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DEVELOPMENT COMPUTATIONAL THINKING TEACHING MATERIALS BASED CS UNPLUGGED FOR FRACTIONAL NUMBERS IN GRADE V ELEMENTARY SCHOOL

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ABSTRACT
Computational thinking is one of the essential skills in 21st-century learning. However, its implementation in elementary schools remains limited, mainly due to the lack of appropriate and contextual teaching materials. This study aims to develop CS Unplugged-based teaching materials that integrate informatics and mathematics learning, particularly in the topic of fractions. The research employed the Educational Design Research (EDR) method, which consists of three stages: (1) analysis and exploration, (2) design and construction, and (3) evaluation and reflection. The developed teaching materials were validated by four experts: an informatics expert, a mathematics expert, a learning design expert, and a pedagogical expert. The validation results indicated that the teaching materials were highly feasible, with an average percentage score of 87%. Therefore, the CS Unplugged-based teaching materials are considered suitable for use in elementary schools and can serve as an alternative solution to foster students' computational thinking skills, especially in schools with limited computer facilities.
Keywords: computational thinking; CS unplugged; fractional numbers; teaching materials

ABSTRAK
Berpikir komputasional merupakan salah satu keterampilan esensial dalam pembelajaran abad ke-21. Namun, implementasinya di sekolah dasar masih menghadapi tantangan, terutama karena terbatasnya bahan ajar yang relevan dan sesuai dengan konteks pembelajaran. Penelitian ini bertujuan untuk mengembangkan bahan ajar berpikir komputasional tipe CS Unplugged yang mengintegrasikan mata pelajaran informatika dan matematika, khususnya pada materi bilangan pecahan. Penelitian ini menggunakan metode Educational Design Research (EDR) yang terdiri atas tiga tahap, yaitu: 1) analisis dan eksplorasi, 2) desain dan konstruksi, serta 3) evaluasi dan refleksi. Produk bahan ajar yang dikembangkan divalidasi oleh empat ahli, yakni ahli informatika, ahli matematika, ahli desain pembelajaran, dan ahli pedagogik. Hasil validasi menunjukkan bahwa bahan ajar memiliki tingkat kelayakan yang sangat baik dengan rata-rata persentase sebesar 87%. Dengan demikian, bahan ajar ini layak digunakan di sekolah dasar dan dapat menjadi alternatif solusi dalam mengembangkan keterampilan berpikir komputasional peserta didik, khususnya di sekolah yang belum memiliki fasilitas komputer memadai.
Kata kunci*: bahan ajar; berpikir komputasional; bilangan pecahan; CS unplugged*

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Introduction

In 21st century education, students are expected to have skills in learning and innovation and be able to utilise technology and information effectively. Kemendikbud, (2020) has developed 21st century skills known as the 6Cs, namely: 1) creativity, thinking and innovation; 2) critical thinking and problem solving; 3) communication; 4) collaboration; 5) character; and 6) computational thinking. One of the essential skills aligned with the demands of this era is computational thinking. Computational thinking is a problem-solving process that involves systematic, logical, and structured steps, typically applied in computer science. The concept of computational thinking was first introduced by Seymour Papert in 1980. The application of computational thinking has become an important aspect of holistic understanding and strengthening of basic competencies emphasised in the current independent curriculum (Alpiyanah dkk., 2023). In line with Yasin, (2020), who emphasises that computational thinking is a basic skill that must be integrated into the school curriculum so that students can learn to think systematically, develop abstract understanding, and apply algorithmic and logical approaches in solving various problems.

Zia *et al*., (2024) state that computational thinking does not always require the use of computers to solve problems but rather emphasises systematic and logical thinking, similar to how computers operate. In line with Wing's theory Wing (2006), computational thinking is a foundational skill that aligns with other fundamental abilities, such as reading, writing, and arithmetic. In its application, computational thinking skills can be integrated into various disciplines, one of which is mathematics education. This aligns with Marifah *et al*., (2022), who state that the development of computational thinking skills can be maximised through a series of mathematics lessons in primary school.

Based on the results of the 2022 Programme for International Student Assessment (PISA), Indonesian students' mathematics scores reached 366 points. This figure is still far below the average of OECD member countries, which reached 472 points. Based on these results, Indonesia is at level 1a, which indicates that most students are only able to solve problems with simple contexts, clearly formulated questions, and all the necessary information (OECD 2023).

Given that computational thinking is one of the basic competencies that students must possess in preparation for future challenges, just as mathematics lessons teach students how to think critically, analytically, and structurally, computational thinking skills also equip students with the ability to solve problems systematically and efficiently. Therefore, educators need to design learning optimally and efficiently to develop students' competencies in line with the principles of the independent curriculum, one of which is by utilising creative teaching materials that are appropriate for learning needs.

However, learning that focuses on computational thinking currently faces challenges in its implementation, so it is not yet widely applied in primary schools. One form of teaching material that incorporates and supports the development of students' computational thinking skills is the student worksheet (LKPD). The student worksheets provided by educators can help guide and direct learning more effectively, enabling students to solve problems in a structured, efficient manner

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that aligns with the desired learning objectives (Susanti, 2022). The context to be applied in this LKPD is an approach to Computer Science Unplugged activities that can be carried out without using digital technology/computers, but this approach utilises logic games and physical movements aimed at helping students understand various concepts in computer science (Nurhopipah dkk., 2021). According to the theory of Bell, Witten, dan Fellows (1998), CS Unplugged is an activity that provides students with the opportunity to learn about computers without having to use computer hardware or software.

Additionally, the material presented in CS Unplugged is closely related to computational thinking, where students learn to describe a problem, identify key elements in solving it, break it down into small, sequential steps, apply these steps systematically to design a solution, and evaluate the process used to solve the problem (CS *Unplugged*, n.d.). Thus, CS Unplugged activities in basic programming education can strengthen students' computational thinking skills and help address the challenges they face in 21st-century education.

Relevant research conducted by Mufliva & Iriawan, (2022)concluded that CS Unplugged-based mathematics teaching materials can be developed sustainably and are recommended for continued use by educators to improve computational thinking skills and enhance students' understanding of mathematics. Based on this explanation, this study will develop CS Unplugged-based computational thinking teaching materials integrated with fraction material, which will then be tested in fifth-grade elementary school classes at two elementary schools in Tasikmalaya City with the hope of training students' computational thinking skills. Additionally, Rahman *et al*., (2023) state that the development of teaching methods and materials can benefit teachers, students, and schools. Based on this, this study aims specifically to develop CS Unplugged-based computational thinking teaching materials integrated with mathematics learning on fraction material in fifth-grade elementary schools. The development was carried out through the Educational Design Research (EDR) approach, which includes three main stages, namely analysis and exploration, design and construction, and evaluation and reflection.

Research Methods

This study uses an educational design research (EDR) approach. This method focuses on solving problems through the process of designing and developing programmes, materials, teaching materials, and learning and teaching strategies, which can be realised in the form of available products or systems (Lidinillah, 2012). According to Mc Kenney & Reeves (2014), the EDR method consists of three stages: (1) Analysis and Exploration; (2) Design and Construction; and (3) Evaluation and Reflection. These stages are illustrated in Figure 1, which presents the EDR model.

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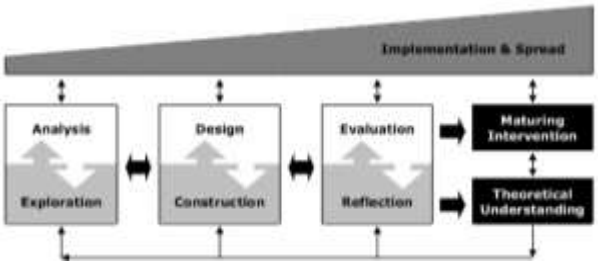

Figure 1. EDR stages according to the mc kenney & reeves model

The procedure shown in Figure 1 consists of three stages in the EDR method, which will be described as follows.

1. Analysis and Exploration

In this stage, the researcher analyses the problem and conducts exploration through preliminary field studies by interviewing educators and conducting documentation studies, as well as reviewing literature through a literature review.

2. Design and Construction

In this stage, the researcher begins to design and develop teaching materials based on CS Unplugged, specifically for fifth-grade fraction material. The development of these teaching materials is tailored to the needs of the students that have been analysed and is aimed at achieving the expected learning objectives. Once the teaching materials have been developed, they are validated by expert validators to assess their quality and suitability.

3. Evaluation and Reflection

At this stage, after the product was developed, the researcher conducted a trial. Next, an evaluation and reflection process was carried out. After that, improvements were made to address the shortcomings found during the trial.

This research was conducted in two cycles at two elementary schools in Tasikmalaya City, namely SDN 2 Kawalu and SDN 2 Linggajaya. The researcher conducted a trial in cycle 1 on computational thinking teaching materials based on CS Unplugged on fractions at SDN 2 Kawalu with 12 fifth-grade students as the research subjects. The teaching materials were then evaluated based on the results of the student response questionnaire and the researcher's observations during the trial.

The teaching materials were then evaluated based on the results of student response questionnaires and the researcher's observations during the trial. The questionnaires were given to the students after they participated in learning using the computational thinking teaching materials based on CS Unplugged. In this study, the data were analysed using qualitative and quantitative descriptive methods. Qualitative descriptive analysis was used to describe the results of preliminary studies, such as interviews and documentation studies. Meanwhile, quantitative analysis was used on expert validation sheets and student response questionnaires using a Likert scale of 1–4 to assess the results obtained.

The following is the formula used to calculate the average score of all aspects of the assessment obtained:

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$$P = \frac{\sum x}{\sum xi} x\ 100\ \%$$

Explanation:
P : Percentage value
∑ x : Total score of respondents' answers from the assessment indicator
∑ xi : Total ideal value

Results and Discussion

This development research produced teaching materials that integrate informatics and mathematics subjects, which were applied to fifth-grade students at SDN 2 Kawalu and SDN 2 Linggajaya. The development of these teaching materials utilised the stages of the EDR model proposed by McKenney & Reeves. This method consists of three main stages: 1) Analysis and Exploration; 2) Design and Construction; and 3) Evaluation and Reflection.

1. Analysis and Exploration

Based on the results of the analysis conducted by the researcher at SDN 2 Kawalu and SDN 2 Linggajaya, by interviewing two fifth-grade teachers at the two schools, it was found that the schools had begun to implement the independent curriculum in their teaching but were still in the adjustment phase, so that the subject of informatics had not yet been implemented at those schools. This finding is in line with the research by Sucipto et al., (2024), which states that the implementation of informatics learning in elementary schools still faces various challenges, including a lack of teacher understanding of the material and limited access to appropriate learning resources. In the interview results, educators also stated that fractions are one of the mathematical concepts that are still difficult for students to understand.

In the learning process, educators also stated that they more often use existing teaching materials, although some try to create their own by searching for references on the internet. However, they experience difficulties in adapting teaching materials to the abilities of students and the limitations of school facilities. Based on the findings in the field, the researcher is interested in developing CS Unplugged-based teaching materials on fractions. This teaching material is expected to help students learn independently and train them in critical thinking and computational thinking. In line with Ezeamuzie & Leung (2022), who stated that computational thinking is a cognitive ability that can be applied in various problem-solving situations, especially in everyday life.

In learning, computational thinking can be integrated with other disciplines, one of which is mathematics. Mardianto (2024) shows that the application of computational thinking in mathematics learning can significantly improve students' critical and creative thinking skills. This aligns with the view of Lockwood et al., (2016) who state that computational thinking in the context of mathematics learning helps students solve problems systematically, structurally, and logically. Additionally, the sorting network activity in the teaching materials allows students to understand algorithms through concrete, enjoyable activities, as explained by (Bell et al., 1998). Therefore, the development of this teaching material is aimed at linking mathematical concepts, particularly fraction material, with activities that stimulate computational thinking.Result format research and discussion No

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separated. The research data presented is Already processed, not raw data. Results studies can serve with support tables, graphs, or pictures in accordance need to clarify presentation results verbally. In discussion seen exists a connection between the results obtained and the concept base or hypothesis.

2. Design and Construction

At this stage, researchers designed CS Unplugged computational thinking teaching materials for fifth-grade elementary school students on the topic of fractions, with the aim of introducing and teaching computational thinking integrated with fractions. The design of these teaching materials took into account several important aspects, such as the suitability of the material presented, the appeal of the illustrations, and the language used. The teaching materials include content on computational thinking, fractions, activity instructions/steps, and activities with challenges. The learning activity to be conducted involves searching for references from the website https://csUnplugged.org. The selected activity is the sorting network, which aligns with the objectives of integrating computational thinking with fractions.

After the design stage, the developed teaching materials will undergo a validation process by experts before being tested. This validation process involves several experts, namely computer science experts, mathematics experts, learning design experts, and pedagogical experts. The following are the results obtained from the validation test show Table 1.

Table 1. Average expert validation results

No.	*Expert Judgement*	**Validation Score**
1	Information Technology Expert	95%
2	Mathematics Expert	70%
3	Learning Design Expert	95%
4	Pedagogical Expert	83%
	Average	**87%**

Thus, CS Unplugged-based teaching materials are deemed highly suitable for use or field testing with some revisions. All feedback received will be used as a reference for researchers in refining the teaching materials. The final results of product development can be seen in Figures 2 and 3.

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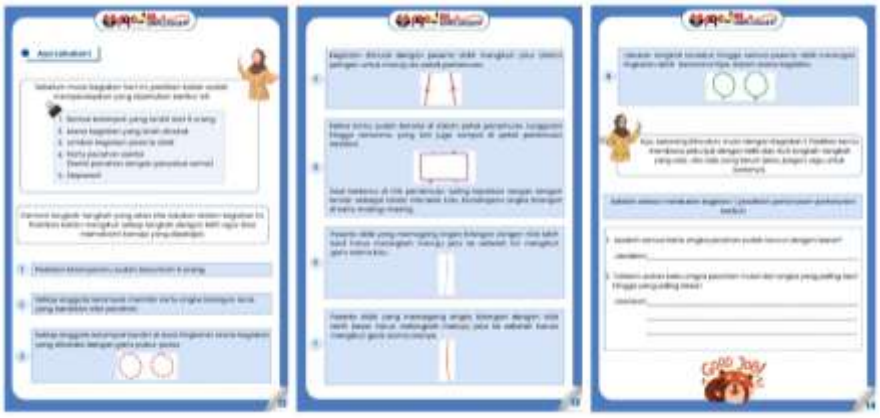

Figure 2. Steps in the sorting network activity

Based on Figure 2, these are the steps of the sorting network activity. This activity is designed so that students can understand the process of sorting fractions through a simulation of a path that resembles a parallel network. Each step guides students to compare two fractions and determine the correct position through movements on the path. This activity supports the strengthening of computational thinking skills, particularly in the aspects of decomposition and algorithms.

Figure 3. Activity practice questions

Based on Figure 3, these are practice questions given to students after they complete the sorting network simulation. These questions aim to evaluate students' understanding of the concept of fraction sorting and encourage them to reflect on the thinking process they have undergone during the activity.

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3. Evaluation and Reflection

After the CS Unplugged teaching materials were validated by experts, the next stage was product testing. This testing aims to assess the suitability and usability of the teaching materials in the learning process, particularly for the topic of fractions. The researcher conducted the product testing over two cycles, with each cycle lasting two sessions. The first cycle of testing was conducted over two sessions on 11–12 March 2025 in Class VA of SDN 2 Kawalu, involving 12 students, while the second cycle of testing was conducted over two sessions on 15th and 19th April 2025 in class V of SDN 2 Linggajaya, involving 18 students.

a. Results of Testing CS Unplugged Computational Thinking Teaching Materials on Fractions for Grade V Elementary School Students

In the first meeting, students were introduced to the concept of sorting networks through a simulation of sorting fractions on a banner. The sorting activity was carried out on the banner, with students starting from the starting point, which was a red circle, holding cards with random fractions. When stepping onto the meeting square, they must compare the two fractions they are holding and clap their hands/high-five as a sign of interaction before moving to the next square. Students holding the smaller fraction move to the left path, while those holding the larger fraction move to the right path, in accordance with the rules outlined in the guide. This process continues until all students reach the green circle marking the end point. At the end point, the sequence of fractions is arranged from smallest to largest. This activity not only trains mathematical understanding but also cooperation, concentration, and algorithmic skills. The following are Figure 4 and Figure 5, which are images or documentation of the sorting network activity.

Figure 4. Sorting network activity

Based on Figure 4, there is interaction in the sorting network activity, where each student who meets in the comparison square claps their hands/high fives as a symbol of interaction and cooperation before comparing the values of the fractions they hold. This activity shows collaboration and mutual reminders among group members.

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Figure 5. Each member writes down the numbers in ascending order from smallest to largest.

Based on Figure 5, after completing the sorting network activity, each group member wrote down the order of the numbers on the cards containing fractions from smallest to largest in the green circle as the end point of the sorting network activity. This sequence is the result of the comparison and sorting process carried out in the sorting network. According to Nordby *et al*., (2024), one effective approach to introducing computational thinking to primary school students is through unplugged activities, where students can develop components of computational thinking, such as algorithmic thinking and collaborative skills, which are important aspects of collaborative learning.

Furthermore, students must also complete the exercises in the LKPD, which involve converting common fractions to decimals, according to the numbers on the number cards. Examples of group answers are shown in Figure 6.

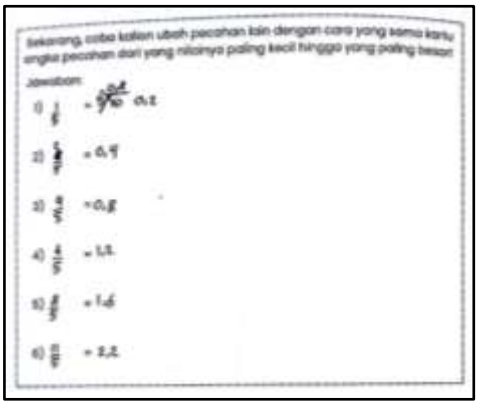

Figure 6. Example of group 1's answer to the exercise on converting common fractions to decimal numbers

Based on Figure 6. this is the answer produced by one of the groups in the second activity. After completing the sorting network activity, students were asked to convert the fractional numbers they had into decimal form. In the figure, it can be seen that this group successfully converted all fractional numbers to decimals correctly. Meanwhile, there were still students who had difficulty converting ordinary fractions into decimal fractions using the long division method. This

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difficulty is evident when students are confused about which number to keep as the numerator and denominator before performing long division.

These difficulties can be overcome through guidance from researchers and cooperation with group members. In line with Widodo, S., & Suryana, (2021) who stated that direct guidance and learning involving group discussions enable students to share their understanding and solve problems together, thereby strengthening their understanding of difficult concepts, such as fractions and decimals. This finding aligns with the research by Mufliva & Iriawan, (2022) which indicates that CS Unplugged-based instructional materials effectively enhance primary school students' mathematical competencies.

In the second meeting, students learned the concept of parallel networks to determine maximum and minimum values. They were asked to draw simple networks and exchange results with other groups. Examples of group answers are shown in Figures 7.

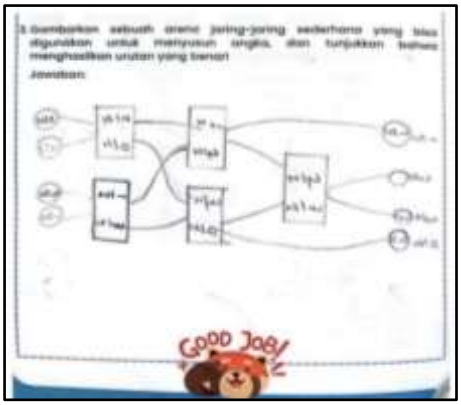

Figure 7. Example of group 1's answer making simple nets accurately

Based on Figure 7, which shows the answers from group 1 in drawing/creating a simple sorting network with the correct path and sorting the fractions from smallest to largest correctly.

The researcher's observations showed that students were highly enthusiastic, actively engaged in discussions, and able to correct mistakes, in accordance with the rules requiring repetition when mistakes occurred. This is in line with Kosasih, (2021) opinion that concrete and collaborative activities facilitate the understanding of abstract concepts such as mathematics. Furthermore, according to Sondakh *et al*., (2024) in their research, sorting network activities can sharpen algorithmic thinking skills without the aid of digital devices, making them very suitable for schools with limited technology.

During the trial, students showed positive responses to the teaching materials. Their responses increased in the second cycle after improvements were made based on previous evaluations. When comparing the results of the hypothetical learning trajectory (HLT) and the actual learning trajectory (ALT), there was good alignment, indicating that the HLT is effective in designing teaching materials and understanding students' thinking processes. This aligns with the view of Wijaya *et al*., (2021) who state that the HLT can assist in designing learning activities aligned with predictions of students' thinking processes.

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b. User Responses to CS Unplugged Computational Thinking Teaching Materials on Fractions for Grade V Elementary School Students

Based on the responses from educators and students, it can be concluded that the teaching materials developed received very positive responses. The researcher can display the percentage of responses from educators in Figure 8 below.

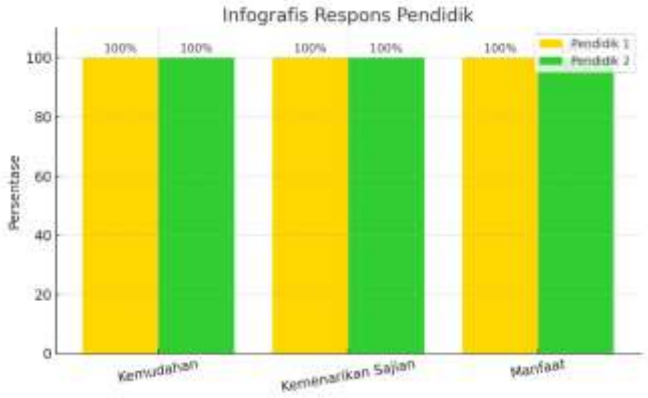

Figure 8. Infographic on educators' responses

Figure 8 shows the responses of two educators to the teaching materials that had been tested. Three aspects were assessed, namely ease of use, attractiveness of presentation, and usefulness, with an average percentage of 100% in the excellent category.

Next are the responses of students to the CS Unplugged computational thinking teaching materials on fractions. In cycle 1, the percentage was 92%, which falls into the 'very good' category. In cycle 2, the percentage increased to 94%, which also falls into the 'very good' category. The responses provided by the students are shown in Figure 9.

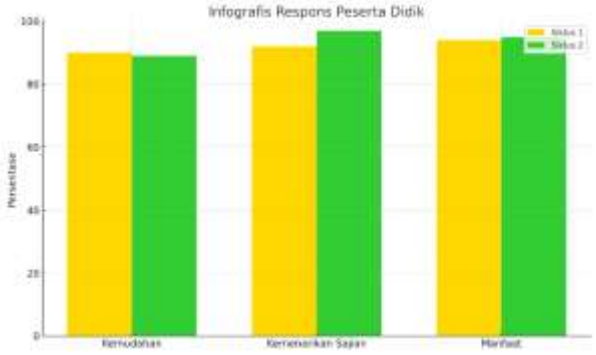

Figure 10. Infographic of student responses

Based on Figure 10, the percentage results of user responses indicate that CS Unplugged-type computational thinking teaching materials are suitable for use and appropriate for learning at the primary school level, particularly in integrating informatics and mathematics. This is in line with Fauzi et al., 2024 who found that computational thinking-based learning can increase students' motivation and active participation in mathematics learning.

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This study shows that the CS Unplugged computational thinking teaching materials developed are suitable for use in mathematics learning, particularly for fraction material in Grade V of elementary school. This is evident from the expert validation results, which reached an average of 87%, as well as the very positive responses from educators and students. This success is due to several supporting factors. First, the CS Unplugged approach used does not require computer devices, making it applicable in schools with limited technology. This aligns with the statement by Zia et al., 2024 that computational thinking does not always have to use digital devices, but rather systematic thinking as done by computers. Second, the sorting network activity applied in the teaching materials is designed to be concrete and fun, making it easier for students to understand the concept of algorithms and the logical order of fractions (Bell et al., 1998).

The advantage of this teaching material is that it can effectively integrate information technology into mathematics learning and create an active collaborative learning experience. According to Nordby et al., 2024 collaborative concrete activities such as this can improve the algorithmic thinking skills of primary school students. In addition, activities such as sorting networks help students think in a structured manner and improve their communication skills within groups. However, there are several shortcomings in the implementation of this study. The trial was only conducted in two schools in one region, so the generalisation of the results is still limited. In addition, CS Unplugged activities require sufficient space and good time management for learning to be effective, especially for physical activities such as sorting network simulations.

The results of this study are in line with the findings of Mufliva & Iriawan, 2022) who stated that CS Unplugged-based teaching materials can improve students' computational thinking skills and mathematical understanding. In addition, Lockwood et al., 2016 and Mardianto, 2024 also emphasise that the application of computational thinking in mathematics learning can improve students' ability to solve problems logically and systematically. The research conducted by Yuliana et al., 2021 further supports this finding, where students' computational thinking skills showed a significant improvement after the implementation of the CS Unplugged method. The post-test results showed that before the intervention, only 40% of students understood the concept, while after the intervention, this increased to 80%.

Thus, this study contributes to the development of innovative teaching materials at the primary school level, particularly in supporting the implementation of the independent curriculum. The teaching materials developed can be an alternative for teachers in teaching mathematics through a fun, interactive, and meaningful approach, especially in schools that do not yet have computer facilities.

Conclusion and Suggestion

This study aims to develop CS Unplugged computational thinking teaching materials on fractions for fifth-grade elementary school students. The results show that the teaching materials developed are highly suitable for use, with an average expert validation score of 87% and positive responses from teachers and students. In general, these teaching materials are effective in helping students understand the concept of fractions and practise computational thinking skills through concrete

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activities without the aid of computers. These CS Unplugged computational thinking teaching materials can be used by teachers as an alternative to fun and meaningful mathematics learning, especially for fraction material. Schools that do not have computer facilities can also use these teaching materials because they do not rely on digital devices.

Further research is recommended to develop this teaching material for other topics or grade levels, as well as to expand the pilot study to schools with different characteristics. Additionally, further research using specific instruments to measure computational thinking skills is needed.

Reference

Alpiyanah, Y., Jaelani, A. K., & Tahir, M. (2023). Pengaruh Model Pembelajarn Mind Mapping Terhadap Kemampuan Berpikir Kritis Peserta Didik Kelas IV SDN 3 Maria Tahun Ajaran 2021/2022. *Jurnal Ilmiah Profesi Pendidikan*, *8*(1b), 793–799. https://doi.org/10.29303/jipp.v8i1b.1125

Bell, T., Witten, I., & Fellows, M. (1998). Off-Line Activities and Games for All Ages. *Science*. https://jmvidal.cse.sc.edu/library/bell98a.pdf

CS Unplugged. (n.d.). Computational Thinking and CS Unplugged. *Retrieved from CS Unplugged: https://csunplugged.org/en/computational-thinking/.*

Ezeamuzie, N. O., & Leung, J. S. C. (2022). Computational Thinking Through an Empirical Lens: A Systematic Review of Literature. *Journal of Educational Computing Research*, *60*(2), 481–511. https://doi.org/10.1177/07356331211033158

Fauzi, A. L., Kusumah, Y. S., Nurlaelah, E., & Juandi, D. (2024). Computational Thinking in Mathematics Education : A Systematic Literature Review on its Implementation and Impact on Students' Learning. *Jurnal Kependidikan: Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran*, *10*(2), 640. https://doi.org/10.33394/jk.v10i2.11140

FRahman, D Abdul Muiz Lidinillah, I. A. (2023). Pengembangan Bahan Ajar Berpikir Komputasional Model Unplugged pada Materi Bilangan Pecahan di Kelas V SD. *Pendas : Jurnal Ilmiah Pendidikan Dasar*, *09*(8), 316–327. https://journal.unpas.ac.id/index.php/pendas/article/view/9475.

Kemendikbud. (2020). *Panduan Penyusunan Kurikulum Pendidikan Tinggi*.

Kosasih, E. (2021). *Pengembangan Bahan Ajar* (hal. 270).

Lidinillah, D. A. M. (2012). Educational Design Research : a Theoretical Framework for Action. *Universitas Siliwangi*, *1*(1), 1–13. https://dosen.ikipsiliwangi.ac.id/wp-content/uploads/sites/6/2018/04/Educational-Design-Research-A-Theoretical-Framework-for-Action.pdf.

Lockwood, E., Asay, A., DeJarnette, A. F., & Thomas, M. (2016). Algorithmic thinking: An initial characterization of computational thinking in mathematics. *38th Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*, 1588–1595. https://files.eric.ed.gov/fulltext/ED583797.pdf.

Marifah, S. N., Mu'iz L, D. A., & Wahid M, M. R. (2022). Systematic Literatur Review: Integrasi Conputational Thinking dalam Kurikulum Sekolah Dasar di

e-ISSN 2746-5594
p-ISSN 2746-5608

Indonesia. *COLLASE (Creative of Learning Students …*, *5*(5), 928–938. https://www.journal.ikipsiliwangi.ac.id/index.php/collase/article/view/12148

Mufliva, R., & Iriawan, S. B. (2022). Pengembangan Bahan Ajar Matematika Bidang Kajian Bilangan Berbasis Computer Science Unplugged (CSU) untuk Siswa Sekolah Dasar. *DWIJA CENDEKIA: Jurnal Riset Pedagogik*, *6*(2), 209. https://doi.org/10.20961/jdc.v6i2.62088.

N F Mardianto, Y. (2024). Systematic Literature Review: Penerapan Berpikir Komputasi Dalam Pembelajaran Matematika. *Journal of Student Research (JSR)*, *2*(4), 41–55. https://doi.org/10.55606/jsr.v2i4.3082

Nordby, S. K., Mifsud, L., & Bjerke, A. H. (2024). Computational thinking in primary mathematics classroom activities. *Frontiers in Education*, *9*(July), 1–14. https://doi.org/10.3389/feduc.2024.1414081

Nurhopipah, A., Suhaman, J., & Humanita, M. T. (2021). Pembelajaran Ilmu Komputer Tanpa Komputer (Unplugged Activities) Untuk Melatih Keterampilan Logika Anak. *JMM (Jurnal Masyarakat Mandiri)*, *5*(5), 2603–2614. https://doi.org/10.31764/jmm.v5i5.5295.

OECD. (2023). Program For International Student (PISA) 2022 Assessment and Analytical Framework. In *OECD (Organisation for Economic Co-operation and Development) Publishing*. https://www.oecd-ilibrary.org/education/pisa-2022-assessment-and-analytical-framework_dfe0bf9c-en.

Sondakh, D. E., Pungus, S. R., Maringka, R. C., & Tangka, G. M. W. (2024). Memperkenalkan Algoritma dan Berpikir Algoritmik kepada Siswa Sekolah Dasar Menggunakan CS Unplugged. *Servitium Smart Journal*, *2*(2), 134–140. https://doi.org/10.31154/servitium.v2i2.29.

Sucipto, S., Sukri, M., Patras, Y. E., & Novita, L. (2024). Tantangan Implementasi Kurikulum Merdeka di Sekolah Dasar: Systematic Literature Review. *Kalam Cendekia: Jurnal Ilmiah Kependidikan*, *12*(1), 277-287. https://doi.org/10.20961/jkc.v12i1.84353.

Susanti, S. (2022). Efektivitas LKPD Berbasis Penemuan Terbimbing untuk Meningkatkan Kemampuan Pemecahan Masalah Matematis Kelas XI SMA. *Indonesian Journal of Intellectual Publication*, *2*(2), 44–53. https://doi.org/10.51577/ijipublication.v2i2.197.

T.C.Reeves, S. M. &. (2014). Handbook of research on educational communications and technology: Fourth edition. *Handbook of Research on Educational Communications and Technology: Fourth Edition*, *January*, 1–1005. https://doi.org/10.1007/978-1-4614-3185-5.

Widodo, S., & Suryana, A. (2021). Pengaruh Pembelajaran Kolaboratif terhadap Pemahaman Matematika Siswa pada Pembelajaran Pecahan. *Jurnal Pendidikan Dasar*, *8(1)*, 34–47.

Wijaya, A., Elmaini, & Doorman, M. (2021). A learning trajectory for probability: A case of game-based learning. *Journal on Mathematics Education*, *12*(1), 1–16. https://doi.org/10.22342/JME.12.1.12836.1-16.

Wing, J. M. (2006). Computational Thinking. *Communications of the ACM*, *49*(3), 33–35. https://www.researchgate.net/publication/274377900_Computational_Thinking.

e-ISSN 2746-5594
p-ISSN 2746-5608

Yasin, M. (2020). Asesmen Penulisan Jurnal untuk Meningkatan Kemampuan Berpikir Komputasi (Journal Writing Assessment to Improve Computational Thinking Ability). *ResearchGate*, *April*, 0–21.

Yuliana, I., Hermawan, H. D., Prayitno, H. J., Ratih, K., Adhantoro, M. S., Hidayati, H., & Ibrahim, M. H. (2021). Computational Thinking Lesson in Improving Digital Literacy for Rural Area Children via CS Unplugged. *Journal of Physics: Conference Series*, *1720*(1), 1-10. https://doi.org/10.1088/1742-6596/1720/1/012009.

Zia, S., Hasanah, H., Yahfizham, Y., Williem Iskandar, J., & Estate, M. (2024). *Systematic Literature Review: Analisis Kemampuan Berpikir Komputasional Siswa Sekolah Dasar Menggunakan Scratch*. *2*(3), 90–97. https://doi.org/10.51903/pendekar.v2i3.732.