The Effectiveness of Scratch Coding Activities in English Language Learning

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Abstract

This study is aimed at examining the effectiveness of using Scratch Coding Activities (SCAs) in English Language Learning (ELL) to enhance computational thinking skills necessary for the twenty-first century and language growth, notably in reading comprehension. In addition, this paper discusses Pre-Service Teachers' (PSTs) interests and motivation in learning English through SCAs. The research was conducted in a higher education English for Young Learners (EYL) class. In this investigation, a quantitative study using frequency and percentage analysis was applied. There were 64 volunteers divided into two groups: control and experiment. The findings demonstrated that weaving SCAs in EYL class improved the students' language mastery, computational thinking skills, interests and motivation in ELL.

Keywords: scratch program, coding, reading comprehension, computational thinking

1. Introduction

Coding involves the coder interacting with equipment to solve problems, transforming solutions from natural to computer-executable languages. It is required for various jobs, including system engineers, game developers, and AI programmers. New employment is being created in rapidly increasing industries, necessitating additional experts with coding and other higher-order thinking abilities (Jin & Zha, 2019). According to Dudeney, Hockly, and Pegrum (2013), coding is a more profound ability that falls within the four core digital literacies of language, connections, information, and (re)design. Learning to code enables students to be creators rather than mere consumers of technology. It helps develop critical skills such as problem-solving, logic, and critical thinking. Analyzing, critical thinking and problem-solving processes can result in meaningful language exercises. English instructions can be combined with encouraging students to engage with code, inspiring 21st-century skills while supporting language development (Stevens & Verschoor, 2017). Teaching young pupils to code can improve their ability to think logically, be creative, solve problems, and transfer their talents to other subjects and real-world situations (Garcí a-Peñalvo et al, 2016).

Coding is creating step-by-step instructions that a computer understands for programs to function. Early coding allows young learners to integrate communication, thinking, and problem-solving (McLennan, 2017). Most students spend several hours playing online games, but only some know how to create a game. Learning to code will encourage students to become creators, not just consumers of the technology they use. Furthermore, coding will also help them to develop essential skills such as problem-solving, logic, and critical thinking. Through coding, there is more than one discussing how to solve a problem, and more straightforward and efficient solutions are often better. Analyzing critical thinking and problem-solving processes can result in meaningful language practice.

Wing (2017) defines computational thinking as the intellectual processes involved in describing solutions as computational steps or algorithms carried out by a computer. Computational thinking is linked to literacy acquisition because algorithmic thinking entails deciphering textual or block-based programming commands. It is a fact that nowadays, computer application has flourished in all sides or aspects of life. Those, who are familiar with English, share wider social and economic opportunities. However, they will have more and more opportunities to use computer or ICT skills, especially block-based coding. English teachers have fewer opportunities if they are negligent in coding skills. Thus, the integration of SCAs in ELL will be much more beneficial. The fact shows that Teacher Educators (TEs) and PSTs need to provide coding skills. However, ICT needs to be improved, particularly in coding programs. Thus, the situation needs overcoming, and the study addressed the situation.

Students need seven survival skills such as critical thinking and problem-solving, collaboration and leadership, agility and adaptability, initiative and entrepreneurship, effective oral and written communication, accessing and analyzing information, curiosity, and imagination to be prepared for twenty-first-century life, work, and citizenship (Hoffman, 2020). Employers are looking for students who can learn on the job and have various skills to adapt to rapidly changing work environments. The students will interact not only with people in their immediate surroundings but also with those across networks.

Sometimes teachers look out at students peering at their hand-held devices and wonder if they are using them productively or distractingly. Often, it is apparent that the latter is the case. Engaging students is the teacher's key to success, for then teachers can discourse with them and have them describe their adventures on their learning journeys and how these relate to their present (perhaps the present class) and long-term goals. Nevertheless, teachers themselves must be worthy of their side of the discourse, which means teachers have to keep notching their skills upward in order to bootstrap their students or to appreciate when they bootstrap teachers, which can be the case when teachers learn to leverage into their teaching style the vulnerability of not knowing (O'Brennan, 2014). Future English teachers should familiarize themselves with various programs and websites that can be utilized to teach and learn English (Azmina et al, 2019).

1.1 Objective of the Study

Based on the introduction, the objective of this study is to investigate the effectiveness of using Scratch Coding Activities (SCAs) in English Language Learning (ELL) in order to enhance computational thinking skills for the twenty-first century and language growth, notably in reading comprehension. In addition, this study investigates the Pre-Service Teachers' (PSTs) interests and motivation in learning English through SCAs.

2. Literature Review

2.1 Scratch Coding in English Language Learning

Bahar (2021) studied the effect of Scratch on children's English language and cognitive development. In his study, Scratch was integrated into language training for children, and the effects on language and cognitive skills and the benefits and challenges from the students' and teachers' viewpoints were studied. The research was divided into two sub-studies. The results of study A demonstrated that Scratch increased children's listening and computational thinking skills but not their academic achievement or language use. During the study, it was determined that the students liked Scratch and enjoyed constructing projects and working in groups. Teachers found Scratch beneficial for developing language skills, motivation, and collaboration. Overall, the advantages of Scratch outweighed the disadvantages.

El Sourani and Ihmaid (2017) conducted a study on integrating Scratch into English language learning. The goal was to investigate the feasibility of incorporating Scratch in enhancing sixth-grade students' English vocabulary, retention, and self-efficacy. Forty-four male EFL students took part in the study. Twenty- two were in the experimental group, while 22 were in the control group. The results revealed that the experimental group outperformed the control group in learning and retaining English vocabulary. The results for the students' self-efficacy levels also favoured the experimental group.

Reading comprehension and code literacy skills of Pre-Service Teachers (PSTs) were categorized as low; moreover, Teacher Educators (TEs) needed to integrate coding programs into ELL. So, PSTs' computational thinking was also categorized as low. Therefore, the research problems in this study consisted of (1) whether the use of the Scratch program in English for Young Learners Class improved reading comprehension and code literacy of Pre-Service Teachers' (PSTs) at Universitas Negeri Medan; and (2) whether the use of the Scratch program in English for Young Learners Class improved motivation of Pre-Service Teachers' (PSTs) at Universitas Negeri Medan.

Scratch can be used in a variety of ways in the learning process, such as (1) Scratch's importance originated from the way it simplified the programming language; (2) It allowed learners to be imaginative and creative; (3) It aided learners in designing their ideas and putting them into action; (4) It prepared secondary school students to comprehend programming language, mainly Object Oriented Programming; (5) It aided the students in understanding programming fundamentals like frequency and conditions; and (6) It improved core abilities such as analysis, collaboration, and lifelong learning in students (Obri, 2014). Scratch is a code-based application that may be used to teach various subjects. Then, Daher et al. (2020) investigated a path for enhancing the meta-cognitive solving of mathematics-based programming issues using Scratch. Sarasa-Cabezuelo (2019) described Scratch as a valuable tool for teachers and students in acquiring second languages. Meanwhile, in Indonesia, the researchers investigated the impact of digital story design created by students working on group projects using the Scratch application on their reflective thinking skills toward problem-solving.

There have been some previous studies about using Scratch as a learning tool. For example, Budak et al. (2021) conducted a study to investigate the impact of digital story design created by students working on a project in groups using the Scratch application on their reflective thinking skills in problem-solving. The study showed that Scratch programming positively impacts Archeology, Philosophy, and History students and is particularly effective in the questioning sub-dimension.

Since the purposes of this study were to evaluate the use of the Scratch program in English for Young Learners Class in improving reading comprehension, code literacy, and motivation of Pre-Service Teachers (PSTs) at Universitas Negeri Medan, ELL was designed by integrating the Scratch program. Some topics were provided in supporting PSTs' knowledge about the current issues to enhance an effective language learning process, such as English for Young Learners, Modern Teaching Media, STEAM (Science, Technology, Engineering, the Arts and Mathematics), Digital Citizenship, and Classroom Management. Figure 1 shows a screenshot of the Scratch project used in ELL in English for Young Learners class.

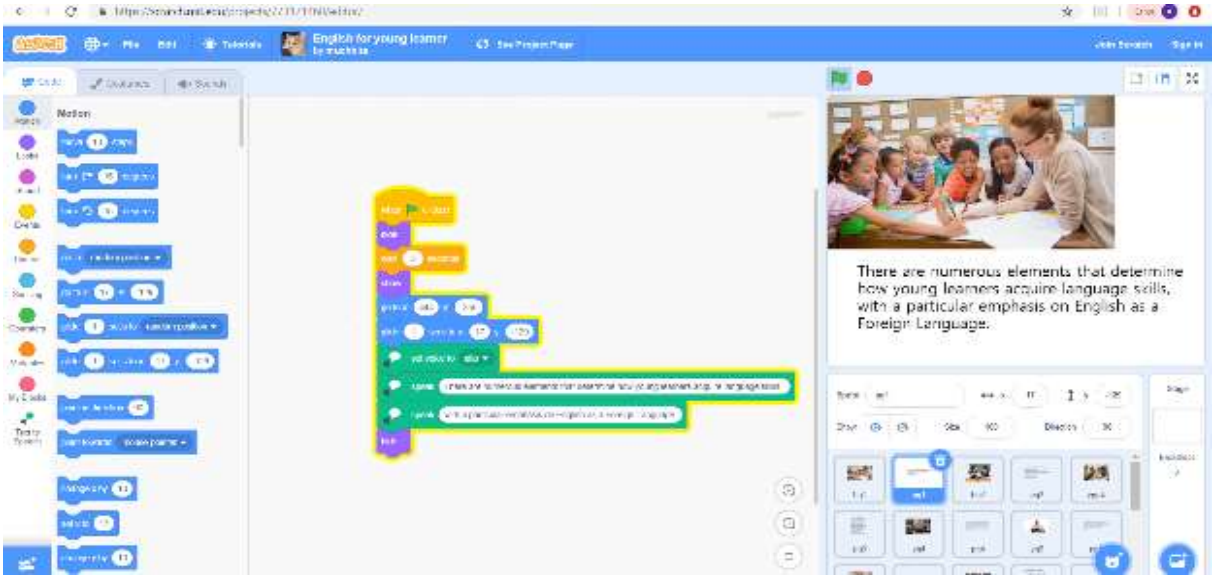

Figure 1. Scratch Project

Figure 1 above shows the result in the Scratch Programming on the right side. Then, on the left side were the blocks menu and the worksheet in the middle of the program. Using the Scratch Program in ELL helped Pre-Service Teachers (PSTs) develop reading comprehension skills through the coding program and code literacy skills, particularly computational thinking.

After reviewing the literature, indeed in previous research, more studies were found on the integration of coding and computing concepts in science and other social subjects rather than in English (Budak, 2021; Cabezuelo, 2019; Daher et al, 2020; Endah et al, 2020; Lonati, 2019; Permatasari, 201 8 Pratiwi, 2022). However, there needs to be more studies on using coding and computing concepts in English teaching and learning (Bahar, 2021; Cabezuelo, 2019; Costa, 2016).

2.2 Students' Reading Comprehension

The pre-survey results showed that the students still had difficulties comprehending the main idea and detailed reading comprehension information. Then, the students also found difficulties using the textual devices of code literacy. Teacher Educators (TEs) should facilitate the students' needs because the students will become professional future teachers.

The observation results showed that code literacy must be provided in teaching and learning. Meanwhile, TEs in the 21st century should assist all PSTs in learning how to learn. TEs were expected to inspire creativity, encourage cooperation, require and reward critical thinking, and educate children on communicating. 21st-century education prepares students with the knowledge, skills, and abilities needed to succeed in the twenty-first century. The survey result's conclusion could have been a more effective active teaching and learning process since it had not been student-centred learning and related to upholding code-literacy, particularly computational thinking.

Based on the interview conducted with the TEs of the English for Young Learner Class, it was known that, generally, learning was oriented to the book used. There was no contextual learning, which gave PSTs some experience teaching Young Learners. Then, there was no particular model to improve PSTs' reading comprehension and, at the same time, improve code literacy skills as needed in 21st-century learning

3. Research Methodology

3.1 Method

The researcher did a study based on quantitative research to evaluate the effectiveness of the Scratch Program in improving Pre-Service Teachers (PSTs)' reading comprehension and code literacy; and PSTs' motivation. There were some steps done in this study, namely, (1) Initial training of Teacher Educator (TE) participating in this study; (2) initial questionnaire and pre-test to measure reading comprehension, code literacy, and motion of PSTs; (3) Implementation of ELL through Scratch Program; and (4) Evaluation to measure PSTs' skills and motivation through the post-test and final questionnaire.

3.2 Participants

Two groups involved in this study had the same semester and subject, English for Young Learners. The groups comprised a control group of 30 students and an experiment group of 34 students. The participants were selected based on random sampling at the English and Literature Department Universitas Negeri Medan.

3.3 Instruments

There were three instruments of this study, namely, (1) a questionnaire, (2) a test, and (3) interview questions. The questionnaire consisted of two parts . They are initial and final questionnaire. The initial questionnaire aimed to investigate Pre-Service Teachers' (PSTs)'

problems in ELL. The final questionnaire aimed to evaluate PSTs' responses to Scratch Program in English for Young Learners class. The questionnaire used the Likert scale model.

Furthermore, the test was conducted to measure PSTs' reading comprehension integrated with the coding program. The test consisted of pre-test and post-test. The test is a tool used to assess students in order to obtain the desired results. Although some tests, such as personality tests, are descriptive, most tests are measuring. Educational exams are usually classified into two categories: test outcomes earning or learning achievement tests and psychological tests (Sukmadinata, 2008: 223). The learning outcomes test measures students' initial ability before learning (pre-test) and after learning (post-test).

An in-depth interview was conducted to gain information on PSTs' skills and motivation in English for Young Learners learning. It was also conducted to investigate Teacher Educator's (TEs) knowledge about coding programs and how to improve PSTs' motivation. The questions in the interview were open-ended questions.

3.4 The Technique of Analysis Data

To analyze the data, the researcher used quantitative techniques to evaluate the study's results relating to reading comprehension, code literacy, particularly computational thinking and motivation.

3.5 The Steps of Research

3.5.1 Initial Training of Teacher Educator (TE)

Teacher Educators (TE) needed to gain experience in applying coding programs such as Scratch in teaching and learning classes. Thus, the training in teaching English to Young Learners through the Scratch program was conducted. The TE was trained to teach and design material through Scratch Program using specific topics and current issues such as English for Young Learners, Modern Teaching Media, STEAM, Digital Citizenship, and Classroom Management.

3.5.2 Initial Questionnaires

Before the study, Pre-Service Teachers (PSTs) completed an initial questionnaire to measure reading comprehension integrated with coding. PSTs also filled out the questionnaire about needs, lacks, and wants. Then, PSTs also do a pre-test to measure the prior knowledge about reading comprehension integrating with coding.

3.5.3 Implementation of English Language Learning Through the Scratch Program

Coding in English Language Teaching model was implemented in English for Young Learners through Scratch Program. There were some activities applied, such as (1) Problem Encounter; (2) Learning Issue; (3) Coding Activity; and (4) Evaluating. Then, five units had to be completed. Each unit had coding activities which directed Pre-Service Teachers (PSTs) to complete the task through the Scratch program, either through reading activities or designing answers in Scratch Program.

3.5.4 Evaluation

After implementing Coding in English Language Teaching, Pre-Service Teachers (PSTs) did the post-test, similar to the test they took at the beginning of the study, to check the degree of improvement during the sessions. PSTs also completed the questionnaire on motivation and interest in reading comprehension integrating with coding.

3. Findings

3.1 Students' Reading Comprehension

In gaining the data for the study, the researcher conducted a test to assess Pre-Service Teachers' (PSTs)' reading comprehension integrated with a coding program, Scratch Program. It was conducted into two groups, categorized as control and experiment groups. The control group was a group which did not get experience with coding programs during the research. Meanwhile, the experiment group was a group which got experience in coding programs, namely, Scratch Program in ELL, to improve reading comprehension during the research. Thus, in assessing PSTs' reading comprehension, pre-test and post-test were conducted toward both the control and experiment groups. Table 1 shows the result of the pre-test and post-test in this research.

Table 1. The result of the Pre-Test and Post-Test

Average Score	Score of Control Group (30 Students)	Score of Experiment Group (34 Students)
Pre-Test	40	40
Post-Test	40	75
Improvement	0	35

Based on Table 1 above, it was obtained that the average score of the pre-test in both the control and experiment groups had the same score, namely 40 out of 100. From the table, it was concluded that there was no improvement in the control group because the average post-test score was still 40. It occurred because Pre-Service Teachers (PSTs) needed to gain information and knowledge about code literacy from ELLs. Meanwhile, Teacher Educators (TEs) applied to code ELL through Scratch Program in the experiment group. Then Table 1 shows an improvement in PSTs' average score (35). The explanation above showed that there was an improvement in PSTs' reading comprehension by using Coding ELL through Scratch Program.

3.2 Students' Motivation

In gaining the data on Pre-Service Teachers' (PSTs)' motivation, PSTs were provided with the questionnaire. Figure 1 shows the result of the questionnaire relating to PSTs' motivation.

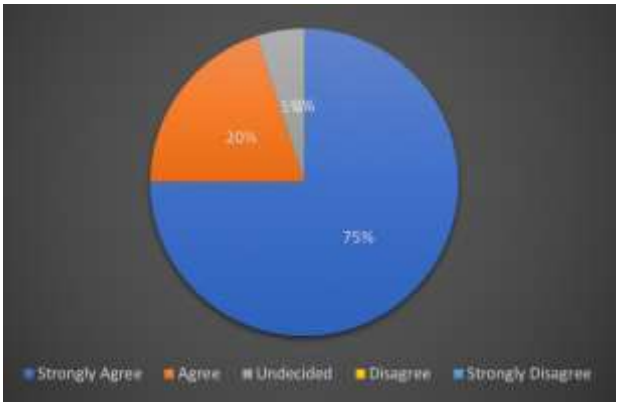

Figure 2. Students' Motivation

Figure 2 illustrates that 75% PSTs-strongly agree that they were motivated to answer reading comprehension questions through Scratch Program. 20% said to agree if Scratch Program motivated PSTs. Then, 5% chose undecided since PSTs might need more practice with Scratch Program provided.

Learning English integrated with Scratch coding activities also encouraged PSTs to learn collaboratively. It is shown in Figure 3 below.

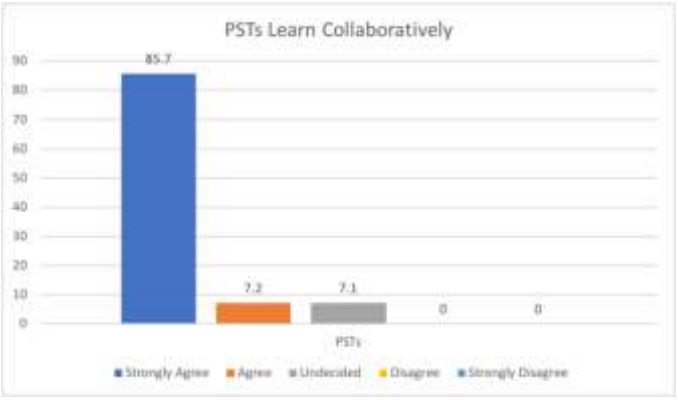

Figure 3. Students' teamwork

Figure 3 shows that 85,7% strongly agree that learning English integrated with Scratch Program Coding activities encourages PSTs to learn collaboratively, and 7,2% stated agree. Meanwhile, 7,1% stated undecided because some PSTs preferred to learn individually.

Furthermore, in knowing PSTs' interest in learning English-integrated Scratch Program coding activities, PSTs were provided with some questionnaires shown in Table 2.

Table 2. The result of Students' Interests

No	Statements	Responses (%)				
		Strongly Agree	Agree	undecided	Disagree	Strongly Disagree
1	I enjoyed learning English which is integrated with Scratch coding activities.	75%	20%	5%	-	-
2	Scratch coding helped to improve my interest in understanding the texts in reading comprehension.	78.6%	20 %	1.4%	-	--
3	Learning English with Scratch coding activities enhanced my ability in computational thinking skills.	82.1%	10.8%	7.1%	-	-

Table 2 shows the responses on Pre-Service Teachers' (PSTs) interests in learning English integrated with Scratch Coding activities. Stood at statement No. 1, 75% of PSTs strongly agreed, 20% agreed, and 5% undecided while none of PSTs chose disagree and strongly disagree. For statement No. 2, 78.6% of PSTs chose strongly angree, 20% chose agree, and only 1.4% chose undecided while none of the PSTs chose disagree and strongly disagree. Lastly, 82% of PSTs chose strongly agree and 10.8% chose agree and 7.1% chose undecided to the statement No. 3. Then, none of the PSTs chose disagree and strongly disagree with the statement No. 3.

3.2 Students' Computational Thinking

Applying for the Scratch Program in English for Young Learners class was not only to improve PSTs' reading comprehension but also to improve computational thinking in the same way. It was gained when PSTs did some activities in putting or designing the response through Scratch Program. There were some aspects which were used in assessing PSTs' computational thinking through Scratch Program, such as (1) abstraction and modularization, (2) parallelism, (3) synchronization, (4) logical thinking, (5) flow control, (6) user interactivity, and (6) data presentation.

Figure 4 shows the result of PSTs' computational thinking after having the product through Scratch Program.

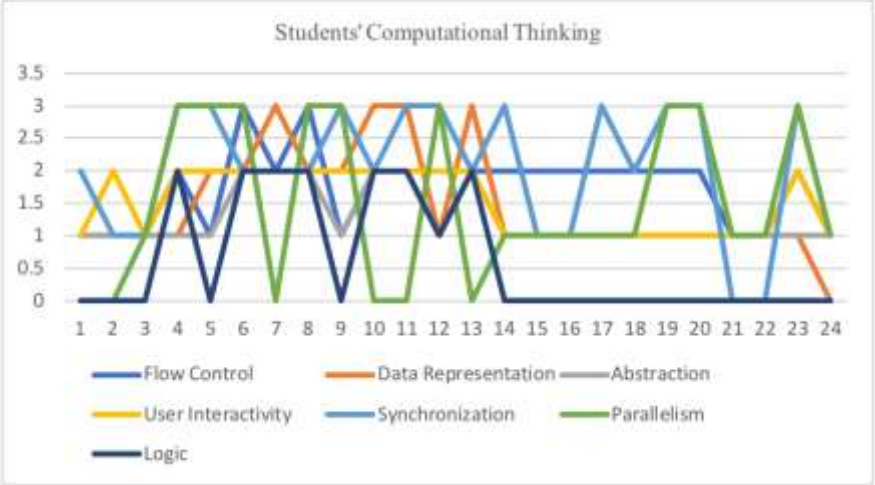

Figure 4. Students' Computational Thinking

Figure 4 shows the results of the students' computational thinking after implementing learning English-integrated Scratch coding activities. It was known that PSTs had some aspects relating to computational thinking, such as (1) abstraction and modularization, (2) parallelism, (3) synchronization, (4) logical thinking, (5) flow control, (6) user interactivity, and (6) data presentation.

4. Conclusion

Based on the findings, this study can be concluded that the Scratch Coding Activities (SCAs) improve the students' language mastery especially reading comprehension. Moreover, SCAs also gives a positive effect on computational thinking skills, interests and motivation in English Language Learning. Therefore, teachers, lecturers and other language practitioners are encouraged to consider integrating coding activities in ELL to boost students' interests, motivation, and competence in computational thinking skills and language mastery.This current study was focused on reading skill in English language learning and the scope of the respondents were limited. Therefore, further research on other language skills such as writing, speaking and listening with wider respondents is recommended to be conducted so that English language teaching and learning program can be benefited from SCAs.

References

Azmina, B., Endang, F., & Nur, A. D. (2019). Instructional design of call course in Indonesian higher education for future English teachers: a case study. *International Journal of Educational Research Review*, *4*(2), 223-230. https://doi.org/10.24331/ijere.518058

Bahar, N. (2021). *The effect of Scratch on children's English Language and cognitive development [M.S. - Master of Science]*. Middle East Technical University.

Budak., E. Ç., Ge œr, A. K., & Topal, A. D. (2021). The effect of programming with scratch course on reflective thinking skills of students towards problem solving. *Journal of Learning and Teaching in Digital Age*, *6*(1), 72-80.

Cabezuelo, A. S. (2019). Use of scratch for the teaching of second languages. *International Journal of Emerging Technologies in Learning (iJET)*, *14*(21), 80-95. https://doi.org/10.3991/ijet.v14i21.11217

Costa, S., Gomes, A., & Pessoa, T. (2016). Using scratch to teach and learn English as a foreign language in elementary school. *International Journal of Education and Learning Systems, 1*, 207-213.

Daher, W., Baya'a, N., Jaber, O., & Awawdeh Shahbari, J. (2020). A Trajectory for advancing the meta-cognitive solving of mathematics-based programming problems with Scratch. *Symmetry*, *12*(10), 1627. https://doi.org/10.3390/sym12101627

Dudeney, G., Hockly, N., & Pegrum, M. (2013). *Digital Literacies.* Harlow: Pearson. https://doi.org/10.4324/9781315832913

El Sourani, A. I., & Ihmaid, M. K. (2019). The effectiveness of using scratch applications in developing sixth graders' English vocabulary, its retention, and self-efficacy. *IUG Journal of Educational and Psychological Sciences, 27*(60), 01-23.

Endah, S. N., Sarwoko, E. A., Bahtiar, N., Wibowo, A., & Kurniawan, K. (2020). Pembinaan pola pikir komputasi dan informatika pada siswa Sekolah Dasar. *E-Dimas: Jurnal Pengabdian kepada Masyarakat*, *11*(1), 1-6. https://doi.org/10.26877/e-dimas.v11i1.2317

Garc á-Pe ñalvo, F. J., Reimann, D., Tuul, M., Rees, A., & Jormanainen, I. (2016). An overview of the most relevant literature on coding and computational thinking with emphasis on the relevant issues for teachers.

Hoffman, B. (2020). *7 Survival Skills for 21st Century Students.* Retrieved July 11, 2022, from https://mylearningspringboard.com/

Jin, Y., & Zha, S. (2019). Weave coding into K-5 curricula as new literacies. *Information Discovery and Delivery*, *48*(2), 49-66. https://doi.org/10.1108/idd-09-2019-0069

Lonati, V., Chiazzese, G., Arrigo, M., Chifari, A., & Tosto, C. (2019). Educational robotics in primary school: Measuring the development of computational thinking skills with the bebras tasks. *Informatics*, *6*(4). https://doi.org/10.3390/informatics6040043

McLennan, D. P. (2017). *Creating Coding Stories and Games*. Retrieved April 19, 2023, from https://www.naeyc.org/resources/pubs/tyc/feb2017/creating-coding-stories-and-games

O'Brennan, L. M., Bradshaw, C. P., & Furlong, M. J. (2014). Influence of classroom and school climate on teacher perceptions of student problem behavior. *School mental health*, *6*, 125-136. https://doi.org/10.1007/s12310-014-9118-8

Obri, H. (2014). *What is Scratch and What It is Educational Uses? New Leaning.*

Özdemir, B. G., Basir, R., Balbay, A., Meredova, P., & Çağlar, K. (2021). Digital games designed by prospective teachers in the scratch program through the eyes of mathematics teachers. *International Journal on Lifelong Education and Leadership*, *7*(2), 37-58. https://doi.org/10.25233/ijlel.994301

Permatasari, L., Rosihan, A. Y., & Dwi, M. (2018). Implementation of scratch application to improve learning outcomes and student motivation on basic programming subjects. *Indonesian Journal of Informatics Education, 2*(2). 97-104. https://doi.org/10.20961/ijie.v2i2.15206

Pratiwi, I. R., Josi, A., & Silalahi, P. (2022). Pengenalan computational thinking dan bebras task sebagai keterampilan berpikir di abad 21 untuk guru SD dan SMP Sungailiat. *Martabe: Jurnal Pengabdian Kepada Masyarakat*, *5*(1), 252-258.

Sarasa-Cabezuelo, A. (2019). Use of Scratch for the teaching of second languages. *International Journal of Emerging Technologies in Learning (iJET)*, *14*(21), 80-95. https://doi.org/10.3991/ijet.v14i21.11217

Stevens, V., & Verschoor, J. (2017). Coding and English language teaching. *The Electronic Journal for English as a Second Language, 21*(2), 1-15.

Sukmadinata, N. S. (2008). *Metode penelitian Pendidikan*. Bandung : PT Remaja Rosdakarya.

Vee, A. (2017). *Coding Literacy: How Computer Programming Is Changing Writing.* The MIT Press. https://doi.org/10.7551/mitpress/10655.001.0001

Wing, J. (2017). Computational thinking's influence on research and education for all. *Italian Journal of Educational Technology*, *25*(2), 7-14.

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