

Research Article**Student Ability for Learning Computer Programming Languages in Primary Schools***Karzan WAKIL¹  Shanaz KHDIR²  Lava SABIR³  Lezan NAWZAD⁴ **Abstract**

Computer Programming Languages (CPL) is known for its complexity and difficulty. It is believed to be hard to teach and to learn also many pupils and students in CPL courses have difficulties to master all required competencies and skills. At the introductory level of CPL, that problem is even more notable. There are different approaches to improve the dropout rate at CPL courses and to populate CPL. Recently, special visual environments for Visual Programming Language (VPL) are being used. Early research results show that VPL can be more efficient than classical textual programming, students can be more motivated, less bored and not burden with the syntax of CPL in hand, also Iraq as a new developing county especially in education and technology not study CPL in primary and high schools. In this study, we use visual basic for learning CPLs at 6th grade to 9th-grade primary schools in Iraq. We teach visual basic in four primary schools in Sulaimani city during a course and we test the students, the result of the test shows that the students have the ability to learn CPL by rating 71%, also the students enjoyed with learning CPL. Finally, the result of this paper helps us to add CPL curriculum to primary schools as well as to high schools.

Keywords: Learning programming, educational technology, computer programming languages

1. INTRODUCTION

Computer Programming Languages (CPL) is a very useful skill and can be a rewarding career. In recent years, the demands for programmers and student interest in CPL have grown rapidly introductory CPL courses have become increasingly popular. However, novice programmers suffer from a wide range of difficulties and deficits. CPL courses are generally regarded as difficult and often have the highest dropout rates. It is generally accepted that it takes about ten years of experience to turn a novice into an expert programmer (Robins, Rountree, & Rountree, 2003; Winslow, 1996). New generation students, as well as other citizens, are placed in a society in which computers play an important role in their daily lives. Students need to learn the world of computers because even if their major interest resides in other disciplines, such as economics, arts or literature, they will most probably need to use computers and CPL to achieve their goals (Saeli, 2012; Stephenson, Gal-Ezer, Haberman, & Verno, 2005).

In this century, people are expected to not only be consumers but also be prepared as productive individuals in society. Based on that, there is a solemn need to train children at younger age, who born into a technological world. To attain this goal we need to start changing education curriculums in the schools to align with the developments in computer science (Grout & Houlden, 2014a). The computer sciences are very dynamic, flexible and innovative. Therefore, teachers,

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administrators, parents, and society, in general, have to give sufficient importance to computer science in order to create innovators. They need to be educated in a way that stimulates high order thinking skills. Moreover, they have to be provided with problem-solving opportunities, to be encouraged to think creatively, to be able to make decisions and to reflect upon their solutions. To realize these goals, there is a need to help children at a young age to develop for computer sciences.

In many countries, the computer science curriculums have been updated to teach students from a younger age (Bargury et al., 2012; Bers, Flannery, Kazakoff, & Sullivan, 2014; Grgurina, Barendsen, Zwaneveld, van Veen, & Stoker, 2014; Grout & Houlden, 2014b; Kalelioğlu & Gülbahar, 2014; Lee, Martin, & Apone, 2014). For instance, there are many emerging applications that can be used to teach students computer science, robotics programming, and drag and drop blocks. In addition to these, CPL events are held globally which aim to teach children how the computer works, to endear them to computer science and to increase high-order thinking skills. In older-age students, they lack logical reasoning and algorithmic thinking and may have problems in CPL courses. When algorithmic rules of logic and syntax of CPLs are coupled within a course, unresolved issues may arise (Ala-Mutka, 2004; Robins et al., 2003). Therefore, to help children learn how a computer works in a fun way, it is extremely important that these skills are taught to children at a young age.

There are many studies that address the issues of teaching CPL. Some research studies found that teaching CPL to children has effects on their higher level thinking skills, such as algorithmic thinking, critical thinking, creative thinking, and problem-solving (Denner, Werner, & Ortiz, 2012), almost all of the children in the research studies developed a positive attitude to learning computing (Bers et al., 2014; Fessakis, Gouli, & Mavroudi, 2013; Kalelioğlu & Gülbahar, 2014; Keren & Fridin, 2014; Rogozhkina & Kushnirenko, 2011). Two decades ago, the term VPL had been used to describe a wide range of activities, including image processing, animation, presentation of data in graphical form, and construction of specifications, documentation, or programs in pictorial rather than textual form (Rico et al., 2011). Apart from that, the concept of VPL evolved into the CPL that “use meaningful graphics representation in the process of programming” (Roy, Kelso, & Standing, 1998).

There are different approaches to improve the dropout rate at CPL courses and to populate CPL. Recently; special visual environments for VPLs are being used. Early research results showed that VPL could be more efficient than classical textual CPL, students can be more motivated, less bored and not burden with the syntax of CPL in the hand. Iraq as a new developing county especially in education and technology there is no or few studies conducted about teaching CPL in primary and high schools. In this paper, we use visual basic for learning CPL at 6th grade to 9th-grade primary schools in Iraq. We teach visual basic in four primary schools in Sulaimani city throughout a course, then we will test the students to measure their learning capabilities.

This research is organized as follows: Section 2 explains the background work on teaching CPL in primary and high schools. Section 3 prepared research process for solving the problem. In section 4 presents the result of the implementation research process. Finally, section 5 presents some concluding remarks and points for future works.

2. RELATED WORK

Several authors and studies highlighted the benefits of the computer programming for young age in primary schools as well as high schools (Ala-Mutka, 2004; Bargury et al., 2012; Bers et al., 2014; Grgurina et al., 2014; Grout & Houlden, 2014b; Kalelioğlu & Gülbahar, 2014; Lee et al., 2014; Robins et al., 2003). These researches present a positive effect of CPLs on student learning ability. Based on their result the students had motivation for learning CPL, also they enjoy working on CPL as a new course requirement. Moreover, these researches pointed out that parent was contented with studying CPL course because it helped their children to learn many skills such as solving a problem and critical thinking.

Clements and Gullo 1984 pointed out that computers will be an essential part of the classroom and home environment of children. However their effects on young children's cognition are not well understandable. This study evaluated the effects of learning CPL on children's cognitive style (reflectivity, divergent thinking), metacognitive ability, cognitive development (operational competence, general cognitive measures), and ability to describe directions. The results showed that the programming group scored significantly higher on measures of reflectivity compared to the controlled group which showed no significant pre- to posttest differences (Clements & Gullo, 1984). Also another research reported that CPL is not as difficult and inexplicable to children as many adult educators think. The results of this experiment indicates that children can actually acquire and enjoy learning CPL. This study also highlighted the role of most parents and their role in motivating and supporting their children's CPL learning experience (Lin, Yen, Yang, & Chen, 2005).

Moreover, Kalelioğlu, 2015 challenged to investigate the effect of teaching code.org site and investigate the gender differences on reflective thinking skills towards problem-solving. According to the results of this study, CPL to elementary school students in the code.org site did not cause any differences in reflective thinking skills towards problem-solving. Also, students developed a positive approach towards CPL as well as VPL, and female students showed that they were as successful as their male counterparts, and that CPL could be part of their future plans (Kalelioğlu, 2015).

Additionally, Kaučič, and Asič 2011 discussed the VPL environment Scratch as one of the newer environments for teaching and learning introductory CPL. (Kaučič & Asič, 2011) Kalelioğlu and Gülbahar, 2014 explored the effect of Scratch CPL on 5th-grade primary school students' problem solving skills and how 5th-grade primary school students think about CPL. This study involved 49 primary school students. According to the results, CPL in Scratch platform did not cause any significant differences in the problem-solving skills of the primary school students. Moreover, they found only a non-significant increase in the mean of the factor of "self- confidence in their problem-solving ability" and most of the students found the Scratch platform easy to use (Kalelioğlu & Gülbahar, 2014). On the other hand, Sáez-López et al., 2016 assessed the use of a VPL using Scratch in. In this research, students interact and create their own content related to curricular areas with several advantages, such as motivation, excitement, commitment, and interest, showing improvements related to computational thinking and computational practices. According to the outcome of this research, they recommended applying a VPL in educational backgrounds in 5th and 6th grade in primary education through a cross-curricular implementation (Sáez-López, Román-González, & Vázquez-Cano, 2016).

Rico, Martínez-Muñoz, Alaman, Camacho, & Pulido (2011) presented the results of an experiment conducted in several high schools in which a course was offered on CPL through a Visual World (VW) educational platform to make CPL concepts more interesting for students. At the same time, the offered platform minimizes the effort required by the teachers to use the VW environment. The results of this assessment showed that both teachers and students had a very satisfactory educational experience (Rico, et al., 2011). Furthermore, Kelleher et al., 2007 described Storytelling Alice, a CPL environment that introduces middle school girls to CPL as a means to the end of creating 3D animated stories. In the study storytelling, Alice was introduced to girls' experiencing learning to the used CPL and a version of Alice without storytelling support (Generic Alice). It was found that users of Storytelling Alice and Generic Alice were equally successful at learning basic CPL constructs. However, the users of Storytelling Alice were noticed to be more motivated to the CPL; and were likely to spend more time, 42% more time CPL, to work on their programs, and expressed stronger attentiveness in the future use of Alice than users of Generic Alice (Kelleher, Pausch, & Kiesler, 2007).

In previous works, we found effective technology in teaching and learning in primary and high schools (Wakil, Rahman, Hasan, Mahmood & Jalal, 2019; Mohammed, Wakil, & Nawroly, 2018;

Nawzad, Rahim, & Said, 2018; Wakil, Muhamad, Sardar, & Jalal, 2017; Wakil, Nasraddin, & Abdulrahan, 2018; Wakil, Omer, & Omer, 2017; Wakil, Qaisar, & Mohammed, 2017). In the ones, we present how enriching classroom by using new technology (Wakil, 2017), the result of this research presented that the learning increased 22.9% after using technology for teaching inside classrooms. In another work, we found the side effect of electronic games on the students GPA (Wakil, Omer, et al., 2017) when using games helps students to think if they use it under control, but they decreased their GPA when used 1-3 hours per day by -2.41%. Also, we explained how ICT subject has a positive role in the Primary schools (Wakil, Muhamad, Sardar, & Jalal, 2017) when exams the schools when studied ICT subject better evolved and increased teaching process compared with other schools. Moreover, we found effective Microlearning in the process learning (Mohammed, Wakil, & Nawroly, 2018) this learning a new style of learning and memorizing information in students mind for long times. In this research, we will find the ability to learn a CPL from students.

3. METHODOLOGY

To determine the efficiency of teaching CPL course and the motivation for learning these CPLs. The plan is to teach Visual Basic in two primary schools in Sulaimani city during a course and then testing the students at the end of the course. The participated schools are Karem Zad Basic School and Khaka Lew basic school, with 50 students in both schools. Two grades were determined for this research: seventh and eighth grades with two groups for each grade. (15) students in each group of seventh grade and (10) students in each group of eighth grade were participating to evaluate the understanding of this new course in tow dimensions: first will the student be interested in learning this new computer educational course and second will this understanding be affected by age. The Visual basic language was taught for a month, one lesson per week, and then a testing session was conducted at the end of the course to evaluate the understanding of the students. The steps followed in the methodology of this research are shown in Figure 1.

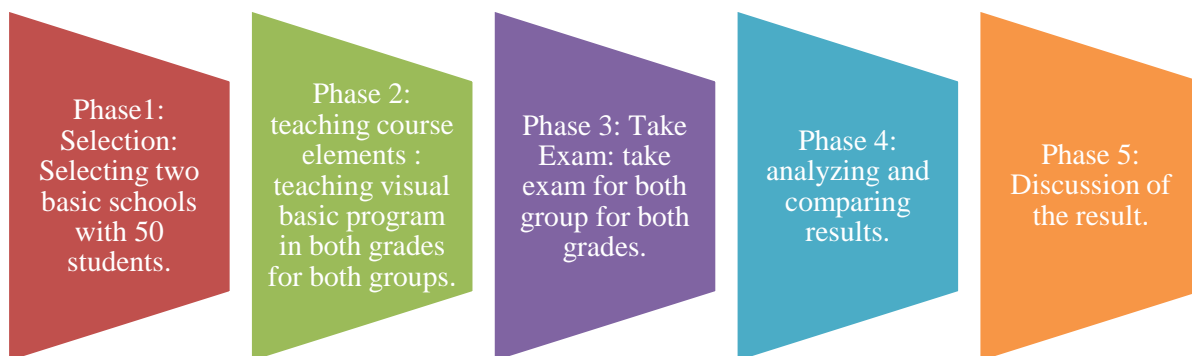


Figure 1: Course subjects introduced to the students for assessing the understanding of Basic Visual

4. RESULT AND DISCUSSION

This chapter displays the outcomes of the efficiency of teaching CPL to primary school students' and also the results of the test sessions conducted to evaluate the students 'achievement and understanding. For this, in each school two groups were assigned for the research. As mentioned in the previous section 50 students into different grades were participating in this study, 15 students in each group for the seventh grader and ten students in each group of the eighth grader in both, Kareem Zand basic school and Khaka Lew basic school were involved respectively as shown in Table 1.

Table 1: Students numbers involved in the research study in each school in Sulaimani City

School Names	Grades	Number of Students
Kareem Zand Basic School	Seventh	15
	Eighth	10
Khaka Lew Basic School	Seventh	15
	Eighth	10
Total	4 groups	50 students

After applying the mentioned methodology in each school for four weeks, a testing exam was performed for each group in each grade to evaluate the students ‘understanding. In this research, it was shown that most of the students’ preferred to study this program and actually enjoyed the session. The results showed that students passing rate in the exam was 75% and 73% for 7th and 8th grades in Kareem Zand basic school, While the exam results in Khaka low basic school recorded 70% and 64% for both 7th and 8th graders respectively, see Table 2.

Table 2: Student’s passing rate for teaching CPL sessions

School’s Name	Graders	Passing Rate
Kareem Zand Basic School	Seventh	75%
	Eighth	73%
Khaka Lew Basic School	Seventh	70%
	Eighth	64%

According to this study, the passing rate in both schools for both grades recorded high rates of understanding and student’s showed motivation and enthusiasms for learning CPLs. As shown in Figure 2, there are no significant differences in the passing rate for seventh grade between the two basic schools. However, a difference in the Eighth grade was observed between both schools.

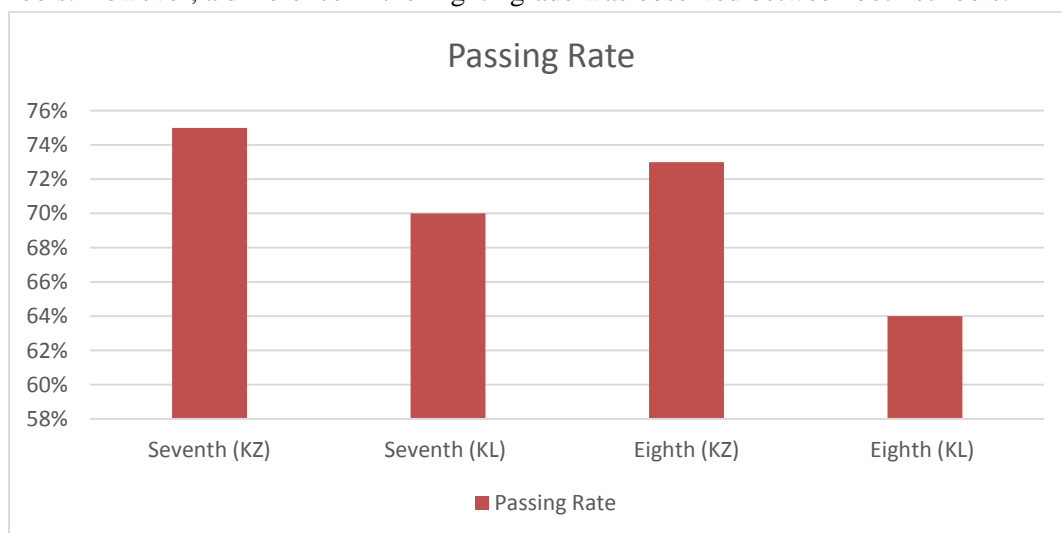


Figure 2: Student’s passing rate for CPL sessions

Note: (KZ) stand for Karem Zand Basic School and (KL) stand for Khaka Lew Basic School

As shown in this study, the students presented high motivation and commitment to learning visual learning CPL in both schools. This result is compatible with the outcome of Sáez-López et al.,

2016 who reported that VPL increase student motivation and excitement. Moreover, the students enjoyed learning and develop important skills such as critical thinking and problem-solving. This finding supports the outcomes of Clements and Gullo 1984 who reported that CPLs need to be an important part of the classroom and home environment for children to help them be more reflective and skillful toward problem-solving.

Regarding the seventh grades, there was no significant difference between the two schools in the term of academic achievement and both groups showed motivation to learn and reflected high skill toward problem-solving. This finding is proving that emerging CPL course to the school curricula will improve students' achievements and support their problem-solving skill. The study results are supporting the outcome of Kalelioğlu, 2015 and Gülbahar, 2014 who reported that learning CPL at school would improve students' critical thing and "self- confidence in their problem-solving ability". However, a slight difference in the passing rate of eighth grade was noticed between the two schools. This finding may be due to the study environment or they may be some students were reluctant to learn the basics of this program as it was newly introduced to them.

5. CONCLUSION

In this research, we present the ability of Iraqi children as a new developing country to learn a CPL as a new course in the primary schools. We use visual basic for learning CPL at 6th grade to 9th-grade primary schools in Sulaimani-Iraq. We teach visual basic in four primary schools in Sulaimani city during a course and we test the students, the result of the test shows that the students have the ability to learn CPL by rating 71%, also the students enjoyed with CPL. We recommend to the researcher work on the preparing curriculum; they can show how and which curriculum has effective for learning for CPL.

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