Advancement of STEM-Based E-Student Worksheet To Enhance The HOTS of Elementary School Students

Melva Zainil[1*], Ary Kiswanto Kenedi[2], Asnawi[3] 🆔
[1] Elementary School Teacher of Education, Universitas Negeri Padang, Padang, Indonesia
[2,3] Elementary School Teacher of Education, Universitas Samudra, Langsa, Indonesia

A B S T R A K

Penelitian ini dlatarbelakangi oleh perlunya inovasi pembelajaran online pada masa pendemi covid-19 yang dapat sesuai dengan karakteristik siswa sekolah dasar dan mampu mengembangkan HOTS siswa sekolah dasar. Tujuan penelitian ini adalah untuk mengembangkan E-LKPD berbasis STEM untuk meningkatkan HOTS siswa sekolah dasar pada masa pandemi covid-19 yang valid dan efektif. HOTS yang diukur pada penelitian ini adalah tingkatan kognitif C4, C5 dan C6. Penelitian ini merupakan penelitian pengembangan denggan menggunakan model 4-D. Subjek penelitian ini adalah siswa kelas dua sekolah dasar sebanyak 60 orang. Data yang dugunakan pada penelitian ini adalah data kualitatif dan data kuantitaif yang terdiri dari lembar observasi, dokumentasi, angket dan soal test. Teknik analisis data kualitatif dengan cara mengumpulkan data, mereduksi data dan menarik kesimpulan sedangkan data kuantitaif dianalisis dengan menggunakan uji independent t-test. Hasil penelitian menyatakan bahwa telah dikembangkan E-LKPD berbasis STEM untuk meningkatkan HOTS siswa sekolah dasar pada masa pandemi covid-19 yang valid dan efektif. Implikasi penelitian ini dapat dijadikan sebagai referensi bagi guru dalam melaksanakan proses pembelajaran online pada masa pandemi covid-19.

A B S T R A C T

During the covid-19 pandemic, there was a demand for online learning innovations that could meet the characteristics of elementary school students and develop HOTS for elementary school students. The goal of this study is to develop a STEM-based E-Student Worksheet to enhance valid and effective HOTS of elementary school students during the COVID-19 pandemic. HOTS measured in this study was the cognitive level C4, C5 and C6.This study used a four-dimensional model to conduct development research. The participants in this study were elementary school students in second grade as many as 60 students. The qualitative and quantitative data used in this study included observation sheets, documentation, questionnaires, and test questions. Qualitative data was analysed by collecting data, reducing data, and drawing conclusions, whereas quantitative data was analysed by applying the independent t-test. According to the study's findings, a STEM-based E-Student Worksheet had been developed to enhance elementary school students' valid and effective HOTS during the covid-19 pandemic. The findings of this study can be used by teachers to guide them through the online learning process during the COVID-19 pandemic.

1.   INTRODUCTION

The worlds of education and science are developing at a rapid pace (Kenedi et al., 2019; O'Connor, 2021; Teo et al., 2021). This can be seen in the learning process, which includes curriculum, learning models, learning strategies, and teaching materials utilized to attain educational goals, and which receives innovation from time to time. This development begins with the learning process in higher education and continues with the learning process in basic education (Dhawan, 2020; Eliyasni et al., 2019). Learning in primary and secondary education is different from learning at higher levels. Learning is contextualized in basic education, particularly in the elementary school learning process. This has to do with the era and the characteristics of elementary school children's development. Children in elementary school are those who are in the concrete operational period (Fitria et al., 2021; Mirza et al., 2019). Children must learn from real objects and direct experience at this period (Arlis et al., 2020; Puspitarini & Hanif, 2019). As a result, to satisfy the developmental characteristics of elementary school students, a contextual learning process is required. However, the researchers found from their literature review that many of the learning processes used by elementary school teachers did not contribute to the developmental characteristics of elementary school-age children (Kenedi et al., 2019). Many people have discovered that in elementary schools, teachers still employ the lecture method to deliver the learning process (Dewi & Primayana, 2019; Kenedi et al., 2019; Puspitarini & Hanif, 2019). The findings of this literature review

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are supported by a survey conducted by the researchers in Padang, which revealed that 77 percent of teachers used the lecture method in the learning process, 13 percent used the Exercise method, and 10% used the experimental method in elementary school. As a result of these findings, many primary school teachers continue to use the lecture method in the learning process.

The teacher has a significant impact on the quality of an education (Bürgener & Barth, 2018; Scull, J., M. Phillips, U. Sharma, 2020). The quality of the teacher's learning design will have an impact on the quality of education (Floden et al., 2017; Kenedi et al., 2019). Teachers must be able to design, develop, and implement new learning procedures that strengthen attention, interest, motivation, and other thinking abilities (Dinayusadewi & Agustika, 2020; Munirah, 2018). Higher order thinking skills (HOTS) are one of the thinking skills that teachers must teach to children, particularly elementary schoolchildren. HOTS is a higher cognitive process-based thinking ability (Ichsan et al., 2019; Jaenudin et al., 2020). In order to solve problems, HOTS requires the ability to think creatively and critically (Yulianto et al., 2021). Students should learn HOTS because it is one of the abilities required in the twenty-first century. As a result, teachers must create learning processes that allow elementary school students to develop HOTS during this covid-19 pandemic.

The learning process was performed through distance learning or online during the COVID-19 pandemic (Adedoyin & Soykan, 2020; Almaiah et al., 2020). There are numerous issues with distance learning and online learning (Fikri et al., 2021; Hutauruk & Sidabutar, 2020). The most critical problem in online learning is the failure to ask students to participate in the learning process. This is in line with the findings of a survey done by the researchers among 100 elementary students in Padang, which revealed that 98.00 percent of students felt bored by online learning activities given by teachers. These findings are backed up by interviews with elementary school students, who concluded that they are bored and dissatisfied with the teacher's teaching methods. Students were bored with the learning process carried out by the teacher by only sending teaching materials and assignments to students through the WhatsApp application, according to questionnaires and student interviews. As a result, students believe there is no interaction in the learning process that provides for a joyful learning experience (Albab, 2020; Primasari & , Zulela, 2019).

According to the researcher's analysis of the questionnaire and interview, there is a lack of teacher strategies for utilizing technology to assist online learning activities. Teachers have been unable to use creative learning techniques that can help students enhance their thinking skills, particularly their HOTS abilities. Therefore, during the covid-19 pandemic, an innovative effort is required to enhance the HOTS of elementary school students. Teachers should make an effort to build HOTS for elementary school students during the learning process by creating a lesson that demands students to actively find information utilizing both mental and psychomotor processes. This learning can be developed utilizing student worksheets. Student worksheet is a component of teaching materials that includes activities aimed at assisting students in finding information that is relevant to the learning objectives (Monika & Ramadan, 2022; Prasadi et al., 2020). Student worksheet is a method for students to actively find their own knowledge during the learning process (Haidir et al., 2021; Putri et al., 2019). Student worksheet can also greatly increase the quality of student learning.

By adapting the learning process to technology advancements, student worksheets can be created. This is in line with the requirements of the covid-19 epidemic, which necessitates the ability of teachers and students to employ technology in the online learning process (Islam Sarker et al., 2019; Ying et al., 2021). Therefore, the Student worksheet can be transformed into an electronic Student worksheet, also known as an E-Student worksheet. The E-Student Worksheet follows the learning process to help students develop their 21st-century skills. STEM learning is one type of learning that may be incorporated into student worksheet to help them improve 21st-century abilities. STEM is a learning process that combines science, technology, engineering, and mathematics into one integrated learning process. STEM is a learning system that connects science, technology, engineering, and mathematics to real-world situations (Huang et al., 2022; Nurtanto et al., 2020). By connecting science and technology, STEM may relieve students' pressure of dealing with real-world problems. STEM has also been shown to improve student interest, according to other experts. Students' motivation, perception, and learning outcomes are all benefit from STEM (Julià & Antolí, 2019; Vennix et al., 2018). According to the researcher's hypothesis, STEM can help children develop their HOTS. Therefore, researchers intend to create a STEM-based digital Student Worksheet that can assist elementary school students improve their HOTS during the COVID-19 epidemic.

This study is backed up by a study published, which created a STEM-based Student Worksheet to increase valid, practical, and effective primary school student learning outcomes (Manalu et al., 2022; Saputra et al., 2020). However, the Student Worksheet created in that study was a printed Student Worksheet that was used in the face-to-face learning process. Furthermore, that Student Worksheet focuses on the process of enhancing elementary school kids' learning outcomes. However, the development of a STEM-based E-Student Worksheet focused on developing HOTS for elementary school students was not identified in the online learning process during the COVID-19 epidemic. As a result, the goal of this study is to develop a STEM-based E-Student Worksheet to enhance elementary school students' valid and effective HOTS during the COVID-19 pandemic.

The HOTS measured in this study were the ability to analyze (C4), the ability to evaluate (C5) and the ability to create (C6). Researchers hope that the implementation of this research can help elementary school teachers in maximizing the development of HOTS for elementary school students during the COVID-19 pandemic.

2. METHOD

This is a development study employing a four-dimensional model. The four-dimensional model stage is define, design, development and disseminate. Initial analysis, student characteristics analysis, and material analysis are all done during the define stage. The Student Worksheet framework and the HOTS instrument were drafted during the design stage. During the development stage, an E-Student Worksheet was created, as well as validity and effectiveness assessments. The product is distributed to schools during the disseminate stage. The data collection instruments in this study were initial analysis questionnaires, student characteristic analysis documentation sheets, material analysis documentation sheets, validation sheets and HOTS questions. The initial analytical questionnaire was developed with the HOTS indicator consisting of statements of understanding, assessing and creating. The student characteristics analysis sheet contains a profile of the dominant sources of information and the characteristics of primary school students. The validation sheet consists of validating the content feasibility aspect (suitability of the material, accuracy of facts, suitability of questions, and novelty of science) and the presentation feasibility aspect (systematics, illustrations and pictures, and the letters used). The data collection tool has been validated by experts and was declared suitable for use. The HOTS questions, 10 questions were developed that were adjusted to the HOTS indicators, namely the ability to analyze (C4), the ability to assess (C5) and the ability to create (C6). This question is content validated by a HOTS expert. HOTS questions can be used if the experts state that the questions are suitable for use. Data analysis techniques for questionnaires and documentation sheets are by collecting data, reducing data and presenting data. The data analysis technique for the validation test was analyzed by calculating the average percentage score and then converted into the values presented in Table 1.

Table 1. Validation Criteria

No	Percentage	Criteria
1	$x \geq 75\%$	Very High
2	$50\% \leq x < 75\%$	High
3	$25\% \leq x < 50\%$	Low
4	$x < 25\%$	Very Low

(Eliyasni et al., 2019)

The independent T-test was used as a data analysis tool to assess the feasibility of the HOTS ability. The feasibility test took place at Padang City's Elementary School 21 Bandar. The participants in this study were primary school students in second grade as many as 60 students. Purposive sampling is the sample approach used in this study. This study included two classes: class II A (30 students), which served as the control group, and class II B (30 students), which served as the experimental group. The feasibility test in this study is designed to be presented in Table 2.

Table 2. Design of Feasibility Test

Group	Pre-test	Treatment	Post-test
Experiment	O1	X	O2
Control	O3	-	O4

(Rogers & Revesz, 2019)

Both data have been declared normal and homogeneous. Students in the control class study using traditional means during online learning, whereas students in the experimental class learn using STEM-based E-Student Worksheets during online learning. The following formula will be used to evaluate HOTS of students using gain-normalization or N-Gain. After calculating the N-Gain, then the data is calculated using T-Test.

3. RESULT AND DISCUSSION

Result

This study began with the distribution of an initial analytical questionnaire on students' issues. Students are given questionnaires online. According to the questionnaire, students expressed boredom with the teacher's

teaching methods. This is because the teacher solely uses the Whatsapp application to conduct the learning process, and the teacher only sends teaching materials and assignments to the students. Furthermore, the average student received a HOTS score of 34.67 based on the questionnaire given addressing the students' initial HOTS, indicating that students are in the low HOTS category. After that, examine the characteristics of the students. This is the foundation for the E-Student Worksheet, which intends to develop HOTS for elementary school students in the online learning process during the COVID-19 pandemic that are appropriate for elementary school students' characteristics. The characteristics of primary school children were found to be learning from concrete objects, being happy to feel, do, or demonstrate something directly, liking to work in groups, liking to play, and liking to move, according to the analysis of student characteristics. STEM-based E-Student Worksheets will be developed based on these characteristics. The analysis of learning materials is the next step. Material from class III, theme 3, learning 1 was used to create the learning materials.

The design stage is the next step. The e-Student Worksheet framework will be developed at this stage. The cover, introduction, table of contents, about the Student Worksheet, STEM competency screening, identity, basic competencies, learning objectives, tools and materials, and work steps will all be designed as part of the E-Student Worksheet framework. Then I put together a list of HOTS questions to see how effective the e-Student Worksheet is. HOTS indicators, such as critical thinking and creative thinking, are used to organize the questions. There are ten questions in total that have been designed (5 questions about critical thinking skills and 5 questions about creative thinking skills). The question was then verified by two HOTS experts and approved for use. The development stage is the following step. The E-Student Worksheet was created using the results of the define and design stages. The validity test was carried out after the E-Student Worksheet was designed. Two categories of experts are involved in the validity test: STEM experts (content aspect) and technological experts (presentation aspect). A summary of the results of the validation of these experts is presented in Table 3.

Table 3. Recapitulation of Validation Results

Type of Validation	Validator	Meeting 1		Meeting 2	
		Score	Category	Score	Category
Content Aspect	Validator 1	67	High	76	Very High
	Validator 2	69	High	78	Very High
Presentation Aspect	Validator 1	60	High	75	Very High
	Validator 2	61	High	76	Very High

Table 3 shows that both the content and presentation aspects of expert expert validation are in the very high category. This demonstrates that the generated E-Student Worksheet is really feasible to use. The next activity is to test the feasibility. Students will be given test questions to measure their hots after they have received treatment. The findings of the measurements are subsequently processed and analysed. The findings are shown in the Table 4.

Table 4. T-test Results of N-Gain of HOTS

Classes	Pre-test (x±sd)	Post-test (x±sd)	N-Gain (x±sd)	Criteria	T-test	Classes
Control	44.50 ± 12.67	50.50 ± 11.56	0.10 ± 0.06	Low	0.000	Control
Experiment	89.50 ± 13.77	50.00 ± 10.56	0.79 ± 00.7	High	0.000	Experiment

Table 4 shows that the control class got an N-Gain score of 0.10 with a low category while the experimental class got an N-Gain score of 0.79 with a high category. This demonstrates that during the online learning session, the HOTS of elementary school children increased significantly in the experimental class. The T-test calculation resulted in a sig value of 0.00 < 0.05, as shown in the table. This indicates that during the covid-19 epidemic, primary school children who study utilizing the E-Student Worksheet in the online learning process have a considerable rise in their HOTS ability. It may be concluded that using STEM-based e-Student Worksheets during the covid-19 epidemic can boost student HOTS during the online learning period.

Discussion

According to this study, a legitimate and effective STEM-based e-student worksheet was produced to increase the HOTS of elementary school pupils throughout the covid-19 pandemic's online learning session. The findings of this study are backed up by the findings of earlier research. According to research undertaken by Hartini et al in 2020, a STEM-based Student Worksheet for high school students has been designed with the goal

of improving valid, practical, and effective critical skills (Hartini et al., 2020; Prasadi et al., 2020). This study has a common thread: the creation of a STEM-based Student Worksheet. A distinctive finding is that this research develops an effective digital-based e-student worksheet to enhance the HOTS ability of elementary school students in online learning during the COVID-19 pandemic. According to research, STEM-based student worksheets for high school students have been produced to boost students' critical thinking skills (Oktaviani et al., 2020). The development of a STEM-based Student Worksheet is a common theme in this research. A distinctive finding is that during the COVID-19 pandemic, this research develops an effective digital-based e-student worksheet to enhance the HOTS ability of elementary school students in online learning. Valid and effective STEM-based Student Worksheet had been designed to increase learning results (Indrianingrum et al., 2018; Means et al., 2017). This study has a common thread: the development of a STEM-based Student Worksheet. A distinctive finding is that this research develops an effective digital-based e-student worksheet to enhance the HOTS ability of elementary school students in online learning during the COVID-19 pandemic. The findings of this study are different, according to the research, because this study claims to have built a genuine STEM-based E-Student Worksheet that is employed in the online learning process during the covid-19 pandemic. According to the findings of this study, the STEM-based E-Student Worksheet developed is beneficial in enhancing elementary school students' HOTS.

At the initial stage, namely the needs analysis, it was found that the results of the initial analysis through the distribution of online questionnaires stated that students tended to be bored in the online learning process carried out by the teacher through WA. The saturation of students in the online learning process is caused by the teacher only giving assignments to students. This finding is supported by the results of research which states that students who study online using the whatsapp application tend to be bored (Handaru & Pujiriyanto, 2020; Supratiwi et al., 2021; Ulinsa et al., 2021). This is due to the lack of interaction between teachers and students. The learning process in elementary schools is different from the learning process at other levels of education. The learning process in elementary schools must be contextual, involve active students and relate to students' direct experiences (Budiman et al., 2021; Suryawati et al., 2020b). Therefore, teachers must be able to design learning according to the characteristics of elementary school students. The findings also state that the HOTS of elementary school students is in the low category. The low HOTS of elementary school students during the COVID-19 pandemic is a form of student saturation with the learning process carried out by the teacher. HOTS students will be able to develop through a series of activities that involve students to think unusually (Rapih & Sutaryadi, 2018; Rosidin et al., 2019; Spector & Ma, 2019). Students must be trained to be able to think of solutions to problems through the process of analyzing, assessing and creating solutions. HOTS students will not develop if there are no learning activities that require students to think. Therefore, there is a need for learning that can activate students even though it is carried out online during the covid-19 pandemic. So a STEM-Based E-Student Worksheet to Enhance The HOTS of Elementary School Students was developed.

At the design stage, a worksheet framework is designed consisting of cover, preface, table of contents, About LKPD, STEM competency screening, identity, basic competencies, learning objectives, tools and materials and work steps. The design of this worksheet framework aims to make the developed student worksheets more focused, systematic and structured (Manalu et al., 2022; Rosidin et al., 2019). At this stage, the HOTS instrument is also designed which aims to measure. The purpose of this instrument is to determine the effectiveness of the developed student worksheets. The instruments are arranged according to the indicators (Onat et al., 2017; Van der Zanden et al., 2018).

In the next stage, the development of STEM-based worksheets is carried out. At this stage, validation and effectiveness tests are carried out.The study concludes that a valid and effective STEM-based E-Student Worksheet for elementary school students has been developed to enhance student HOTS in online learning during the covid-19 epidemic. This is because the development of the E-Student Worksheet was developed by taking into account the content and presentation aspects. In the aspect of content, attention is paid to the suitability of the material with the desired competence. This is in line with the opinion which states that the development of student worksheets must consider the suitability of the material with the competencies to be achieved (Muslim et al., 2020; Pratita et al., 2018). This E-Student Worksheet also considers the accuracy of the facts and theory of the material developed. This is so that the information obtained by students becomes new information. This is in accordance with the statement which states that the Student Worksheet must pay attention to the accuracy of the facts (Fajarianingtyas et al., 2019; Indrianingrum et al., 2018; Yulkifli et al., 2019). The E-Student Worksheet was also developed by considering the questions that lead to information discovery. This is so that students can find answers to problems from the questions presented. This is in line with the statement that the Student Worksheet must be developed by presenting problem questions that can lead students to find solutions to problems (Suryawati et al., 2020a; Yuenyong & Wongsila, 2019). In addition, the developed E-Student Worksheet also considers scientific novelty. This is in line with the opinion that the Student Worksheet must be developed by taking into account the novelty of the knowledge that will be presented (Desnita et al., 2021; Tsani et al., 2019).

This E-Student Worksheet also considers the presentation aspect so that students become more interested in using it. In the aspect of presentation, the developed E-Student Worksheet is arranged systematically. It aims to make it easier for students to find the menu on the E-Student Worksheet. This systematic presentation is in line with the opinion that Student Worksheets should be developed systematically to make it easier for students to understand information (Naezak et al., 2021; Yulkifli et al., 2019). The E-Student Worksheet was also developed by paying attention to illustrations and pictures that match the characteristics of students. It is intended that students are interested in learning through the E-Student Worksheet. This fact is in line with the opinion which states that the Student Worksheet must present illustrations and pictures that are in accordance with the characteristics of elementary school students (Hamdu et al., 2020; Hilmi & Sapri, 2022). This E-Student Worksheet is also presented with attention to writing. The writing chosen is the writing that is liked by the students, namely comic san. It is intended that students feel like reading a comic book which is their daily reading. This statement is in line with the opinion which states that Student Worksheets must be developed by paying attention to writing that is appropriate for elementary school students (Hamdu et al., 2020; Hilmi & Sapri, 2022).

Besides being declared valid, this E-Student Worksheet was declared effective in increasing the HOTS of elementary school students. This E-Student Worksheet was developed by taking into account the predetermined HOTS indicators, namely C4, C5 and C6. This is in line with the statement which states that to achieve HOTS, the learning process must be adjusted to the HOTS indicators (Ichsan et al., 2019; Vidergor, 2018). In addition, in this E-Student Worksheet, steps for activities that require analysis, assessment and creation are developed. So that indirectly students have been accustomed to higher order thinking. This is in line with the statement which states that to develop HOTS, students must be accustomed to higher-order thinking (Suratmi et al., 2020; Susilowati & Suyatno, 2021). In addition, in the process of developing the E-Student Worksheet, HOTS questions are also presented so that students are accustomed to thinking in HOTS ways. This is in line with the opinion which states that students must be accustomed to answering questions that require HOTS abilities in order to develop their higher order thinking skills (Rintayati et al., 2021; Susilowati & Suyatno, 2021). These factors make this e-student worksheet valid and effective for increasing student HOTS during the covid-19 pandemic. The results of this study provide benefits to the learning process. Especially in the learning process during the COVID-19 pandemic. The limitations of learning about COVID-19 have made it difficult for teachers to develop learning that can improve HOTS, especially for elementary school students. Therefore, teachers must try to find innovative solutions in order to increase the HOTS of elementary school students. So that with the development of this STEM-based e-worksheet, it can be used as an alternative solution for elementary school teachers in developing student HOTS during the COVID-19 learning period.

Student Worksheets play a critical role in the learning process in elementary schools (Lee et al., 2019; Sumarni et al., 2020). The learning process in elementary schools differs from the learning process at higher levels of education. In elementary schools, learning should be concrete and focused on students' real-life experiences (Asmawati & Bintang Kejora, 2020; Kenedi et al., 2019). As a result, elementary school teachers must be able to construct learning that is consistent with the characteristics of elementary school learning. The learning process utilizing the Student Worksheet is one of the learning methods that is in line with the characteristics of learning in elementary schools. Student Worksheets are a way for teachers to get pupils to think and find information on their own (Dobber et al., 2017; Septiana et al., 2019). This Student Worksheet can assist in finding learning information by guiding them through the analysis of actual or real things (Hidayah et al., 2021; Rahayu et al., 2017). Therefore, the Student Worksheet is one of the most appropriate teaching materials for elementary school students. However, the Student Worksheet, which was designed as an E-Student Worksheet, was the subject of this study. E-Student Worksheet is a type of student worksheet that is designed to be accessed online by students at any time and from any location. Audio and visual elements are also included in this E-Student Worksheet. During the COVID-19 epidemic, this E-Student Worksheet is appropriate for supporting the online learning process.

During the COVID-19 pandemic, the learning process is conducted entirely online, but the learning objectives must still be met (Sepulveda-Escobar & Morrison, 2020)(Tetep & Dahlena, 2021). Its goal is to raise the standard of education in elementary schools . The quality of HOTS is one of the learning goals that elementary school students must meet. HOTS is an integral part of the learning process in the twenty-first century (Ramadhan et al., 2019; Vidergor, 2018). HOTS refers to a student's problem-solving process that incorporates higher-order thinking skills such as critical thinking and creative thinking (Ishartono et al., 2021; Miri et al., 2017). HOTS is extremely beneficial to students now and in the future. As a result, HOTS must be developed in children as early as elementary school. HOTS achievement must be incorporated into the learning system. So, during the covid-19 pandemic, this study shows that the developed E-Student Worksheet can enhance the HOTS of elementary school students in online learning.

The STEM learning process is integrated with the developed E-Student Worksheet. STEM learning incorporates the concepts of science, technology, engineering, and mathematics into a single integrated approach

of learning. STEM is a type of learning that is appropriate for the twenty-first century and the Industrial Revolution 4.0 period. This is because technology components in the STEM process can teach 21st-century skills and are in line with the characteristics of the Industrial Revolution 4.0 era. Therefore, STEM is a nice choice for integrating into the development of E-Student Worksheets that can help elementary school students improve their HOTS abilities. This research contributes to the learning process in elementary schools because the use of STEM-based e-woorksheets is an innovation that can be implemented by elementary school teachers in developing student HOTS during the covid-19 pandemic. The results of this study can also add references for basic education practitioners in developing student HOTS during the covid-19 pandemic. The results of this study can be used as a reference for elementary school teachers in developing student HOTS during the covid-19 pandemic. The results of this study can also be used as a guide for basic education practitioners in developing HOTS for elementary school students. However, in this study, there are still limitations to activities, namely that there has not been a practical test of the use of STEM-based e-worksheets. So it is highly recommended in further research to carry out practicality tests.

4. CONCLUSION

The study concludes that a valid and effective STEM-based E-Student Worksheet for elementary school students has been developed to enhance student HOTS in online learning during the covid-19 epidemic. This study suggests that the STEM-based E-Student Worksheet can improve not just elementary school students' HOTS but also other learning variables, indicating that more research is needed.

5. ACKNOWLEDGE

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