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Research Article

The Effect of Computer Game on Coding Learning: A Case Study of University Students

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Abstract

The rapid change of computer and internet technology such as IoT (Internet of Things) or cloud computing have a serious impact on human life. Knowing the coding language is one of the way to keep up with this rapid change in computer and internet technology. This is why coding is seen as the new equivalent of terms such as thinking and producing, as well as being as important as spoken languages in recent times. One of the most important advantages of having coding knowledge is the possibility of finding jobs in almost every business area. Because of these advantages, the importance of having coding knowledge is gradually increasing. For this purpose, coding education has been added to the curriculum and started to be taught in many countries. This study examines the contribution of coding in education using computer games to make coding education more popular and easier. The main argument for the analysis of this study was the unsuccessful results of university students in coding courses. This study was conducted on two different groups in computer laboratory. In the first group, coding lessons and assignments were given by using computer games. However, the second group completed their education using classical educational materials. This study was carried out during a school term (almost 12 weeks) and the participation of the students between two groups, results of the exams, attendance and their interest in coding were compared accordingly. The analyses conducted mid-term and end of term reflected significant differences between two groups. Additionally, same results showed an increase in coding among the students in the group who were given coding training using games , and this interest was reflected in their exam results. Finally, the success rate of coding education through computer game was higher than the previous coding education. Considering that computer games have disadvantages as well as advantages, all analyses determined that the effect on computer games on coding education was significant.

Keywords: Coding, Computer Games, Coding Knowledge, Coding Lessons, Coding With Games

Students Bilgisayar Oyununun Kodlama Öğrenimine Olan Etkisi: Üniversite Öğrencileri Üzerinde Durum Analizi

Öz

IoT (Nesnelerin İnterneti) veya bulut bilişim gibi bilgisayar ve internet teknolojisinin hızlı bir şekilde değişmesi insan yaşamını ciddi şekilde etkiliyor. Kodlama dilini bilmek, bilgisayar ve internet teknolojisindeki bu hızlı değişime ayak uydurma yollarından biridir. Kodlamanın son zamanlarda konuşulan diller kadar önemli olmasının yanı sıra düşünme ve üretme gibi terimlerin yeni eşdeğeri olarak görülmesinin nedeni budur. Kodlama bilgisine sahip olmanın en önemli avantajlarından biri, hemen hemen her alanda iş bulma olasılığıdır. Bu imkanlardan dolayı, kodlama bilgisine sahip olmanın önemi giderek artmaktadır. Bu amaçla birçok ülkede kodlama eğitimi müfredata eklenmiş ve öğretilmeye başlanmıştır. Bu çalışmada kodlama eğitimini daha popüler ve kolay hale getirmek için bilgisayar oyunları kullanılarak kodlama eğitimine katkısı incelenmiştir. Bu çalışmanın yapılmasında ki temel problem üniversite öğrencilerinin kodlama derslerindeki başarısız sonuçları olmuştur. Bu çalışma laboratuvar ortamında olup iki farklı grup kullanılmıştır. İlk grupta bilgisayar oyunları kullanılarak kodlama eğitimi ve ödevler verilirken, ikinci grupta klasik eğitim materiyalleri kullanılarak eğtim tamamlamıştır. Yapılan bu çalışma bir eğitim dönemi (12 hafta) boyunca uygulanıp, iki grup arasındaki öğrencilerin derse olan katılımı, sınav sonuçları ve kodlamaya olan ilgisi karşılaştırılmıştır. Dönem ortasında ve sonunda yapılan analizlerde iki grup arasında ciddi farklar olduğu göze çarpmıştır. Ayrıca, dönem ortası ve sonu analizlerindeki sonuçlara göre oyun kullanılarak kodlama eğitimi verilen gruptaki öğrenciler arasında da kodlamaya olan ilgi artmış ve bu ilgi notlarına da yansımıştır. Son olarak, bilgisayar oyunu ile verilen kodlama eğitiminin başarı oranı geçmiş dönemki kodlama eğitimine göre daha fazla olduğu görülmüştür. Yapılan tüm analizlerin sonucunda, bilgisayar oyunlarının dezavantajları yanında avantajlarının da olduğu göz önünde bulundurularak, kodlama eğitimine ciddi oranda bir etkisi olduğu tespit edilmiştir.

Anahtar Kelimeler: Kodlama, Bilgisayar Oyunları, Kodlama Bilgisi, Kodlama Dersi, Oyun ile Kodlama

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1. Introduction

Computer and internet revolution have completely reshaped the relationship between society and technology. While people fulfill their daily needs with conventional media tools, but with the technology revolution, everything started to be done more easily with computers. In fact, a coding technology is used in all business areas for any purposes, such as stock programs, budget programs, online schedules or online documentatios and etc... With this revolution in technology, humanity needed coding knowledge such as spoken language (Çavuş, Ayhan and Tuncer, 2016). For this reason, especially in developing countries, learning coding is the most important concept in education all around the world (Aytekin et. al., 2018).

To have the ability to do coding in our age, it was seen as an obligation rather than a necessity to act (Keçeci, Alan and Zengin, 2016). Individuals of 21st century have the characteristics to do research, learn, be creative, career and personal skills as well as coding (Demirer and Nurcan, 2016). Additionally, the literature studies show that coding to be acquired in the 21st century has many skills that facilitates ownership and enables the development of these skills. At any age of life, it is a great investment to learn coding or to have coding knowledge to prepare for the future. Thus, through production or development of IT application, society will be creative rather than consume IT application society. That is why coding has become an important part of the education in many developed countries (Williams and Cernochova, 2013).

1.1. Coding Education

In the past, the significance of coding was not that much important. Therefore, coding was only a great importance for program developers and computer engineers. However, due to the rapidly changing and renewed internet technology, nowadays, coding education has become more of a requirement than a need (Sayın and Seferoğlu, 2016). Although individuals may not develop themselves in the software field, coding logic will contribute to their success in other fields. That is why coding is a new way of thinking and producing as the alphabet of the new age (Dolmaz, 2019).

According to Arıkan and Ünsal (2019), the first step of the software, coding, refers to all the operations that need to be done per certain conditions and order. In other words, coding is defined as the whole or part of the directory of computer or electronic circuit and mechanism commands.

In developing countries, coding is on the agenda as a new type of literacy. Therefore, developed countries think that coding is the 21st century skill that every student should acquire; hence, coding courses were added to the curriculum. Every individual, who receive coding training have a number of skills as finding solutions to problems, seeing the results, correcting mistakes, being happy when successful and targeting better (Başaran, 2017; Yecan, Özçınar and Tanyeri, 2016). Therefore, the ability to do coding also reveals many abilities of individuals. In addition to the effect of such abilities, it is seen that coding knowledge has a serious effect on determining students' careers. Such as Mark Zuckerberg founded Facebook by learning coding at a very young age or Bill Gates, who is one of the creators of Windows Operating System, wrote his first software at the age of 13 (Oluk, Korkmaz and Oluk 2018).

In consideration of recent studies, it is seen that coding knowledge has many contributions to each individual. For example, pursuant to the authors (Resnick and Silverman, 2005; Coravu, Marian and Ganea, 2015), with the coding skill experience, children solve errors easily and their ability to evaluate the consequences increases. Another study conducted with researchers stated that, coding knowledge develop system design and algorithmic thinking ability (Taylor, Harlow and Forret 2010; Wing, 2006).

There are many ways for people of all ages to learn coding.. One of the widely known methods for learning coding are video tutorials, online courses or block websites. Apart from these, many animation, simulation or games are also available on internet (Kaplancali and Demirkol, 2017). Watching online tutorials or courses have many contributions to develop and improve coding knowledge, but these are for some people, who have much enough knowledge to understand the video. For beginners or all ages, online games are the best option to learn and understand the basics of coding and coding structure (Falloon, 2016; Resnick et. al., 2009).

1.2. Computer Games and Education

Playing game has been a part of human life since infancy and is an activity that continues its existence by changing its form. Like playing activity, education defined as a lifelong process. Therefore, game and education intercepts and that started to be a part of human life (İnan Kaya, 2018). However, the intersection of game and education methods has changed over the years because of technology and internet. Nowadays, the traditional education methods are inadequate due to the rapid development of the Internet and technology. In particular, it helped to a certain extent in technological facilities such as online courses provided by internet technology. However, it was not effective to learn with online courses (Martin, Silander and Rutter, 2019). Because of the lack of traditional education methods and online courses, educators have started to search for new ones, and consequently, computer games are thought to help in many areas of learning (Iacovides, 2012; Wu, Hou and Hwang, 2012). The concept of game is even older than culture and contains many features. Ability and intelligence development are one of these features (Huizinga, 2013). Therefore, it is thought that computer games will make a great contribution to learning. According to Barr (Barr, 2017), there is quantitative evidence that PC games can be used to develop a range of useful skills and competences in students such as communication, resourcefulness, and adaptability.

2. Literature Review

According to literature, various studies were performed in the field of education by combining PC games with internet technology. Unlike traditional methods, these studies has been more successful respectively

Adachi and Willoughby (2013) examined playing role-playing games in their 4 years long study . Researchers reported that PC games positively affected the participants' problem solving skills. Similar study by another researchers (Shute, Ventura and Ke, 2015), analyzed the playing of a PC game called portal 2. The researchers concluded that playing this game improved players' problem solving skills. Rozali and Zaid (Rozali and Zaid, 2017) developed a mobile game based on problem-based learning to analysis the effect of learning

programming. Researchers found that, playing mobile games motivate students in learning programming. In a very similar study by Santos and Batista (Dos Santos, 2014), researchers designed and proposed a tool to analyze the effect of learning a programming language with specific game.

Researchers also performed survey studies. Hamari et. al. (2016) used questionnaire tools to measure subjective experience of participation in educational play and Ruggiero (2015) demonstrated similar questionnaire research to measure students' affective learning and attitude after they played a game designed to affect players' attitude towards homelessness. Bourgonjon et al. (2016) designed an online discussion form to analyze player perspectives on the positive impact of video game. On the other hand, there are many interview and observation studies in the literature. Researchers used qualitative interviews to analyze whether the players tend to integrate elements of their game playing experience into social life (Gortari, 2011).

Apart from these researches, PC games are used to improve communication or educational skills. According to Barr's (2018) quantitative research study, playing specific pc games improved communication skills between students. Similar study by Vasalou et. al (2017) analyzed verbal and non-verbal interaction between children according to the game logs and observation on the students' behaviors. According to Campe and Denner (2015), construction-based coding games create a potential increase on the skills of all students such as confidence, motivation and etc.… At the same time, other researchers designed a tool to increase student motivation among higher education students. In the light of statistical analysis, the results of this study shows that games increased students' learning motivation significantly (Arango-López et. al, 2019).

Moreover, researchers conducted an interesting study to analyze the effectiveness of PC games based on safe design thinking. The researchers compared computer-based games, paper based games and a traditional lecture. Traditional lecture education completely failed, and paper-based game failed to motivate the students,while computer-based game accomplished to train and educate the students perfectly (Din and Gibson, 2019).

3. Material and Method

The sample set of this study is comprised of Engineering and Management Information Systems Department students at European University of Lefke during the spring semester of 2018/2019 academic year. Computer Foundation course was chosen with 131 registered students, and study was conducted during all spring semester between March 2019 and June 2019 (10 weeks except mid-term and final weeks). The students selected randomly and divided into 2 different groups. First group used computer lab by games while the second group used computer lab by course documents and exercises during all semester. The importance of conducting this study is that coding knowledge is the basic requirement for the literacy of the 21st century (Baz, 2018). The aim of the study is to analyze the effect of PC games on coding education based on university students and prevent students' failure and absenteeism in coding education. This method and hypothesis have been determined in order to solve this problem through the literature researches as an example.

At the end of the education methodology applied to the students for 3 months, the following research questions were asked to learn the thoughts of the students about the applied education method (Yücel and Rızvanoğlu, 2019; Yang and Teng, 2014).

- RQ1: Do you think these teaching method and material have helped you to develop any coding skills?
- RQ2: Were the factors of applied method affected the desire to learn?
- RQ3: Was the applied method sufficient to increase motivation?

As mentioned above, literature review and experimental study lead to formulate the following hypothesis.

- H1: To change students' thinking on coding with the applied game method,
- H2: To increase students' attendance in coding lesson with the applied game method,
- H3: To increase the motivation of students towards coding lesson with the applied game method,
- H4: To like coding with the applied game method,
- H5: To enable students learning coding easier with the applied game method,
- H6: To provide students to pass the lesson with sound information with the applied game method,
- H7: To ensure that students continue to learn and write code after the 3 months education given to the students with the applied game method.

There are many computer games for teaching purposes in the computer world. Although many of these games aim at teaching reading and writing for students with disability, on the other hand, there are also various PC games that provide coding education in the literature likeCode Puzzle (Rozali and Zaid, 2017), Code.org, CodeMonkey, GoogleBlocky, Code Combat (Aytekin et. al, 2018). On the other hand, some researchers used PC games to analyze students' learning behavior, which created for only entertainment rather than educational purpose (Barr, 2018). Additionally, few researchers created their own PC games for various purposes (Rozali and Zaid, 2017; Yang and Teng, 2014; Dos Santos, 2014; Arango-López et. al, 2019).

In this study, CodeCombat game was used for analysis purposes. CodeCombat is an online and open source code learning game with many stages and characters. Characters do not have special powers but the stages have difficulties and different aims. As shown in Figure 1, the game has many stages based on coding topics. The first main stage is related with syntax, methods, parameters, strings, loops and variables; and second main stage is related with if/else, Boolean logic, relational operators, functions, object properties, event handling, input handling; and third main stage is related with arithmetic, counters, while-loops, break, continue, arrays, string comparison, finding min/max; and the stages went up to the advance programing skills. In addition to these main stages, CodeCombat has side stages related with HTML, AI scripting and etc.… After stage and character selection, the chapter selection menu appears on the screen related with stage topic and player starts using in the beginning of stage that he/she selected to play. Figure 2 illustrated the chapter selection menu in stage one.

Figure 1: Stage selection screen in CodeCombat game

Figure 2: Chapter selection in stage one

Figure 3 shows the gaming screen of CodeCombat. The play screen is divided by two parts. The first part on the left side, is the gaming screen. Second part is the editor screen. Players typed the codes in editor screen and run. The character starts to move according to the coding that players typed on editor screen. The aim of all chapters is to reach the end of the maze without being stuck in any obstacle based on the codes that player typed. The game has 59 different language options including Turkish. The aim of whole game is to prepare learning to code, because of this aim, the slogan of the game is "learn to code by playing the game". When the game was available on the internet first time, it was only for 9 year-old kids, but now the creators of the game modified it for all ages. Therefore, CodeCombat is available on the internet for all ages now.

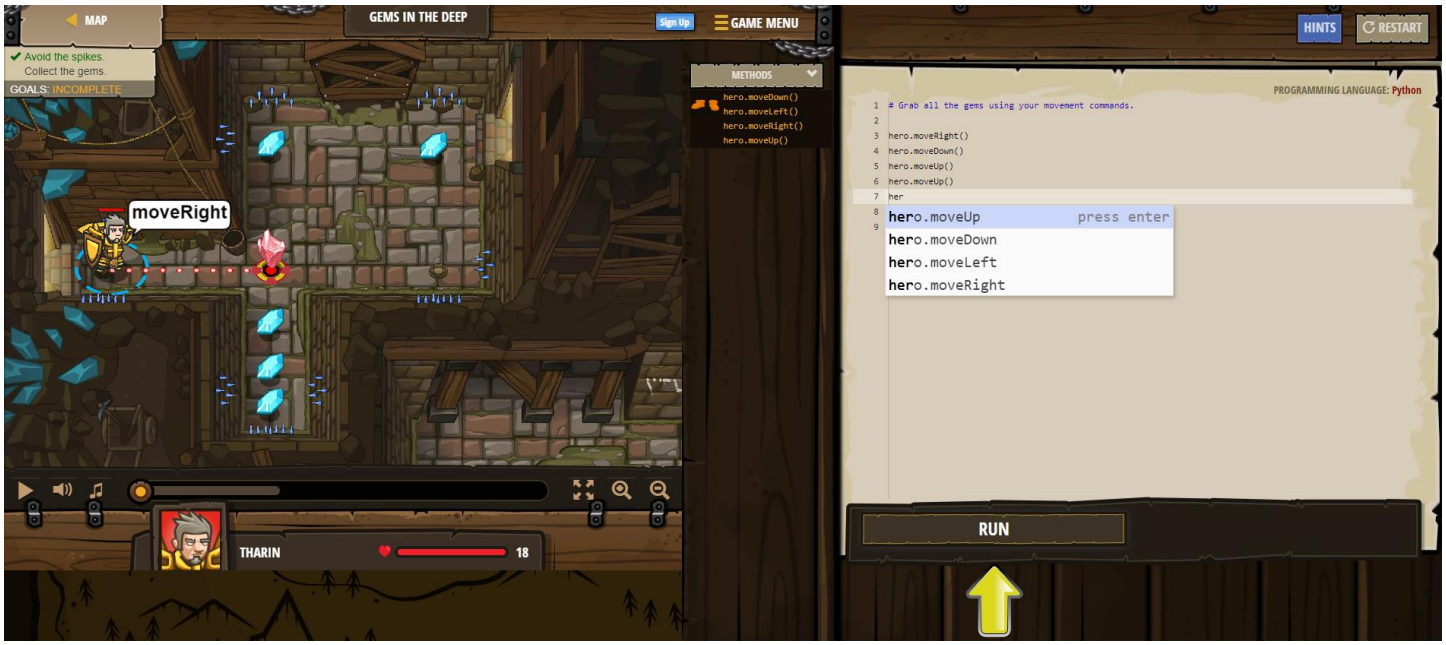

Figure 3: Play screen of CodeCombat

As mentioned above, CodeCombat game was applied on half of the 131 university students. Three different types of data were collected for analysis. The first is related with the attendance, second with exam grades and the last one with research questions. The first data is about the attendance to lab sections for 10 weeks in comparison with 2018/2019 fall semester and 2018/2019 spring semester. With the comparison of attendance, it is possible to find out the interest towards the course after the gaming education method. The second data was on the total exams scores again comparing the exams grades and averages between 2018/2019 fall semester and 2018/2019 spring semester. With the grade comparison, it is possible to see the effect of the gaming method. Lastly, students were asked 3 research questions at end of the all to identify whether the applied method affected students' learning process.

When the application of this method was first introduced, there were no limitations and major difficulties were encountered respectively since game never requires powerful hardware, fast internet speed or huge storage but internet connection and minimum PC requirements to play. Besides these, game does not need any game knowledge, so it has very simple and easy playing infrastructure. CodeCombat used in this research due to its simple requirements and easy to play options.

Following the data collection from all sources, different tests were used on SPSS as normalization test was used to check whether data are parametric or non-parametric. Since if data are parametric, T-test (Student T-test) must be used, but where data are non-parametric, Mann Whitney U test must be used for analysis. In addition to these tests, Independent Sample T test was used to examine the means among the groups.

4. Results and Findings

As given under Table 1, the lab attendance data was used in the first experiment. Two different groups that gaming method and classical materials were compare by 10 weeks. Atotal number of 131 students attended to the experiment during 2018/2019 spring semester.. In game education group, 17 students attended to all sections, 23 students attended 9, 22 students attended 8 and only 3 students attended 7 sections. On the other hand, only 7 students attended 8 sections in classical education

Table 1. Crosstabs analysis based on groups and attendance

Count

		Grup		
		Game Education	Classical Education	Total
Attendance	1	0	8	8
	2	0	3	3
	3	0	5	5
	4	0	9	9
	5	0	8	8
	6	0	13	13
	7	3	13	16
	8	22	7	29
	9	23	0	23
	10	17	0	17
Total		65	66	131

Apart from crosstabs analysis, Normalization test was used to find out whether the data are parametric or non-parametric. 5 different aspects were used to identified data, as; Histogram, Variance, Skewness, Detrended Plot and Normality.

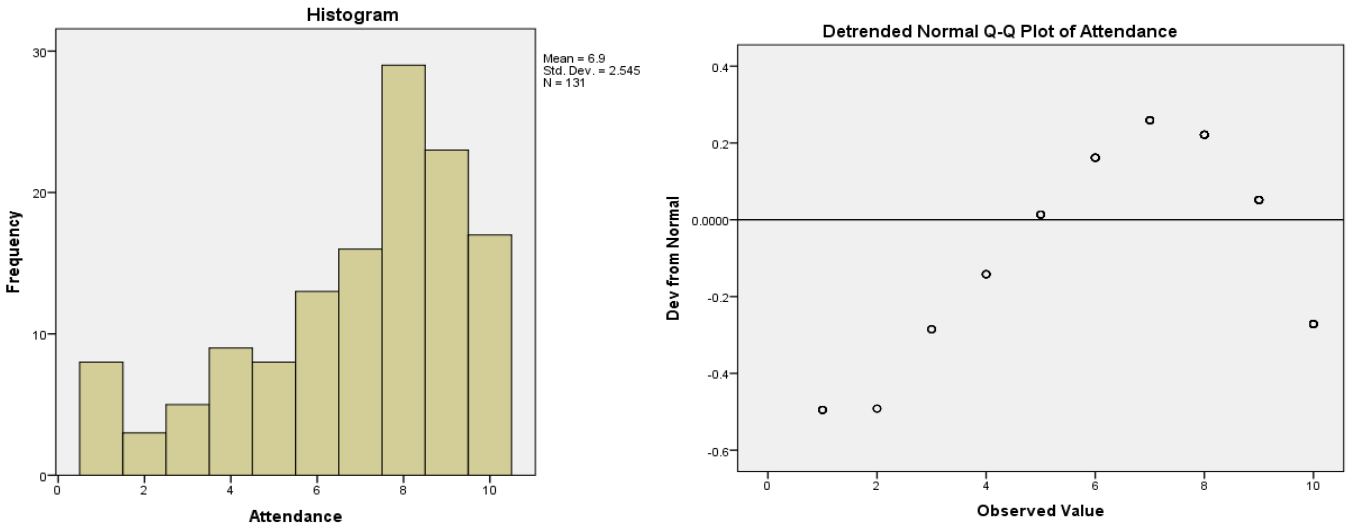

Figure 4: Histogram and Detrended Normal Chart

Table 2. Descriptive and Normality Tests

Descriptives

			Statistic	Std. Error
Attendance	Mean		6.90	.222
	95% Confidence Interval for Mean	Lower Bound	6.46	
		Upper Bound	7.34	
	5% Trimmed Mean		7.06	
	Median		8.00	
	Variance		6.475	
	Std. Deviation		2.545	
	Minimum		1	
	Maximum		10	
	Range		9	
	Interquartile Range		4	
	Skewness		-.863	.212
	Kurtosis		-.112	.420

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Attendance	.194	131	.000	.896	131	.000

a. Lilliefors Significance Correction

In order to check whether data are parametric or non-parametric, at least 3 of 5 aspects must provide the normality. Data in histogram chart must been collected frequently, like triangle shape unlike shown in Figure 4. Variance isthe standard deviation divided by mean. In Table 2, it is 0,36, but it must be less than 30%, so it is not provided. In the third aspect, if 2 multiplied by standard error data of skewness is bigger than the absolute value of skewness data; it means that data are normal. In Table 2, 0.212 multiplied by 2 is equal to 0.424, so it is still less than skewness data, which is not normal. Where the detrended normal chart has some pattern like “W”, “V” or “S”, it means that data are not normal. In the last aspect, Kolmogorov smirnov data should be used as more than 50 data were used in this research. Where “Sig.” value is less than 0.05, data are not normal. Since normality test was based on attendance data and 5 aspects, none of the aspents provided the normality. In other words, data are non-parametric, so Mann Whitney U test should be used to examine the data.

As mentioned above, Table 3 shows that Mann Whitney U test. Mean Rank of Game Education value is more than the Classical one in the first part of Table 3 and Asymp. Sig. value is less than 0.05 in part two, so it is easy to say that Game Education method affects the motivation to the course and students want to come more often.

Table 3. Mann Withney U Test

Ranks

	Grup	N	Mean Rank	Sum of Ranks
Attendance	Game Education	65	97.19	6317.50
	Classical Education	66	35.28	2328.50
	Total	131		

Test Statistics[a]

	Attendance
Mann-Whitney U	117.500
Wilcoxon W	2328.500
Z	-9.438
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: Grup

Lastly, considering the attendance in 2018/2019 fall semester and analysis on the gaming education class, it is possible to say that gaming method motivates the students to attend lessons regularly. Table 4 shows that the attendance of 2018/2019 fall semester is based on 10 weeks. In 2018/2019 fall, only 5 students attended 8 times. Unfortunately, no one attended 9 or 10 times.

Table 4. 2018/2019 Fall Semester Attendance

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	17	11.2	11.2	11.2
	2	24	15.8	15.8	27.0
	3	17	11.2	11.2	38.2
	4	30	19.7	19.7	57.9
	5	28	18.4	18.4	76.3
	6	19	12.5	12.5	88.8
	7	12	7.9	7.9	96.7
	8	5	3.3	3.3	100.0
	Total	152	100.0	100.0	

Apart from the attendance analysis, 2018/2019 spring semester game method and classical method grades and 2018/2019 fall with 2018/2019 spring total grades were compared respectively

Table 5. Crosstabs analysis based on groups and exams grade

		Grup		
		Gaming Education	Classical Education	Total
Grade	23	0	1	1
	26	0	2	2
	29	0	1	1
	31	0	2	2
	33	0	2	2
	34	0	1	1
	35	0	1	1
	36	0	2	2
	37	0	3	3
	38	0	2	2
	40	0	2	2
	41	0	3	3
	42	0	1	1
	43	0	4	4
	44	0	3	3
	46	0	2	2
	47	0	3	3
	48	0	2	2
	49	0	3	3
	50	0	2	2
	51	0	2	2
	52	1	1	2
	53	0	1	1
	54	1	3	4
	55	1	3	4
	56	1	4	5
	57	2	1	3
	58	1	0	1
	59	2	0	2
	60	3	0	3
	61	1	2	3
	62	1	1	2
	63	2	1	3
	64	4	0	4
	65	1	0	1
	66	5	1	6
	67	2	1	3
	68	3	0	3
	69	4	0	4
	70	1	0	1
	71	1	0	1
	72	3	1	4
	73	3	0	3
	74	5	0	5
	75	1	1	2
	76	1	1	2
	77	3	0	3
	80	3	0	3
	81	1	0	1
	84	2	0	2
	85	3	0	3
	90	1	0	1
	95	1	0	1
	100	1	0	1
Total		65	66	131

Table 5 shows the comparison of grades based on 2 groups, which were gaming education group and classical education group. In gaming education group, one student got 100 out of hundred on the other hand, only 76 is the highest mark. Therefore, it is obvious that the grades of gaming education class is much higher than the other group.

Table 5 illustrates the difference between two groups, and gaming group is better than the classical method, and Table 6 shows the differences between spring and fall semester.

Table 6. Comparison between 2018/2019 fall and spring grades

SpringGrade

N	Valid	131
	Missing	21
Mean		58.48
Median		59.00
Range		77
Minimum		23
Maximum		100

FallGrade

N	Valid	152
	Missing	0
Mean		35.34
Median		33.00
Range		58
Minimum		16
Maximum		74

Table 6 shows Mean, Median, Range and Max/Min of 2018/2018 spring and fall full grades shown. As shown, the mean value is 58.48 among 131 students in spring, but it was 35.34 among 152 in fall. At the same time, the highest grade is 100 in spring semester. Therefore, it is easy to say that, gaming education style has a great influence on learning.

Lastly, small questionnaire was used to learn students' idea about gaming style education. As mentioned above, the questions were as follows:

- RQ1: Do you think these teaching method and material have helped you to develop any coding skills?
- RQ2: Were the factors of applied method affected the desire to learn?
- RQ3: Was the applied method sufficient to increase motivation?

In questionnaire, five-point Likert scale ranging from "strongly agree=1" to "strongly disagree=5" was used to measure. The questionnaire was applied on 2018/2019 spring semester students in both group. Table 7 shows the results of questionnaire.

Table 7. Crosstabs analysis of questionnaire

Grup * QS1 Crosstabulation

Count

		QS1					
		Strongly Agree	Agree	Hesitate	Disagree	Strongly Disagree	Total
Grup	Game Education	34	22	9	0	0	65
	Classical Education	0	0	13	27	26	66
Total		34	22	22	27	26	131

Grup * QS2 Crosstabulation

Count

		QS2					
		Strongly Agree	Agree	Hesitate	Disagree	Strongly Disagree	Total
Grup	Game Education	36	25	4	0	0	65
	Classical Education	0	0	6	22	38	66
Total		36	25	10	22	38	131

Grup * QS3 Crosstabulation

Count

		QS3					
		Strongly Agree	Agree	Hesitate	Disagree	Strongly Disagree	Total
Grup	Game Education	28	24	13	0	0	65
	Classical Education	0	0	5	27	34	66
Total		28	24	18	27	34	131

According to the results of Table 7, almost all students,who attended game education class, accept and like the style, while, almost no one can likes classical education style.

As mentioned above, 3 different analyses and data were used to analyze 7 different hypotheses. With the results of 3 analyses, gaming education style has been proved success for all the hypotheses.

In this research, gaming education style was applied and in the light of results, it has been determined with 3 different studies that the gaming method is very effective on learning and motivation.

5. Conclusion and Recommendation

Due to the rapid development of internet technology, having coding knowledge has become as important as being able to read and write any language fluently. Because of this significance on coding knowledge, coding lessons are provided even in high school. However, many more students still do not have coding knowledge or at least basic details. So, the aim of this research is to boost up students' motivation and interest to learn and get an idea about coding. Coding game was used to reach the aim of this research and compare data from current semester and past semester to analyze hypothesis.

In European University of Lefke, the student data from 2018/2019 fall and spring semesters were used accordingly. 2 different groups were used in spring semester and one of them was provided education through coding game and other group used the classical materials. Attendance, grades and small survey study data were all used to find out the differences between both groups. After that, these data were compared with fall semester data based on same parameters.

According to the results of analysis, coding game style helped the students to learn coding and at the same time boost up their motivation. Therefore, game education style affects student-learning motivation positively. However, I personally believe that gaming style education and the number of such games are not enough to teach complex coding technics. Based on the results, the recommendations to instructors or students are as follows:

- Create various kind of games like code combat with an better graphics and story to motivate students and increase the playing time and practice
- Create online multiplayer type of coding game for encouraging students to play more increasing competition.
- Create different type of coding games for specific purpose such as, web coding, database coding, front end or back end coding.
- In the future, sell this kind of games for everyone as game console or may be as a mobile application game.

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