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GAME BASED LEARNING OF COMPUTER PROGRAMMING IN EARLY YEARS EDUCATION

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ABSTRACT

Nowadays, commerce, facilities, knowledge, amusement and so on are all in one way or another controlled by software that has been developed by a programming language. The United Kingdom is waking up to the need for children to start being taught at an early age about how the progressively digitalised world in which they are living is created. In September 2014, computer programming was made part of the UK's national curriculum for pupils in early years education. With this decision came several challenges for UK primary schools, including the school teachers and pupils e.g. lack of engagement on learning programming. This paper provides a detailed discussion of game-based learning and how it can lead to reduce the challenges of learning programming and ease the process of learning computer programming for pupils in early years education. It was also aimed on this paper to illustrate the details of the two experiments conducted at a UK primary school. The first experiment was done on teachers to investigate to what extent do they agree that teaching pupils programming in early years education would be a helpful step and could positively affect their pupils' learning and the second experiment was conducted on pupils to measure the impacts of the proposed system on their programming performance and enjoyment in learning programming in comparison with two other different learning methods include learning programming from a school teacher and Scratch programming system. Results have indicated that pupils who learnt programming from the proposed system (which is based on the approach of learning through playing a game) found learning programming more enjoyable and fun, and it increased their interest in continuing to learn programming compared to those who learnt programming from a classroom teacher (they found learning programming difficult and boring).

Keywords:
Game, Education; Programming; Children, Software

INTRODUCTION

With the UK government deciding to make 2014/15 the year of 'Teaching Children Programming' at the primary school level [1] [2], including recent changes in the information communications technology (ICT) curriculum (e.g. the subject name was changed from ICT to computing [3]), teaching and learning programming became vital for children in UK primary schools. Furthermore, some researchers from various disciplines, including computer science,

psychology, and education, started directing their scientific research to how children can learn and understand programming at this early age [4] At the same time, both teachers and pupils are facing several challenges in early years education. To clarify this further, teachers require further support and training in how to deliver programming concepts to their pupils in the classrooms. Pupils have an initial lack of understanding of what programming is and what the basic programming constructs are, Sequence, Iteration and so on. A further issue is that of learners' engagement in learning such a difficult and practical subject as 'programming' while they are still young. Consequently, it was interested in this research to tackle those challenges and developed a programming system for pupils that inspired by including the idea of game-based learning, whereby learners can actively be engaged in learning and enjoy practising programming, such as learning programming through playing a game; similarly, letting children discover the consequences of different activities and to make mistakes in a risk-free situation. This paper provides a detailed description of the two conducted experiments on both teachers and pupils from a UK primary school to test the proposed system and measure the impacts of the proposed system on pupils' programming performance and enjoyment in learning programming from the proposed system as well as to obtain and analyse UK teachers views on whether teaching programming in early years education is a good step and could positively affect their pupils' learning. The results of those experiments are also discussed in depth in this paper.

Learning Theories in Early Years Education

This section is intended to include a discussion of relevant theories which underpin this research study. There are several theories available to describe how pupils learn [5] [6]. Learning can be explained as a way of obtaining new or existing information. However, it is not as simple as this, which is why there are several models or theories about the same process of learning. These theories include behaviourism, constructivism, and others [5] [6].

Behaviourism can be described as a learning theory that depends on the response to stimuli [7]. This theory is simply related to how to shape the learner's behaviour. To illustrate this particular theory, the use of positive reinforcement (rewards) could help pupils to learn more from their teachers in the classroom [7]. It could also increase the possibility that the right behaviour would reoccur, whereas the use of negative reinforcement (punishment) when an undesired behaviour is performed could decrease the possibility of the wrong behaviour reoccurring [7].

When teaching children programming, this particular theory (Behaviourism) can be incorporated into a technological programming tool by rewarding children for performing well when learning programming, while not giving them rewards when they have not made any achievements. More importantly, this theory was implemented in the proposed programming tutoring system, and it worked effectively for children as it was mixed with the idea of "game-based learning" as well as

keeping them motivated and focused on the learning. More information about the proposed system and game-based learning is provided in this paper.

Constructivism can be explained as one of the learning theories where a learner is learning concepts by doing, and this theory would benefit children in the learning process [8]. Children learn more and enjoy learning when they are actively involved in the learning part. Learning works best when it focuses on thinking and understanding not memorising. This approach could help learners to develop their problem-solving skills [8].

When teaching children programming, this theory can be included by making the learning into a form of problem-solving and letting children learn programming concepts through solving a problem. In the proposed system, children were learning programming concepts such as iteration by having to use their analytical skills to solve a problem.

Effects of Gaming on Children

A. Children's Motivation

The use of computer games by children is nowadays becoming widespread, and it can be seen that children are using some of their time to play computer games as they find this an essential part of their daily lives [9]. According to Vos et al. [10], economically, the games manufacturing industry is one of the biggest businesses around the globe [10]. By studying the gaming concept from relevant literature, children's motivation often appeared as a key element in learning. Kirriemuir et al. [11] reported that a learner's motivation could possibly be increased with the use of computer games. This is because computer games prompt curiosity and awareness, as learning materials are presented in an interactive mode which keeps the learner in control.

Additionally, some experimental studies [12] [13] [14] have been conducted by studying the relationship between computer games and learners' motivation, and their results have indicated that computer games have the potential to increase learners' motivation. To illustrate this, an experimental study was carried out by Carova et al. [14], focusing on the effects of learning mathematics in a meaningful context (gaming) on students' motivation, and their results showed that learners' motivation and performance increased significantly. Another empirical study was conducted by Tuzun et al. [15], which related to learning geography through the use of a game-based system, and they found that learners who had used this system proved that their level of motivation was significantly higher than those who had learnt geography traditionally. More importantly, the system proposed in this paper had been experimentally tested in a UK primary school, and the results had indicated that pupils who used it for learning programming outperformed those who learnt traditionally; additionally, this proposed system enhanced their motivation towards learning about programming. Consequently, educational games could

support learners to increase their motivation to learn more than the traditional approach used in the classroom.

B. Deep Learning Approach and Attainment

Researchers have described the concept of deep learning [10] (p.128) as "involving the critical analysis of new ideas, linking them to already known concepts and principles, and leads to understanding and long-term retention of concepts so that they can be used for problem-solving in unfamiliar contexts." According to Gee [16], game-based learning may be suitable for the development of deep learning processes in children where they learn through trial and error to solve problems. A deep learning process is a learning approach that differs from the surface learning approach, and Marton et al. [17] differentiated between these two approaches to learning. Other researchers, including Craik et al. [18] and Tulving et al. [19], have reported that information learnt through the deep learning approach will be better recalled than information gained through the second approach, surface learning. Further studies [20] [21] have shown that the deep approach to learning is related to higher-quality learning outcomes. In the proposed system, the focus was on the assessment of a high-level learning outcome; for instance, can a pupil apply the concept of iteration in solving such a problem? In contrast, the surface approach can only be used for lower learning outcomes, such as a simple assessment of multiple-choice questions. Another weakness of surface level learning is that it is used only for the purpose of memorising concepts, such as what the teacher said about such a concept in the classroom [17], whereas the deep learning approach is frequently preferred by learners as it enables them to look beyond the material that was given to them and helps to develop their thinking [22]. With regard to the proposed system, the deep learning approach was included in the learning process where learners were learning programming concepts such as iteration through thinking and learning by doing in how to solve a problem with the use of iteration programming concepts, not simply memorising and answering multiple-choice questions (surface learning). It can be confirmed that mixing deep learning with game-based learning is a suitable approach for children to learn programming effectively. This is because learners were positively affected by learning through the use of the proposed system as well as it led to them engaging with learning programming concepts. Consequently, based on the positive results that had been found in the experimental study of this research, it would be confirmed that the deep learning approach could reduce some of the complexities and difficulties of learning programming for young students, particularly when it is mixed with game-based learning. In relation to the type of online games that this research was focused on, the next section discuss it in depth.

ONLINE GAMES

There is a more extensive range of online games than many people expect. They include casual games, advergames, and serious games [23] [24]. Each is designed with a different intention. To

illustrate this, a casual game is purely built for entertainment purposes whereas advergames are designed to be marketing advertisements and promote a product to the public [23]. More importantly and of main relevance to this study are serious games. This is because serious games are developed for a primary purpose other than pure amusement [25]. Such purposes include education, healthcare, emergency management, defence and other various serious aspects. Researchers [25] [26] have described serious games as computer games that are designed for learners to learn something and have fun whilst doing so. Michael et al. [27] discussed the difference between serious games and other forms of online games, and they reported that serious games are more focused on learning and training than anything else, e.g. entertainment. Additionally, serious games differ from other online games by their mission, as they focus on precise, purposeful learning outcomes to accomplish serious, measurable, continued enhancements in the performance of learners or players [23]. According to Derryberry [23], McDonald's uses serious games to train store employees in, for instance, customer service, store operations and employee supervision.

The use of serious games has many benefits for learners. Retention increases when using computer games compared to other traditional teaching methods [28]. They provide learners with the opportunity to experience a situation that is impossible to meet in the real world for reasons like safety, time, cost, and so on [29]. Serious games can be used in several aspects of life including military, safety, education, etc.; however, in this study, the focus is on the education aspect of the serious game, which can be called "Game-Based Learning" [30]. More specifically, this research is related to simplifying the process of teaching and learning programming for pupils in early years education. This is because the education sector is still suffering from many issues. Muratet et al. [26] reported that all over the world students are becoming less interested in computer science. As a result of this, the number of enrolled computer science students is shrinking, and they are no longer interested in continuing with this particular specialisation [26] [31]. Consequently, it is important to consider the idea of game-based learning as a possible solution to some of these significant issues. The details of game-based learning are discussed in the following section.

C. Game-Based Learning

A review of the game-based learning literature shows that there are a number of approaches to develop a game-based learning application [32] [33] that encourages gamers to enhance, for instance, their learning skills. The first one would be programmers (while taking some pedagogical instructions from educational researchers) making a professional educational game for learners to learn by playing. The next one would be students making a simple game where they take on the role of game creators in developing the simple game and learning about the content [32] [33]. Further illustration of the approach that has been adopted for developing the proposed system is provided in the subsequent section.

D. Learning Programming by Playing a Game

The impact of technology in education has created a major increase in students understanding their subject area effectively. Vos et al. [10] have shown that, when learners are playing a game, they are immersed in personal learning experiences, which could be less accessible in regular educational environments. Furthermore, embedding the method of playing into a learning process offers many benefits that could be acquired by learners. To illustrate this more, when playing a game, many activities are carried out; for instance, learners would reflect on their actions as well as being able to draw conclusions, and these advantages are not available in other learning environments such as traditional educational environments. It also can be observed that playing games are becoming an essential activity in the daily life of children. With regard to the proposed system, pupils were confronted with problems they had to overcome if they intended to achieve their goals and more information about the proposed system can be found in the following section.

The Framework of the Proposed System

This system is designed to teach children the fundamental aspects of programming, such as iteration, through playing a game, and in a way that suits their learning level. The main inspiration for the proposed system is the Assessment for Learning (AFL) initiative, comprising diagnostic and continual assessment. This defines a structured learning approach based on a student's prior knowledge, followed by learning informed by that student's assessment performance. This methodology is applied to the proposed system, such that curriculum sequencing and material generation is fully integrated into an adaptive, student-centric learning tool. In addition, the proposed system was based on the behaviourism and constructivism learning theories. In relation to the first learning theory included in the proposed system, "behaviourism," learners who used the proposed system and performed well in learning programming, received rewards, as reinforcing correct actions. The second learning theory considered in the proposed system was "constructivism": learners who learnt programming from the proposed system were learning by thinking and doing in solving problems, not simply memorising information, and, according to the findings of this research, those considered learning theories kept learners actively involved in the learning process of the proposed system and they enjoyed it, as they were rewarded for their positive performance.

More important is the interaction between a learner and the proposed system or learning process, which is shown in Figure1. When first-time learners enter this proposed system, they need to sign up to it by completing a registration form (each learner was given a username and password). Once a learner registers, a learner profile will be created to store all their information, and it will be saved in the Student Knowledge model. After that, the system will assess the learner's prior knowledge of the subject via Diagnostic Assessment (which is providing a learner

with a list of different programming activities to test his/her current programming ability via the use of sequencing and iteration concepts) in order to establish the learner's entry-level ability.

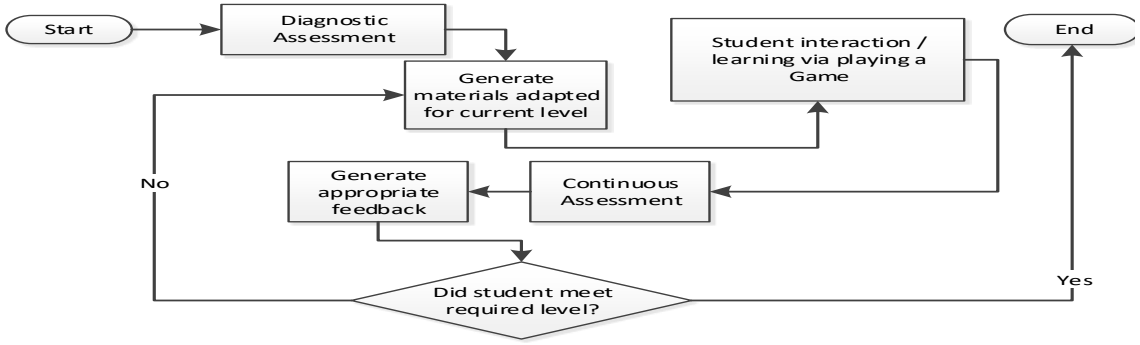


Figure 1. Learner-Followed Process in Proposed System

Once the initial assessment is completed, the system will generate appropriate material for the learner in the form of playing a game (suitable for entry level); for example, if a learner was unable to achieve the first learning outcome – which is being able to apply the concept of sequencing to solving a simple problem – at the first attempt, this learner is considered to be at a beginner level and so on and so forth. Then, the student continues to be engaged through informative "Continuous Assessment," providing appropriate feedback and adapting the learning materials accordingly, which simply means such a student is given more exercises suitable to his/her needs or level of learning until he/she has achieved the specified learning outcome. It is expected that learning completed in this way will be an enjoyable experience through which pupils can learn the fundamental aspects of programming, such as iteration and sequencing, as well as how to practically apply these two programming concepts to solving a simple or complex problem. Once again, this proposed system consisted of a series of levels that the learner was required to complete, collecting stars (e.g. solving a given problem correctly) along the way and avoiding "death" (e.g. solving a given problem incorrectly). For each level, the learner was timed, and the stars and deaths were stored and can be viewed by the teacher.

LEARNING ACTIVITIES IN THE PROPOSED SYSTEM

There are a number of various learning activities in the proposed system which is tailored to the learner needs. In this paper, two examples will be given here to illustrate those activities:

E. Sequencing Programming Concept

This particular activity is one example of how pupils can learn to solve a problem with the use of sequencing programming concept. By looking at Figure2, it can be seen that a learner is

required to do a number of steps to reach the desired goal and get the key. In addition, the number of the attempts made by the learner for solving this problem is calculated by the proposed system and considered in the learner model. For example, there is a difference between the one who solved this problem in the first attempt and the one who has managed to get it right in the second or third attempt. The right steps for solving the given problem in Figure2 are as follows: First, a learner needs to turn right (step 1). Then, it is required to turn right again (step 2) and then repeat the same action again (turn right step 3). After that, the learner goes up (step 4) and then followed by turning right (step5) to get to the destination or the desired goal. However, the subsequent example (3erugiF) illustrates a different activity of how our system can teach the concept of iteration to the student/player.

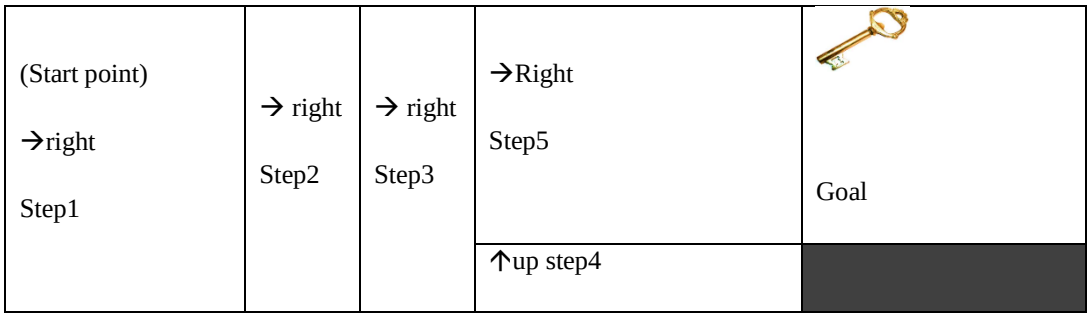
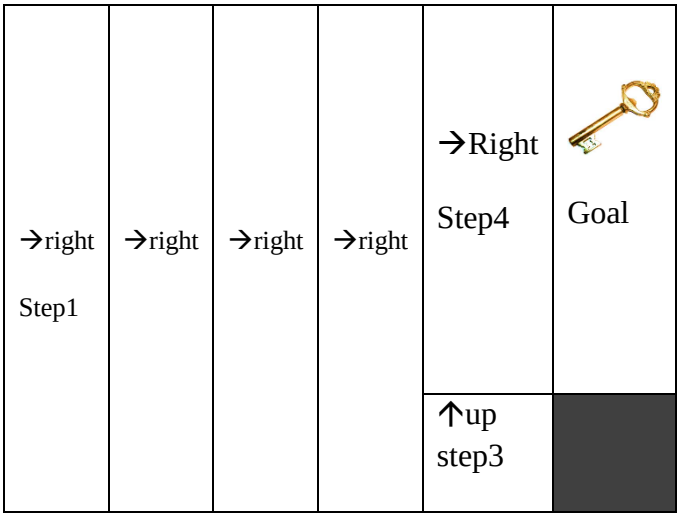


Figure 2: An example of Sequence lesson in the proposed system

F. ***Iteration Programming Concept***

The subsequent example is about the iteration concept.



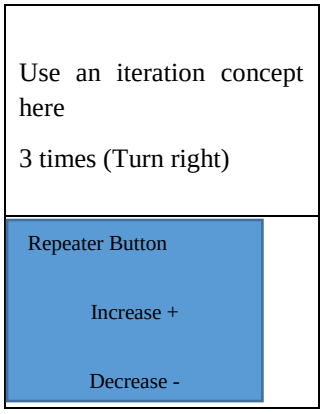


Figure 3: An example of the iteration lesson from the proposed system

In Figure3 a learner is going to learn an iteration concept which is using in this example a repeater button to increase the number of turning right to three times. The proposed system can distinguish between the one who has used the iteration approach for solving this problem or sequencing approach. In addition to this, the system will also calculate the number of times that repeater button has been increased or decreased and store this action in the student model as this will show if this learner has understood the iteration concept and met the desired learning outcome or needs further various examples.

RESEARCH EXPERIMENT & FINDINGS

A number of experiments were conducted on this research to test the effectiveness of the proposed system on pupils from a primary school, compare the proposed system with other learning methods e.g. traditional method (learning programming from a classroom teacher) and investigate to what extent do UK teachers agree that teaching pupils programming in early years education would be a helpful step and could positively affect their pupils' learning as well as obtain their views towards the decision of teaching and learning programming in an early years education.

G. Experiment on Teachers

The aim of this investigation was to study and analyse teachers' reactions to the decision to teach children programming in early years education (as is becoming compulsory in the UK), their preparations to tackle the challenges of teaching programming to young pupils, and how the proposed system could solve some of these challenges and support their pupils to learn programming better. According to the statistical results in Table I, it can be seen that a number of items were made for the participating teachers. Those items were distributed to teachers from a UK primary school, and the details of those created items and participants' responses to this survey are discussed in detail as follows. In this particular study, 23 teachers informed the

researcher about their views on the concept of teaching pupils programming in the UK and how programming could be a useful subject for pupils regarding developing their computational thinking and helping them in problem-solving. With regard to the contents of the survey completed by the participants, there were five items. The first one was about the possible benefit that children could acquire when they had the opportunity of being taught programming in early years education, such as the development of their problem-solving skills. This was followed by the second item, which concerned how pleased teachers are to teach their pupils about programming and how the technology works. The third item was about teaching pupils programming at an early stage; this could reduce some future learning challenges when they, for instance, specialise in computing, as they have received a good foundation whilst at primary school. After that, there were two additional items, which were testing the need for assessment-driven learning technology in classrooms to be used by teachers as well as how this technology could be advantageous for teachers by, for instance, reducing some of their workloads.

Table I: Descriptive Statistics of the Items Considered by UK Teachers

Items	***Number of teachers***	***Mean***
Teaching children programming is one of the ways to develop their problem-solving skills and innovative thinking levels.	23	4.74
I like my pupils to learn about programming and how the technology works in their primary schooling.	23	4.57
Teaching programming in early schooling would decrease some of the challenges of learning programming for your pupil when he/she may specialise in computer science in the future (e.g. college).	23	4.26
I need an assessment-driven learning tool to teach my pupils programming in the school or at home.	23	4.39
An assessment-driven learning tool would reduce some of my workloads when I am teaching my pupils programming.	23	4.30

H. *Experiment on Pupils*

This experiment was performed after the completion of the development of the proposed system. It took place in a UK primary school, and 52 pupils participated in this experimental study. Those participants were divided into three groups with the help of the ICT school teacher. The first group was the “Experimental Group,” which comprised those who have used the proposed system for learning programming through playing a game (a mixture of Year 3 pupils and Year 4 pupils, as they still have not experienced programming at the school). The second group was the “Traditional Group,” which comprised those who have learnt programming via attending a traditional classroom (a mixture of Year 3 pupils and Year 4 pupils). The last group was those

who have learnt programming via making a game ("Scratch Group") with the use of the Scratch tool (Year 6 pupils). Scratch is a programming language (a visual-based tool) allows pupils to create their own interactive stories, animations, and games (by dragging and drops) and share them with others [34]. In this experiment, many activities were carried out with the participants, such as a pre-run student survey, post-run student survey, and others. Consequently, the researcher visited this primary school several times to successfully complete this experiment. The details of the results of this experiment are illustrated in depth in the succeeding sections.

(1) Measurement of Pupils' Performance (Traditional and Proposed System)

Table II shows the two learning methods used by both groups with an illustration of the mean of the variable "The used learning method has increased my progress in programming," and this statistical data is compared in Table III.

Table II: Some Statistics about a Learning Method Variable for both Groups

Dependent Variable	***Learning method (Independent Variable)***	***No. of pupils***	***Mean***	***Std. Deviation***
The used learning method has increased my progress in programming (Learnability)	traditional	17	3.65	.996
	proposed system	18	4.39	.979

An independent sample was used here as a method to statistically compare the means of programming progress for both groups, those who learnt traditionally and those who learnt via the proposed system. By looking at the statistics in Table III, it can be noticed that there is a statistically significant difference in the programming progress of the two groups and this is according to the significance result, which is .033, as well as it is less than 0.05 (the result of the level of significance or P value).

Table III: Experimental Group & Traditional Group Achievement—t-test at 0.05 Level of Significance

Dependent Variable	***Levene's test for equality of variances***		***T-test for Equality of Means***						
								95% confidence interval of the differences	
Learnability	F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Equal variances assumed	.166	.686	-2.222	33	.033	-.742	.334	-1.421	-.063

(2) Measurement of Enjoyment Rate (Traditional and Proposed System)

Table IV shows the mean of the variable "I have enjoyed learning programming" for the two different learning methods, and this statistical data is compared in Table V.

Table IV: Some Statistics about the Enjoyment Variable of both Groups

Dependent Variable	***Learning-method (Independent Variable)***	***No. of pupils***	***Mean***	***Std. Deviation***
I have enjoyed learning programming (Enjoyability)	traditional	17	3.35	1.057
	proposed system	18	4.67	.594

An independent-samples t-test was used to statistically compare the means of enjoyment scores for both groups. From the generated results in Table V, it can be seen that there is a statistically significant difference in the enjoyment variable between the two groups and this is according to the significance result, which is .000, as well as it is less than 0.05 (the result of the level of significance or P value).

Table V: Experimental Group & Traditional Group Enjoyment—t-test at 0.05 Level of Significance

Dependent Variable	***Levene's test for equality of variances***		***T-test for Equality of Means***						
								95% confidence interval of the differences	
Enjoyability	F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Equal variances not assumed			-4.497	24.884	.000	-1.314	.292	-1.916	-.712

(3) Measurement of Pupils' Performance (Scratch and Proposed System)

Table VI displays the mean of the variable "Using learning method has increased my progress in programming" for the group who used the proposed system for learning programming and the other group, who used the Scratch system, and this statistical data is compared and explained in Table VII.

Table VI: Some Statistics about the Programming Progress Variable of both Groups

Dependent Variable	***Learning method (Independent Variable)***	***No. of pupils***	***Mean***	***Std. Deviation***
The used learning method has increased my progress in programming (Learnability)	scratch	17	3.41	.712
	proposed system	18	4.39	.979

An independent sample was used here as a method to statistically compare the mean of programming progress of both groups. By looking at the statistical data shown in Table VII, it can be noticed that there is a statistically significant difference in the programming progress of the two groups, as shown in the significance result, which is .002, as well as it is less than 0.05 (the result of the level of significance or P value).

Table VII: Experimental Group & Scratch Group Programming Progress—t-test at 0.05 Level of

Dependent Variable	***Levene's test for equality of variances***		***T-test for Equality of Means***						
								95% confidence interval of the differences	
Learnability	F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Equal variances assumed	.096	.759	-3.360	33	.002	-.977	.291	-1.569	-.386

Significance

(4) Measurement of Enjoyment Rate (Scratch and Proposed System)

Table VIII illustrates the mean of the variable “I have enjoyed learning programming” for the two different learning methods, and this statistical data is compared in Table IX.

Table VIII: Some Statistics about the Enjoyment Variable of both Groups

Dependent Variable	***Learning method (Independent Variable)***	***No. of pupils***	***Mean***	***Std. Deviation***
I have enjoyed learning programming (Enjoyability)	Scratch	17	3.71	.772
	proposed system	18	4.67	.594

An independent sample was used here as a method to statistically compare the means of enjoyment for the two groups. By looking at the statistical data in Table IX, it can be noticed there is a statistically significant difference in the enjoyment; as shown in the Sig. (2-tailed) column, the significance result is .000, which is less than 0.05 (the result of the level of significance or P value).

Table IX: Experimental Group & Scratch Group Enjoyment—t-test at 0.05 Level of Significance

Dependent Variable	***Levene's test for equality of variances***		***T-test for Equality of Means***						
								95% confidence interval of the differences	
Enjoyability	F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Equal variances assumed	1.063	.310	-4.141	33	.000	-.961	.232	-1.433	-.489

DISCUSSION OF THE OVERALL RESULTS

According to the statistical data which were presented in the previous section, the results indicate that pupils who used the proposed system to learn programming through playing a game found learning programming to be enjoyable and fun, and it increased their interest in continuing to learn programming. Furthermore, it can be seen that pupils who used the proposed system to learn programming found it suitable, as they were assessed by the proposed system and then accordingly they were provided with suitable material for their learning level. A large number of pupils who used the proposed system to learn programming found their progress in programming had improved and that this system helped them to continuously learn about programming. With

regard to the traditional method of learning programming, results had shown that pupils who learnt programming traditionally found programming a boring and difficult process, and this had severely affected their motivation and acceptance of programming in the school. In relation to learning programming from Scratch programming system, results indicated that using Scratch is another enjoyable approach for teaching pupils programming. However, according to the statistical results, it was observed that, for some pupils, learning programming through Scratch was challenging and made learning programming a little difficult for them, as assessment-driven learning is missing from this tool. Therefore, it can be summarised from the statistical data that learning programming through playing a game via the proposed system was the most suitable approach for children in early years schooling, especially those who need to be encouraged to start learning programming.

CONCLUSION

Computer programming has now become a mandatory subject in primary schools, as the United Kingdom has mandated this subject into the national curriculum. This introduction has resulted in many challenges that have affected schools, teachers, parents, and pupils. The challenges include teachers requiring further training to teach their pupils programming, as well as needing some appropriate programming tutoring systems that could ease the process of teaching and learn programming for their pupils. This paper has provided a detailed discussion of some possible solutions to those challenges e.g. The inclusion of game-based learning to support pupils engaged in learning programming and make the learning process for them easier than learning programming traditionally. A description of two research experiments along with results conducted on teachers and pupils at a primary school in order to measure pupil's performance and enjoyment in learning programming from the proposed system which is learning programming through playing is provided on this paper.

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