated that there has been no meaningful difference between them. However, it has been stated that the reason for not existing a meaningful difference has stemmed from the instruments used in the studies.

Along with “Presentation Format”, which is one of the principles of “Keller Plan” or “Self Learning Model”, because of the ongoing methods, student differences, the presentation of the lecture styles and lesson materials remain Standard or typical so this situation affect students’ success negatively (Sahin, 2011). Therefore, individualizing materials can enhance academic success. While underlining the importance of individualizing materials, not providing opportunities for individualizing educational agents or not giving opportunity to individuals for choosing different types of educational agents are considered as the lack of those software.

Although there exist a variety of studies examining the effects of different educational agent designs on various dependent variables, it has been considered that examining a dependent variable (preference of educational agent) by comparing it according to various independent variables (gender, age etc.) through presenting more than one designed educational agent to students’ choices will be beneficial. In addition, as an independent variable, the effects of the type of educational agent has also been considered to be effective on dependent variables, such as academic success and motivation (Chen, 2012; Lin, Atkinson, Christopherson, Joseph & Harrison, 2013; Osman & Lee, 2014). Related to this, it will be beneficial to investigate how dependent variables undergo a change in different situations.

In this respect, students’ academic success and their motivation levels towards CAIS have been examined by presenting more than one type/form of educational agent to students’ preferences. Therefore, the study seeks to answer “What are the effects of students’ usage of educational agents to their academic success and to their motivation levels?”

Methods

Research Design

The study involves the participants and data of the pilot study, which aims to investigate the effect of pedagogical agents in computer-assisted software on various variables as part of the main study. Regarding this aim, the research has been conducted based on experimental design including pre-post tests and experimental group. The independent variables of the study have been determined as gender and method (that possesses pedagogical agent possesses multi-pedagogical agents and CAIS without pedagogical agent and ongoing instruction). On the other hand, the dependent variables have been determined as MS Excel program, academic success score (literacy score), motivation levels towards course materials and preferences of pedagogical agents. In order for the dependent variable not to be affected by a factor except the independent

variable, basic computer literacy has been determined as the controlling variable.

Participants

Although the main study has been conducted by involving 5th grade secondary school students, 127 8th grade students (44.1% girls and 55.9% boys) from four different classes have participated in this pilot study. The participants' ages vary between 13 and 15. It has been thought that choosing different participants for the pilot study can be beneficial for comparing the findings of the main and the pilot study. In addition to this, since the participants are older, they have been thought to express themselves clearly in case any problem occurs in instruments. Four different study sample (three experimental, one control group) have been determined by selecting participant classes involving thirty/ thirty-five students randomly for the application.

Instructional Materials

For the study, CAIS, which teaches MS Excel program, has been designed by considering related theories especially Cognitive Load Theory and ARCS Motivation Model. After this process, pedagogical agents have been designed, that are convenient for this software. One of these designed pedagogical agents has been selected randomly and added to the software, so CAIS, which has a pedagogical agent, has been obtained. By involving all of the pedagogical agents obtained (see Appendix 1) in to the designed instructional software, CAIS, which has a multi-pedagogical agents enabling participants choose their preferences, has been obtained (see Appendix 2). In the final phase, CAIS, which does not have a pedagogical agent, has been obtained without adding any agents. To sum up, three instructional software have been designed for three experimental groups, namely CAIS without pedagogical agent, CAIS with pedagogical agent and CAIS which have multi-pedagogical agents depending on preferences. Instruction in the Control group has been held via principles of "Instruction by Presentation" and "Display and Action" technique. Therefore, three pedagogical software for experimental groups and overhead projector for the Control group have been determined as course materials.

Measurement

In the study, Computer and MS Excel Programme Knowledge Tests and Skill Exams, which have been developed by the researchers of the study, have been used to gather the data. Computer Knowledge Test (KR-20=.75) and Skill Exam (KR-20=.69) have been used in order to measure students' prior knowledge whereas MS Excel Programme Knowledge Test (KR-20=.85) and Skill Exam (KR-20=.75) have been used for both measuring

students' prior and final knowledge. The reason for conducting skill exam besides knowledge test is that using computer and computer applications is related to both cognitive and psycho-motor skills. Total scoring has been obtained by calculating 60 % of the knowledge test and 40 % of the application test.

The other instrument in the study is the motivation scale towards course materials, which was developed by Keller (2010). The researchers of the study have adapted Keller's scale in to their own native language. However, three items in the scale have been removed as a result of this adaptation. Finally, 33 items of the four factored scale have been applied to the participants. In its original versions, the reliability co-efficient is calculated as .96, whereas in our study it is determined as .93.

Procedures

In the first phase, Computer Knowledge- Skill Exam and MS Excel Programme Knowledge - Skill Exam have been applied to four randomly selected groups (Exp.1, Exp.2, Exp.3, Control) in order to find out whether there is any difference between the groups. By revealing there is no difference between the groups, the first experimental group received education via fixed pedagogical agent whereas the second experimental group received education through CAIS having more than one multi-pedagogical agents within the scope of Information Technologies and Software course. Thus, the second experimental group had the option to choose among several pedagogical agents. Before the implementation, pedagogical agents have been introduced to the students, who use CAIS having more than one type of pedagogical agents. Then, the students were enabled to choose the pedagogical agent, which they would prefer.

On the other hand, the third group received the education via CAIS without pedagogical agent. The Control group received the same education through traditional (non-computer) way. Applications were held in four-week time, two hours for each group in every week as a total eight hours for each group in line with Information Technologies and Software course. After implementing MS Excel Programme Achievement-Skill Post-test, instruction material motivation scale was applied to all groups and the related data were obtained.

Data Analysis

Descriptive data analysis was conducted to summarize the data. In addition to this, in order to find out whether there is a meaningful difference between the groups regarding motivation towards course materials, one way ANOVA was used in pre-tests. In order to evaluate academic success, as measured pre-and post-tests, in respect to groups, Mixed ANOVA was used. To examine the relation between variables Pearson Correlation Co-efficient was used. Finally, influence quantities were measured by using Hedges' g in order to reveal the impact of the implementations.

Results

Findings Regarding Academic Success

In order to test the homogeneity of the groups, the scores of Computer Knowledge Test- Skill Exam and MS Excel Programme Knowledge Test - Skill Exam were used. Total scoring (literacy scores) has been obtained by calculating 60 % of the knowledge test and 40 % of the skill exam. The scores, which the students obtained in those tests, are presented in Table 1 below.

In order to compare these scores between the groups, one-way ANOVA analysis was held to the scores of computer literacy ($F_{(3,123)} = .06, p = .98$) and MS Excel Programme literacy ($F_{(3,123)} = .54, p = .66$) and it was revealed that there was no meaningful difference between the groups and the groups were homogeneous. After four-week education period, MS Excel Programme Knowledge Test and Skill Exam were reapplied to the groups and the scores that the students obtained are presented in Table 1 below.

To examine whether there was a difference in the pre- and post-test scores of groups regarding MS Excel Programme Literacy, Mixed ANOVA was used and it was revealed that there was a meaningful difference between the groups regarding MS Excel Programme Literacy ($F_{(3,123)} = .3.88, p = .01$). In order to determine this difference, post-test scores across the groups were compared and then ordered them as Experiment 2 ($\bar{X} = 84.45, sd = 10.40$), Experiment 1 ($\bar{X} = 79.23, sd = 11.29$), Control ($\bar{X} = 77.50, sd = 9.86$) and Experiment 3 ($\bar{X} = 70.16, sd = 14.32$) from the highest score to the lowest score.

Table 1. Computer and MS Excel Programme Literacy Pre-test & Post-test Scores

	Exp.1		Exp.2		Exp.3		Control	
	n=35		n=31		n=31		n=30	
	M	SD	M	SD	M	SD	M	SD
Computer Knowledge Test	69.	17.	68.	17.	69.	11.77	68.	15.
Computer Skill Exam	58.	14.	58.	14.	59.	9.04	58.	13.
Computer Literacy	65.	16.	64.	16.	65.	10.5	64.	14.
MS Excel Programme Prior Knowledge Test	41	59	16	25	32	6	31	39
MS Excel Programme Prior Skill Exam	24.	12.	22.	10.	22.	10.9	22.	10.
MS Excel Programme Prior Literacy Test	71	24	10	87	42	4	00	55
MS Excel Programme Final Knowledge Test	25.	12.	22.	10.	22.	10.4	21.	10.
MS Excel Programme Final Skill Exam	14	16	38	21	16	6	83	13
MS Excel Programme Final Literacy Test	24.	11.	22.	10.	22.	10.7	21.	10.
MS Excel Programme Final Knowledge Test	59	78	21	58	32	4	93	38
MS Excel Programme Final Skill Exam	81.	11.	83.	10.	73.	15.0	79.	9.3
MS Excel Programme Final Literacy Test	86	95	71	49	06	9	84	3
MS Excel Programme Final Knowledge Test	75.	12.	78.	13.	65.	15.4	74.	12.
MS Excel Programme Final Skill Exam	29	06	06	20	81	4	00	48
MS Excel Programme Final Literacy Test	79.	11.	84.	10.	70.	14.3	77.	9.8
MS Excel Programme Final Knowledge Test	23	29	45	40	16	2	50	6

Influence quantity co-efficient presents more comprehensible knowledge in the comparisons of implementations. To realize this comparison, the influence quantity co-efficient can be done via Hedges' g . In case there are more than two groups, one of the groups should be determined and used as the control variable. In our study, each experimental group was compared with the Control group and the impact co-efficient was calculated. The related findings are presented in Table 2.

Table 2. Comparison of Influence Quantity Regarding Academic Success Scores of CAIS Usage and Traditional Education

	\bar{X}	Sd	n	Std diff in means	Hedges' g	Std Err
Exp.1	79.23	11.29	35	.16	.16	.25
Exp.2	84.45	10.40	31	.69	.68	.26
Exp.3	70.16	14.32	30	-.59	-.59	.26
Exp.1+2	80.27	10.86	66	.26	.26	.22

As a result, while the findings show an insignificant impact according to the Experiment 1 Control group ($g = .16$), the Experiment 2 Control group showed a medium-level impact ($g = .68$). The Experiment 3 group showed a negative medium-level impact ($g = -.59$) when compared to the Control group. The findings revealed that the most successful group was Experiment 2 and the least successful group was the Experiment 3 group regarding both the scores and the influence quantity co-efficients. By joining the first and the second groups, in which the pedagogical agents were used, the influence quantity recalculated. According to this calculation, it was found out that the usage of pedagogical agent had a little impact ($g = .26$) when compared to traditional education in computer classes.

Experimental groups were compared with each other; the impact of Experiment 1 and Experiment 2 on Experiment 3 was analyzed and the findings are presented in Table 3 below. The findings showed that Experiment 1 demonstrated a medium-level impact ($g = .70$) when compared to Experiment 3 group, while Experiment 2 group showed a high-level impact ($g = 1.13$). By joining the first and the second groups, in which pedagogical agents were used, the influence quantity recalculated. As a result of this calculation, the usage of pedagogical agents had a high-level impact ($g = .83$) when compared to the lack of pedagogical agents.

Table 3. Comparison of Influence Quantity in CAIS With Pedagogical Agent and CAIS without Pedagogical Agent Regarding Academic Success

	X	Sd	n	Std diff in means	Hedges' g	Std Err
Exp. 1	79.23	11.29	35	.71	.70	.25
Exp. 2	84.45	10.40	31	1.15	1.13	.27
Exp. 1+2	80.27	10.86	66	.84	.83	.23

Findings Regarding Motivation Levels Towards Course Materials

For the other aim of the study, the scores, which the students gave in the motivation scale towards course materials, were analyzed to examine the motivation variable. The results of the analysis are presented in Table 4 below.

Table 4. Average Scores Obtained From Instruction Material Motivation Scale

		Exp.1 n=35	Exp.2 n=31	Exp.3 n=31	Control n=30
Motivation	M	117.00	116.55	114.48	119.73
	SD	26.21	31.44	27.85	31.04

One-way ANOVA was held to examine whether there was a difference between the groups regarding a change in motivation scores towards course material, and it was found out that there is no meaningful difference between the groups ($F_{(3,123)} = .168, p = .92$). The scores between the groups were compared, and the findings were ordered from the highest to the lowest, such as Control ($\bar{X}=119.73, sd=31.04$), Experiment 1 ($\bar{X}=117.00, sd=26.21$), Experiment 2 ($\bar{X}=116.55, sd=31.44$) and Experiment 3 ($\bar{X}=114.48, sd=27.85$).

The groups were also compared regarding influence quantity, and the impact of experimental groups were examined by comparing them with the Control group. The findings obtained are presented in Table 5 below. To conclude, all the experiment groups' motivation levels had a negative-sided insignificant impact towards course material when compared to the Control group ($g_{Exp1} = -.10, g_{Exp2} = -.09, g_{Exp3} = -.18$).

Table 5. Comparison of Influence Quantity in CAIS Usage and Traditional Education Regarding Motivation Scores Towards Course Materials

	\bar{X}	Sd	n	Std diff in means	Hedges' g	Std Err
Exp. 1	117.00	26.21	35	-.10	-.10	.25
Exp. 2	116.55	31.44	31	-.10	-.10	.25
Exp. 3	114.48	27.85	31	-.18	-.18	.25
Exp. 1+2	116.79	28.56	66	-.10	-.10	.22

Experimental groups were compared with each other; the impact of Experiment 1 and Experiment 2 on Experiment 3 was examined and the findings obtained are presented in Table 6 below. The findings signify that Experiment 1 and Experiment 2 groups showed an insignificant level of impact when compared to Experiment 3 group ($g_{Exp1} = .09, g_{Exp2} = .07$). By joining the first and the second groups, in which the pedagogical agents were used, the influence quantity was recalculated. The findings revealed that the usage of pedagogical agent had a little impact ($g = .08$) when compared to the situation without pedagogical agent.

Table 6. Comparison of Influence Quantity Regarding Motivation Towards Course Material In CAIS Usage With Pedagogical Agent and Usage of CAIS Without Pedagogical Agent

	X	Sd	n	Std diff in means	Hedges' <i>g</i>	Std Err
Exp.1	79.23	11.29	35	.09	.09	.24
Exp.2	84.45	10.40	31	.07	.07	.25
Exp.1+2	80.27	10.86	66	.08	.08	.22

By presenting more than one pedagogical agent, pedagogical agents which were preferred by Experiment 3 group, were analyzed and the pedagogical agents which they preferred based on gender are presented in Table 7 below.

Table 7. Student Preferences of Pedagogical Agents Using CAIS with Multi-Agents

	Tuna		Ada		Ali		Zipzip		Only Audible	Only Textual
	A	T	A	T	A	T	A	T		
Girls	0	1	6	0	7	2	2	0	0	0
Boys	0	0	5	4	2	0	0	2	0	0
Total	0	1	11	4	9	2	2	2	0	0
	1		15		11		4		0	

*A: Audible T: Textual

When the students' preferred pedagogical agents were examined, it was found out that students preferred audible pedagogical agents mostly ($n=22$). As pedagogical agent, students mostly preferred Ada-audible ($n=11$) and Ali-audible ($n=9$) pedagogical agents. Likewise, in character choosing, students primarily preferred Ada character ($n=15$), and secondly they preferred Ali character ($n=11$). The relationship between the student gender and pedagogical agent preference was examined, however a meaningful correlation between two variables could not be found ($r=-.19$, $p=.30$). Despite this finding, it has been stood out that female students mostly tended to prefer Ali character ($n=9$), which is in opposite gender ($n=9$), whereas male students tended to prefer Ada character ($n=9$). By considering the fact that the sample size is less and there was no meaningful difference, Tuna and Zipzip characters are left out of the analysis. Then, the relationship between gender and pedagogical agent character has been examined again and a meaningful medium-level difference has been found out between these two variables ($r=-.42$, $p=.03$, $n=26$). The analysis results have put forward that none of the participants preferred only audible or only textual pedagogical agents. The student interviews have revealed that students did not find only audible or only textual pedagogical agents attractive. The students also stated that there would be no change if audible pedagogical agents and textual pedagogical agents exist or not. Thus, they concluded that they did not prefer these types of pedagogical agents. Besides, the reason of some students' choosing textual formatted characters was examined and the students stated that they could not hear the sounds clearly in the noisy classroom environment.

To evaluate the factors according to which the students prefer pedagogical agents, descriptive data gathered from the students were analyzed. As a result of this examination, in character choosing, students stated “...I chose this pedagogical agent, because it is nice” (for Ada character), “...I chose this pedagogical agent, because she/ he has the same name like me”, “I chose this pedagogical agent, because it has the same name like my friend/sister”.

For not choosing the other two characters, the students stated that they found Tuna and Zipzip characters very childish. Moreover, the students criticized the character Tuna did not have any clothes.

The last findings are related to class management. Along the research, experimental groups completed the tasks and topics earlier, like 10-15 minutes, when compared to the Control group. In addition, experimental groups were more effective in class management. Since the students in the Control group asked questions continuously, there was much noise. Despite controlling and limiting the students' access to some programs and the internet by software, the students in the Control group mostly tended to do extra curriculum activities.

Discussion

The results of the analysis have put forward that there is not a meaningful difference between the groups except the academic success variable. In general, a meaningful difference is expected to be found between the groups regarding all variables considered. However, not being able to find a meaningful difference between the groups in this study has enabled us to obtain a lot of findings and to support the hypothesis of the study.

Firstly, the groups which used pedagogical agents were found to be the most successful ones regarding academic success when MS Excel Programme Literacy Test post-test scores were analyzed. In addition, it was revealed that the least successful group was the one, who used CAIS without pedagogical agent. This finding suggests that there is a necessity of using pedagogical agents in CAIS. Several studies in the literature (Choi, 2005; Choi & Clark, 2006; Dunsworth & Atkinson, 2007; Ebbers, 2007; Gilbert, Wilson, & Gupta, 2005; Moreno & Flowerday, 2006; Osman & Lee, 2014; Meij, 2013) suggest integrating pedagogical agents to CAIS, which also support our finding. This finding is also clearly put forward when the influence quantity coefficients of CAIS are examined (medium-level negative impact in CAIS without pedagogical agent).

Although a meaningful difference has been come across between the groups, not observing a meaningful impact of CAIS regarding influence quantity (insignificant impact) has been associated to individualizing instruction, which is the main thesis of the study. The main study related to this topic was designed for 5th grade secondary school students, who are aged between 10 and 11. To test the instruments, this pilot study has been conducted by involving 8th grade secondary school students, who are aged between 13 and 14. It is thought that the expected impact could not have been reached since the students may have found the pedagogical agents childish. This comment matches with the findings obtained from their motivation levels towards course material. Although motivation

levels made a meaningful difference on the part of the experimental groups in most of the studies (Baylor & Kim, 2009; Chen, 2012; Choi, 2005; Hong, Chen & Lan, 2014; Lester, Converse, Stone, Kahler & Barlow, 1997; Moreno, Mayer, Spires & Lester, 2001; Sibuma, 2007; Meij, 2013), no meaningful difference has been come across between the groups in this study and also the motivation scores of the Control group have been found the highest. Descriptive data obtained from students interviews, have revealed that their motivation levels towards course material have lowered since they have found the pedagogical agent childish. This finding is also supported by the comparison of CAIS with pedagogical agent and CAIS without pedagogical agent since no meaningful impact has been come across. The students have not found the pedagogical agents appropriate, therefore they have been demotivated. As Perez-Marín and Pascual-Nieto (2013) state “*design concerning characteristic properties*” also supports our finding. Although the students did not find the pedagogical agents appropriate, their motivation levels have been found higher than the students who used CAIS without pedagogical agent. This finding suggests that pedagogical agents should exist in CAIS. The result of a study, conducted by Xu and Wang (2006), also supports our finding, since they stated “*pedagogical agents which record and recall users’ preferences are more motivating than not having a pedagogical agent*”.

When the pedagogical agents, which were preferred by the students, are analyzed, it has been found out that the students tend to choose the pedagogical agents, which are opposite-gender. However, there is no clear finding in the literature regarding pedagogical agent preference tendencies. Johnson et al. (2013) states that young children have a tendency to prefer pedagogical agent in their own gender. Contrary to this, when individuals get older they tend to prefer pedagogical agents in opposite gender. This statement also supports our finding about preferring pedagogical agent in the opposite-gender in our study. In addition to this, it has been revealed that students prefer to see a visual character and want the characters to address them orally. This finding matches with most of the studies' results (Buisine & Martin, 2007; Dunsworth & Atkinson, 2007; Rodicio & Sanchez, 2012; Schrader & Bastiaens, 2012).

Regarding classroom management obtained through observation and interviews, it has been concluded that CAIS is more beneficial than traditional education. Since the students proceeded according to their speed, and revise the topics when they wanted, the number of questions was reduced and the time was used effectively. Experimental groups' completion of the topics and tasks in less time has provided this finding. Likewise, Choi (2005) and Ebberts (2007) state that the students who use pedagogical agents complete the tasks in a short time and Plant et al. (2009) state that the usage of pedagogical agents enhance the performance significantly.

Conclusion

As a result of the study, the necessity to individualize CAIS has been highlighted. The limitation of the study is its involving four different visual characters. More pedagogical agents should be designed for CAIS based upon students' focusing on just two different pedagogical agents and not choosing other pedagogical agents. In addition, it is suggested that characters in CAIS should be designed by the users, clothing and the sounds of the characters should also been chosen by the users so as to enhance motivation and academic success. Therefore, the study is suggested to be conducted again by realizing the designs mentioned.

It could be beneficial designing not only pedagogical agents but also background and character names in CAIS optionally. In this study, the users have not been allowed to change the pedagogical agents after they chose them. In order to keep the motivation high, it is suggested that users should be allowed to change the pedagogical agents whenever they demand. In conclusion, pedagogical agents should be integrated to CAIS, however the importance of individualistic designs has become clear.

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Appendix 1 The-Pedagogical Agents



Appendix 2 Multi-Pedagogical Agents



Appendix 3 The CAI Software's Interface

