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# Impacts of Unplugged Activities in Computer Science

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**Abstract**

Computer Science is a fast-growing subject amongst schools. Inside of the program, Computer Science, programming or coding is generally taught. Students will typically learn to code by first using a computer and following instructions. The purpose of this literature review is to research different ideas about unplugged activities used while teaching coding in Computer Science. Unplugged activities are projects that are conducted in hands-on activities instructing students how to code before using a computer. The question that this paper is looking to answer is *"What impacts do unplugged activities have on students learning to code?"* The research conducted will give examples of different types of projects completed as well as data supporting theories.

*Keywords:* Computer Science, Unplugged Activities, Computational Thinking, Coding, Programming

Table of Contents

# Impacts of Unplugged Activities in Computer Science

## Introduction

Computer Science is growing in interest across the world. The content area is being noticed as something that is needed for students everywhere as there is a great deal of need for people in this field (Heinrich, 2018). Programming, also referred to as coding, is an important part of Computer Science. Students have learned to code directly by using lessons taught or explained and then moved to a computer to practice their skills digitally. Over time, teachers have noticed that in order to connect students with a deeper understanding of learning a programming language, it is necessary to help them connect in other ways besides digitally.

The problem is that using unplugged activities while teaching coding is not used nearly enough to help with student learning. There is a correlation between hands on projects and learning to code. Students need to be able to understand that computers can only understand what it is being told (Boston, 2020). Unplugged activities are hands on projects that allow students to practice with tangible items prior to using the computer. The idea behind this research is to determine if students learn more and have a deeper understanding of how to give a computer specific instruction by first using the unplugged activities to help prepare. Research has shown that with an hour a day for ten weeks, unplugged activities can impact student learning. However, an oversized room can cause the learning process to slow progress with these types of activities (Tonbuloglu, B. and Tonbuloglu, I., 2019).

The purpose of this research is to explain how students could be impacted by first using unplugged coding activities to teach programming. With this research, the hope is that teachers will find new ways to present the material to students to help establish a deeper understanding of how to program. Bell and Vahrenhold. (2018) show that research has found that student

learning using unplugged activities was useful but only if it is used correctly during lessons provided by teachers. If students can have an extended desire to learn and learning to program because easier, this will assist with the job market as well. In 2011, within the next decade (which would be now) the job market for computer scientists was expected to grow by 24% (Feaster, Segars, Wahba, and Hallstrom, 2011).

The literature review will provide several articles that have been peer reviewed. The articles will be from the DeWitt Library, Google scholar, and peer reviewed articles. The research is from the last ten years. The research studies consist of articles explaining what unplugged activities are, what computer science relates to, how to engage students in learning to code, and how to learn coding (programming) without using a computer first. There are also studies that show how to learn to code when computers and Internet are minimally used.

## Review of the Literature

### Computer Science Unplugged Activities

In Computer Science, an unplugged activity is a hands-on project without the use of a computer that helps teach a student a deeper understanding of how to program (Bell, Alexander, Freeman, and Grimley, 2009). Some of the activities that Bell, Alexander, Freeman, and Grimley (2009) use consist of games, magic tricks, and competition, which are all used to begin showing students the type of thought process needed with Computer Science. Bell, Alexander, Freeman, and Grimley (2009) suggest that teachers having a wide number of unplugged activities (12 used in their research) readily available will help strengthen their curriculum and will also help differentiate between lesson planning for a wide range of students.

Bell, Alexander, Freeman, and Grimley (2009) used 12 different types of activities with students. Their idea for the projects were to create activities that students could start learning about during elementary and continue to develop through high school. They also point out that classroom spaces, classroom number of students, and time allowed could all differ depending where the unplugged activities are being taught. This was another reason why teachers would need a large number of unplugged activities available for their use.

With Bell, Alexander, Freeman, and Grimley's (2009) research, the intervention for the activities is to deter students from not enjoying programming. It is also stated that the findings from the research showed that student involvement with Computer Science will be positively impacted by using games, activities, and hands on projects prior to going directly to the computer. Students know how to work a computer but they do not necessarily know how a computer works.

### Computational Thinking Skills

According to Tonbuloglu and Tonbuloglu (2019), another skill taught while learning about Computer Science is computational thinking skills. They define computational thinking skills as problem solving skills that require a various number of techniques and strategies. Computational skills are necessary for learning to program and also to have a deeper understanding of how the computer works. Tonbuloglu and Tonbuloglu (2019) researched 114 students in 5$^{th}$ grade to profess those unplugged activities while learning to code can help improve the computational thinking skills of the middle school students. The research that was conducted took place between 1-3 hours daily for a total of 10 weeks.

During the conclusion of Tonbuloglu and Tonbuloglu's (2019) research, it is stated that the rapid growing need for this new skill set has raised awareness about computer science as a whole. In order to continue to reach new measures of shaping the qualifications of young students, it is of great value that students learn these new concepts as beginning building blocks into a larger topic area. Tonbuloglu and Tonbuloglu's (2019) findings during their research showed an increase in scores between the pretest and posttest and reported findings in the daybooks that showed an increase in motivation in classroom attendance.

Ehsan, Rehmat, and Cardella, (2019) conducted research to find out if additional Computer Science skills could be met during unplugged activities. The skills are abstraction, problem decomposition, pattern recognition, and debugging. Ehsan, Rehmat, and Cardella, (2019) conducted the research with an activity called Puppy playground. It is a project that allows students 30 minutes to complete a task. This activity provided some feedback at the conclusion. At the end of the project, several students asked the teacher questions about what they were to be doing and why were they doing it. This led Ehsan, Rehmat, and Cardella, (2019)

to believe that these skills (computational skills) are something that need to be taught even at an early age.

Unplugged activities were used on preschool students in research conducted by Otterborn, Schonborn, and Hulten (2019). The project was used as part of a digital literacy lesson. Otterborn, Schonborn, and Hulten (2019) stated that visual programming language has been downloaded 9.5 million times by early 2018. This shows an increased interest level of using technology for more than gaming and app use. Besides showing an impact on the growing level of interest for students learning about programming, Otterborn, Schonborn, and Hulten (2019) included 200 teachers into their research. The study showed that teachers felt that interpreting programming was the most beneficial for learning technology (92.4%) and mathematics (93.9%).

Preservice teachers were part of an unplugged study conducted by Sendurur (2019). The study was to investigate how preservice teachers could design the activities for students. There were 64 preservice teachers involved in the study. During the study, there were surveys and interviews conducted of the preservice teachers. Each teacher constructed unplugged activities and had students to conduct it with. The results at the end of Sendurur's (2019) study showed that the unplugged activities are beneficial for the students, however, the activities need to be created by teachers and computer scientists that have a clear plan. In order for these unplugged activities to work, the students must see how they will work in conjunction of coding using a computer.

Sendurur (2019) states that Computer Science brings a higher-order of thinking. In order to help students understand and learn the specific skills, such as computational thinking skills, Sendurur (2019) points to the idea that increasing the programming knowledge is the main focus.

To better align with this idea, according to Sendurur (2019), the unplugged activities must be planned out before being taught. This points back to computational thinking and how important learning this skill is while learning to code (Threekunprapa and Yasri, 2020).

Computational thinking skills are a current century skillset that is part of the Computer Science program. Threekunprapa and Yasri (2020) conducted research on 160 secondary students whom had no programming or coding knowledge. In this study, (Threekunprapa and Yasri, 2020) drag and drop programming was used as coding activities. The data was collected in three hours with a research topic of testing ways for students to learn computational thinking with flowblocks. The pretest took 15 minutes and the posttest took approximately 15 minutes as well. The other 2.5 hours was the activity.

Threekunprapa and Yasri (2020) provide data showing the student mean pretest score of 1.98 and the posttest mean score of 11.23. While this was a significant change, Threekunprapa and Yasi (2020) state that they are not convinced that the students were learning the computational thinking skills by using drag and drop block programming. They do however, state that learning computer science concepts are an important part of learning for problem solving on a daily basis.

## Gamifying Activities

Gamifying is another format for creating an interactive way to use unplugged activities while teaching students to code. Klofenstein, Fedosyeyev, and Bogliolo (2017) researched the use of augmented reality in programming. The research was conducted with three high school students. Three students were part of the study but Klofenstein, Fedosyeyev, and Bogliolo (2017) stated that this study could be taken to a larger scale as well. This study was part of a Beta program and the researchers intend on conducting this research to a larger audience due to

the positive impact that they viewed. The researchers state that because of the connection that they could see the students make between this unplugged activity and digital use with a computer, it was very interactive and engaging.

Over the years unplugged activities have been used in different ways. In some countries (Taub, Armoni, and Ben-Ari, 2012) the activities were used as an outreach program to test interest levels of Computer Science amongst students. According to Taub, Armoni, and Ben-Ari (2012), rather than just using unplugged activities to random students, it would be a wise decision to implement it into the classroom. Two separate schools were observed by Taub, Armoni, and Ben-Ari (2012) to find out the student attitudes towards Computer Science and more specifically about coding. A total of 52 students in 7$^{th}$ grade were part of the study.

This research took one semester and explored different objectives of unplugged coding activities. The students were tested on their views, attitudes, and interest levels of Computer Science. According to Taub, Armoni, and Ben-Ari (2012), the statistics from questionnaire stayed relatively the same between the pre and posttests. However, the questionnaire also had a question asking the students what their interest level is with Computer Science. With this question, the numbers went from 10 not interested during the pretest to 25 not interested during the posttest. This was very intriguing data. The researchers stated that there needs to be a follow up on the environment of how the unplugged materials were presented. This again shows the importance level of how the unplugged activities are designed and also how they are presented.

## Limited Internet

According to Bell and Vahrenhold (2018), unplugged activities are also very useful for school districts that have limited Internet capabilities or limited computers to use for students. In a recent study, the effectiveness of teaching unplugged activities for teachers was observed.

Teachers began working through the activities during professional development (Bell and Vahrenhold, 2018) to explore additional ideas that would instruct students in a way that they could better connect with Computer Science topics, such as coding. During this research, teachers viewed the unplugged activities as useful for attitudes towards Computer Science but also assisted their instruction with a more positive interest level for students.

## Professional Development

Bell and Vahrenhold (2018) used the research to help teachers encounter issues that might occur during unplugged activities. For example, the teachers worked through some of the activities during professional development. One common theme reported from this project is that the unplugged activities need to remain relevant with the ever-changing world of technology. If students cannot see the relevance of what they are practicing, it will not stay with them as long. The long-lasting ideas and concepts learned from the unplugged activities will not only help them with current projects once they are in front of a computer but will also be the skills that they use in other problem-solving scenarios.

## Computer Science and Information Technology

The fall in the job market has continued to be a concern. Feaster, Segars, Wahba, and Hallstrom (2011) collected data from 140 middle school students attending Computer Science and Information Technology workshops. The researchers state that there is an expected increase in demand in the Computer Science field by up to 24% (within a decade of when the research was conducted). The purpose of this study is to research how well students engage in hands-on activities that are specifically designed to capture their attention. The 140 students participated in a two-semester long process that consisted of 10 one-hour sessions. The intervention to this research was to find statistical changes in specific attitudes of students while using the unplugged

activities to teach coding. The researchers provided a survey to the students before starting the activities.

## Different Types of Activities

Some of the activities consisted of learning about binary numbers, the anatomy of the computer, algorithms and sorting, error detection, and encryption. During these activities, students worked on many different types of topics while using the unplugged activities. While the researchers (Feaster, Segars, Wahba, and Hallstrom, 2011) were hoping for a statistical change in attitude that could be backed with data, unfortunately they could not report that. They (Feaster, Segars, Wahba, and Hallstrom, 2011) stated that while they were hoping for success, there was no change in attitude. Now, they did discuss how the unplugged activities are used could have played a role in the success of this type of research. If teachers do not use the materials properly, it could end up like this study shows and not be the benefit that teachers are hoping for.

Unplugged activities give teachers additional resources that can be built into their curriculum. According to Nishida, Kanemune, Idosaka, Namiki, Bell, and Kuno (2009), the unplugged activities can be used as a method that can make Computer Science desirable for more students to learn about. The researchers state that using the unplugged projects give non specialists an opportunity to become familiar with computers prior to using them. In their study, 10 students were observed with an objective to help students understand more about Computer Science in general. The study took place using the activities for more than just learning about coding.

In the study conducted by Nishida, Kanemune, Idosaka, Namiki, Bell, and Kuno (2009), ten students were observed. The students used the unplugged activities in a gaming format. In

the conclusion of the research, it is listed that the idea behind the survey was to find out if students would be challenged, entertained, and more motivated to learn. The data collection from the researchers showed that six students reported an understanding and usefulness of the activities, three students reported as somewhat understanding and one student reported as having a partial understanding the use of the unplugged activities relating to computer science.

Nishida, Kanemune, Idosaka, Namiki, Bell, and Kuno (2009), provided a layout of the activities that they used for their research. The activities also had images of the students using the gaming projects as examples of how they could be used. This is meaningful materials because educators have a script that has been developed that can be used will teaching the unplugged activities. These researchers mention that they would like to continue in the future developing additional resources for teachers to add to curriculum.

## Educational Learning Goals

Computer Science activities can also be used to change overall goals in education. In 2016, Rodriguez, Rader, and Camp researched student performance using unplugged activities related to overall strengthening of student problem solving skills. The process consisted of 6 activities during 50-minute class periods. There were 130 students involved all of which were in 7$^{th}$ grade. This research was a mix between two different school districts. Both of these school districts state that they have a heavy emphasis on science and technology.

The research took place on two different occasions. The first was early in the school year and the researchers saw some flaws in their system, which led to weaker results from what they had desired. The study the first time around had very confusing instructions they felt and lead the researchers to feel that their assessments had insufficient data collection because of it. The second time that this study was conducted, later in the school year, the researchers, Rodriguez,

Rader, and Camp (2016), had a much more improved result. With the findings from the second attempt, the researchers stated that the effectiveness from the unplugged activities could have an even larger impact when used during after school activities or in clubs.

The overall goals in education by using Computer Science unplugged activities were noticed as needing to have a real-world connection. Something that the students could see being used beyond the classroom. Rodriguez, Rader, and Camp (2016) state that answers from the students increased by more than 50% on all survey questions, some increased by 80%, and some were as high as 100% after doing the second research. The researchers also stated that the unplugged activities are something that should be conducted as a majority of time on an individual basis. They feel that they saw a better understanding and a higher interest level by the students when they were completing these individually opposed to group work. Another takeaway from the study is that the instructions for the unplugged activities must be kept to a minimal and must be very simple to follow. This is important because if the students are confused about what they are to be doing, they will lose interest and may not even attempt the activity (Rodriguez, Rader, and Camp, 2016).

## Challenges in Teaching CS

A major challenge for teachers instructing Computer Science classes would be keeping it exciting while remaining relevant. Students may view Computer Science in a negative way and assume that people in this field are stuck sitting behind a computer for countless hours without any type of interaction (Busuttil and Formosa, 2020). This is another benefit of the unplugged activities. In a recent study by Busuttil and Formosa (2020), 25 students in 9$^{th}$ grade were part of research looking at potential drawbacks and the effects of unplugged activities. The process was 80 minutes for five different activities.

Busuttil and Formosa (2020) found that some of the benefits were that independent work could be used without using a physical computer or the hardware of a computer. Another benefit from this research was teachers being supported with additional materials to help students with problem solving skills. It was also stated that computational thinking skills were used with manipulatives that students could physically touch and see how they work. The researchers conducted the study in five different activities that consisted of logic gates with twister, building a tower, magic tricks using cards, conditionals using cards and a game adding numbers. Some of these were used as individual work and others were to promote group work.

With this study, the main researcher and the teacher would discuss the observation at the end of the class. At the end of each activity, there was a worksheet that would go along with it. This was part of what they would discuss along with the observation of the activities. The engagement level was obvious to the observers and they stated that in order to keep the attention of the students, it was important as to how they presented the materials. Explaining why they were doing it and how it would help them once they were in front of a computer would be another important aspect to the teaching.

The drawbacks that Busuttil and Formosa (2020) found start with teachers using unplugged activities as homework. This would be a very challenging idea as the concept of the unplugged activities would be to complete in front of the teacher while explaining it. Busuttil and Formosa (2020) stated that teachers needed to choose wisely which activities they want to include in the curriculum they have. Another drawback that Busuttil and Formosa (2020) found was the issue of the proper spacing. In order to effectively use the unplugged activities, if space is an issue, then the resources may be limited as well. For example, in this study the researchers used the Twister game. If there is not space for the participants or the board, then it is not

something that could be used. Another space concerned activity could be the building of a tower. This activity required groups to work on using problem solving skills and computational thinking skills to use marshmallows and spaghetti sticks to build the biggest, strongest tower possible. If space was an issue, this could not be an activity completed.

## Used with Special Education Students

A recent study by Demir (2021) looked at the effects of unplugged activities for special education students. This research was done with 34 total students ranging in age between 14-18 years old. The entire experiment took 12 weeks to complete and was conducted in Turkey and was looking for answers as to how unplugged activities directly affected the problem-solving skills of students who receive special education. Besides problem solving, the other skills that were part of the research were independent thinking skills, ethical behavior skills and overall knowledge building skills.

Demir (2021) points out that learning to code for all students starting at an early age is an important flexibility skill as well as a decision-making skill. Demir (2021) conducted research starting with a pretest moving into the experiment and then ending with the posttest. The data showed that there was a significant change between the pre and posttests with these students. The research mentions that web-based platforms like scratch and code.org should be integrated into the K12 curriculum because of the large number of skills that students will be able to gain. There are many benefits that Demir (2021) reports during the study.

## Benefits of Using Unplugged Activities

One benefit that Demir (2021) points out is the ability for students to have confidence with complex problems and decision making. It is something that is widely used in Computer Science and especially with coding. The next is building a tolerance for uncertainty and dealing

with open ended problems. These go together in coding because the answer may not always be black and white and sometimes using some trial and error is needed. When students learn how to cope with this process, it will make problems outside of class more manageable as well. Students must learn these skills and that is why Demir (2021) conducted the research. Demir's (2021) study showed an increase in understanding between the pre and posttest but primarily because of the use of the unplugged activities for the students. The pretest average score was 10.68 and increased to 13.36 in the posttest.

There is no doubt that Computer Science has become a much-needed topic to promote. According to Fees, A da Rosa, Durkin, Murray, and Morgan (2018), the United States Naval Academy (USNA) and STEM Center of Education and Outreach have currently been focused on creating interest in this topic as well. They suggest that there needs to be a greater amount of awareness brought to several subjects inside of Computer Science including cybersecurity and coding. In order to create the interest, there was a study done in a workshop method. It is 1-hour long modules and there are 30 activities included.

The research conducted by Fees, A da Rosa, Durkin, Murray, and Morgan (2018) state that roughly 900 teachers and 17,000 students are part of this study. The modules consist of logic gates, binary counting, encrypting, decoding and are all hands-on based activities. With these project-based studies conducted by USNA, Fees, A da Rosa, Durkin, Murray, and Morgan (2018) state that the research is showing that elementary students are benefiting from learning about cybersecurity as well. Fees, A da Rosa, Durkin, Murray, and Morgan (2018) also state that the unplugged activities used have a framework of constructivist learning theory, which means that students learn better from doing.

Fees, A da Rosa, Durkin, Murray, and Morgan (2018) state that this research that they conducted, based around the USNA, is an ongoing process. There are roughly 17,000 students involved each year and they are hoping to grow this number continuously as part of the outreach program. There are also summer camps that are geared towards middle school students. The summer camps are useful for further research to change modules and help them evolve to meet the needs of students but also to improve teacher resources. This study is meant for education purposes but is also part of an ongoing professional development for teachers.

## STEM

Unplugged activities have been part of a Computer Science initiative from STEM (Science, Technology, Engineering, and Mathematics), according to Rosamond (2018). This initiative was created as part of an enrichment and teaching activities to give students computational thinking skills. Over the years this initiative has grown and continues to support teachers will attempting to engage and keep the interest level high for students. Rosamond (2018) researched how this topic area provides assistance for teachers with a study through a workshop in New Zeeland.

The intention of the workshop is for middle grades. One of the projects that Rosamond (2018) studies is called Kid Krypto. In this research, this activity is explored to be used to assist teachers with an unplugged activity teaching through storytelling and outdoor activities. During this specific study, Rosamond (2018) explains the need for teachers to have many resources available to engage students. The Creative Mathematical Sciences Communication (CMSC) conference is something that Rosamond (2018) references as a venue that supports scientists that look specifically at different activities to strengthen the number of resources teachers have accessible to them. Besides the unplugged activities for coding, the researcher also mentions

using public key cryptography as a unique skill that can also be used to keep the interest of students.

## Computer Science Concepts

According to Csizmadia, Standl, and Waite (2019), there are some specific Computer Science concepts that students should learn. The concepts are algorithms, hardware, data structure, networks, and systems. In order to learn about these concepts, students have activities that can be taught. The researchers chose to conduct a study amongst 5–11-year-old students. In this research, each concept is examined. There were three students studied and the researchers were using unplugged activities followed up by using the computer after each lesson. The author of the research was working on creating data that would show how constructionist learning theory with computational thinking skills could work together.

The framework from Csizmadia, Standl, and Waite (2019) had limitations. The researchers stated that they are going to look at other additional ways to test their theory for better results in the future. While the researchers stated that only having three coders being observed, the 21 activities turned into 42 due to each coder doing multiple activities. The data that the researchers did collect showed them that there was really no difference in skills being learned between computational thinking and computer science concepts. The researchers used a variety of methods to come to their conclusion. They used unplugged activities and onscreen programs with Google forms and blockly coding techniques as well.

## The Purpose

A purpose for unplugged activities is to use the hands-on approach for students to more effectively learn computer programming. Often times using the onscreen approach for coding or programming can be difficult to learn or understand why concepts are used. Grover, Jackiw, and

Lundh (2019) researched the concepts before coding strategy. This research is conducted on 6-8th graders and is used to find evidence about learning introductory coding concepts. There was a preassessment given before the unplugged activities occurred. This was used to give this research reliability and validity because it was a multiple-choice questionnaire along with open response questions.

The experiment being used in the activities consisted of learning about loops, expressions, and variables. During the observation part of the research Grover, Jackiw, and Lundh (2019) found that the interest level was increased especially when the students had the free choice project. The unplugged activities proved in their research that students were more willing to try more challenging projects due to the confidence level created from the unplugged activities and by developing the computational thinking skills.

According to Alamer, Al-Doweesh, Al-Khalifa, and Al-Razgan (2015), there is a clear gap between views of Computer Science with students. In their study, 13 middle school students were questioned. There were 22 statements asked in the questionnaire and the results showed a majority of students said that CS was focused on installing software and is for the nerdy people. This was the start of the research that was conducted using unplugged activities. The research was conducted with the students during a summer camp that had ten 40-minute activities ending with a posttest consisting of 18 Likert style statements.

The researchers, (Alamer, Al-Doweesh, Al-Khalifa, and Al-Razgan, 2015) used the summer camp to give students a basic idea about programming keys using self-created innovative activities. One of the activities was to create a Minecraft character using scissors, sheets of paper containing functions, glue and shapes of a body. The students were put into groups and at the completion of following the instructions, the students discussed what it was

like following a set of instructions that were made specific to what they were to do to create this project. The students had a few additional similar projects to complete that were teaching them about loops, if statements and variables. Each of these experiments were observed and discussed after completion. All were completed without the use of a screen and were explained how they would connect when using a computer.

After the completion of the activities, the students were given the post survey test. The findings showed that in the pre survey, 4.16% of the students felt computers were boring to use and by the post test, 0% felt this way. The researchers stated that the summer camp was a success because of the answers they received from the post survey as well as the discussion after. Many of the students reported that they had wished the summer camp was longer so that they would have been able to do more activities and experiments to further their knowledge about Computer Science.

Teaching Computer Science and specifically programming is an important part of student learning with 21st century skills (Erumit and Sahin, 2020). Teachers must choose between different types of curriculum, activities, unplugged or plugged projects and how to present the materials. Erumit and Sahin (2020) researched this topic with 38 sixth grade students (20 females and 18 males). These students that were part of the case study had no prior knowledge of coding or Computer Science. The data collection for this case study was based on weekly student journal (for nine weeks total) and interviews.

There were seven lessons in all with this case study. The first four were to be completed without the use of a computer (unplugged activities) and the final three would be done with a computer. Each one of the activities were teaching students computational skills, organizational skills, problem solving skills, and basic programming concepts. At the completion of the

lessons, the researcher reported that 45.83% of the students felt that learning this way was fun. When asked if the students liked the lessons being taught in this way (using unplugged activities), 54.16% agreed stating this was beneficial. 68% of the students voted that using unplugged activities and using the computers were beneficial to their learning. Erumit and Sahin (2020) recommend teachers using unplugged activities that include problem situation that has more than one way to get the answer and use a role-playing or drama method to create additional interest and engagement from students.

In 2019, Delal and Oner researched the role of using unplugged activities for the specific purpose of developing computational thinking skills. The study was conducted on 53 sixth grade students involving tasks of three different difficulty levels. The research conducted by Delal and Oner (2019) showed that students using a computer while programming had developed computational skills with the help of Scratch programming and Alice. These programs are coding programs and can be used in a sequence of instructions given by the teacher or could be used in an open concept type of coding method.

Delal and Oner (2019) developed the research with the intentions of providing data showing the importance of developing the computational thinking skills greater by the use of unplugged activities. With the data collection, an easy, medium and hard level was used. There was a pre and posttest given in this study. The class was over a 120-minute time frame (40 minutes each class). The pretest took one class period (40 minutes), the experiment took one class period (40 minutes) and the posttest took one class period (40 minutes). The findings from the study showed a slight significance in scores. The score levels increased for the students between the pre and posttests but the % difference did not increase much between the easy and difficult levels. The researchers stated that through their study, results showed a significant

increase skill level improvements and it was highly likely that the unplugged activities were the main reason this increase in skill occurred (Delal and Oner, 2019).

## Conclusion

The intention of this research paper was to provide purposeful information that was data driven showing the impacts of using unplugged activities to teach students coding. The activities are hands-on projects that would teach students about coding prior to using the digital computer. Some of the purposes of the activities could be due to lack of quality Internet, lack of time to use the Internet, shortage of actual computers for student use, and to create an environment for students to physically see what the computer would see. According to the data from the research conducted, teachers need to be educated, have quality tested curriculum, and a good time line to use the materials in order for the teachers to see a positive impact on student learning. There have been several different studies over the years that evaluate the use of the unplugged activities. While these studies have changed from time to time on the focal point, nearly all of the research conducted is intended on strengthen the student learning of several different skills including critical thinking skills, computational skills, and problem-solving skills. All of these skills are needed for student success and will also assist the student in a career field.

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