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Learning Design Innovation Based on Tri N and STEAM in Developing 21st Century Skills for Elementary School Students

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ABSTRAK

Rendahnya keterampilan abad 21 yang dimiliki oleh siswa SD. Keterampilan abad 21 ini sangat perlu dimiliki sejak dini agar siswa mampu mandiri, bertahan hidup, dan menyesuaikan diri dengan perkembangan zaman. Penelitian ini bertujuan menginovasi desain pembelajaran berbasis Tri N dan STEAM untuk mengembangkan keterampilan abad 21 siswa SD. Metode penelitian ini adalah penelitian research and development yang dilakukan dengan tahapan: analysis, design, development, implementation, dan evaluation. Subjek penelitian ini terdiri dari guru dan siswa kelas enam SD. Teknik pengumpulan data menggunakan angket, lembar wawancara, lembar observasi dan dokumentasi. Teknik analisis data dilakukan melalui analisis deskriptif dan kuantitatif. Hasil penelitian ini menunjukkan bahwa perangkat pembelajaran berbasis Tri N dan STEAM yang dikembangkan memiliki karakteristik terintegrasi dengan langkah niteni, niroake, nambahake, serta didesain dengan mengintegrasikan aspek science, technologi, enginering, art and mathematic. Hasil validasi perangkat pembelajaran memperoleh rerata 3, 87 dengan kategori baik sekali. Hasil uji efektivitas menunjukkan perangkat yang dikembangkan efektif dalam mengembangkan keterampilan abad 21 siswa yang ditunjukkan terdapat peningkatan rerata awal 2,333 menjadi 3, 747 dengan kriteria sangat baik. Berdasarkan data di atas, maka disimpulkan bahwa inovasi desain pembelajaran berbasis Tri N dan STEAM dapat mengembangkan keterampilan abad 21 siswa Sekolah Dasar.

ABSTRACT

The low level of 21st-century skills possessed by elementary school students. These 21st-century skills need to be acquired early so that students can be independent, survive, and adapt to the times. This study aims to innovate learning designs based on *Tri N* and STEAM to develop 21st century skills of elementary school students. The tools developed include lesson plans, student worksheets, and 21st century skills assessment instruments. The learning tool development process consists of analysis, design, development, implementation, and evaluation stages. The research subjects were teachers and grade six students. Data collection techniques using questionnaires, interview sheets, observation sheets and documentation. Data analysis techniques were carried out through descriptive analysis and quantitative analysis. The results showed that *Tri N* and STEAM-based learning tools developed had integrated characteristics with *niteni, niroake*, *nambahake* steps, and activities designed to integrate aspects of science, technology, engineering, art and mathematics. The results of validation of learning tools obtained an average of 3,87 with a very good category. The results of the effectiveness of the developed tools show that the developed tools are effective in developing 21st century skills of students. In a limited trial, there was an increase in the initial average from 2,333 to 3,659 with very good criteria. In the wide trial, there was an increase from the initial average of 2,842 to 3,747 with very good criteria so it can be concluded that the *Tri N* and STEAM based learning device innovation is effective in developing 21st century skills of elementary school students. based on the data above, it is concluded that Tri N and STEAM-based learning design innovations can develop 21st century skills of elementary school students.

1. INTRODUCTION

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Education is all efforts made to achieve the perfection of the child's inner and outer life so that they are safe and happy physically and mentally, as a person and as a member of society (Darhim et al., 2020; Kintu et al., 2017; Nisa et al., 2020). One of the benchmarks for the achievement of education is the growth of an independent attitude in the child's soul. This independence must be instilled from childhood, including through the learning process. In addition to the attitude of independence, there are four skills needed by someone in the 21st century, including creative, critical thinking, communicative and collaborative or often referred to as (4C) (Arwanda et al., 2020; Makhrus et al., 2018; Sarwanto. et al., 2021). Based on the results of the needs analysis data, 27,9% of the learning process carried out by 61 teacher respondents has not integrated 21st century skills in the learning process. The learning carried out is still prioritizing the knowledge aspect or content oriented. 39% of respondents also said that the obstacles faced were that teachers did not have an understanding of how to integrate aspects of 21st century skills in their learning and 39,3% experienced difficulties in designing learning that integrates 21st century skills in the learning tools developed.

An alternative solution that can be applied to develop 21st century skills in the learning process is the development of learning designs that can provide guidance to teachers in teaching by integrating 21st century skills in the learning process with STEAM approach. This STEAM approach also facilitates students in facing the digital native era in the 21st century (Kartika et al., 2021; von der Heiden et al., 2011). STEAM with its characteristics that combines Science, Technology, Engineering, Art and Mathematics is one of the new frameworks used to educate across disciplines. It has evolved to support new educational theories. STEAM is based on STEM education, which grew out of the great need for more students to achieve success in understanding systems and relationships (Roebianto, 2020; Wahyuningsih et al., 2020; Yakman & Lee, 2012).

STEAM not only strengthens student learning in all disciplines, but through these disciplines students also get the opportunity to explore and make connections between art, music, science, and others. In addition, with STEAM students feel more motivated and more effective in learning (Henriksen, 2014; Nurhasanah & Zelela, 2021). The application of STEAM learning is centered on hands-on activities, group discussions, and reality-based, where STEAM learning has been designed with a framework that can be adapted for all levels, types and teaching styles (Wahyuningsih et al., 2020; Yakman & Lee, 2012). This framework consists of three main components, namely present a situation (allowing students to recognize problems as something connected with their lives and related to the real world), creative design (encouraging students to act creatively in product design), and emotional touch (helping students to develop a perspective in responding to something, expressing expressions, and sympathy).

In elementary school learning that is based on a Theme, the Theme is taught in subjects that are all based on STEAM. Mathematics, Science, Social, Indonesian, and other subjects support STEAM-based learning. In implementing STEAM-based learning, it is inseparable from observing, imitating and modifying a product. This activity is related to the teachings of Ki Hajar Dewantara, especially the teachings of Tri N namely *Niteni, Niroake* and *Nambahake*. Tri N is a student-oriented teaching to foster creativity in order to create new things in the scientific world from an early age. This needs to be developed as a way of taking knowledge, so that it is not just imitating, in the sense of "plagiarizing" or copying, but having to cook it (process) in all ingredients from a foreign world to make "new dishes" that are delicious and healthy for themselves (Dewantara, 2013; Nisa et al., 2020).

The teachings of Tri N itself consist of three phases, namely *Niteni, Niroake* and *Nambahake*. *Niteni* is a cognitive process or human mind, which refers to the ability to carefully recognize, and capture the meaning (nature, characteristics, procedures, truths) of an object being observed, by paying attention, comparing, observing carefully, observantly and deeply and involving all senses. In the process of working, the first activity carried out is observing, by studying and examining problems. Observing is not just reading, seeing, but digesting, and realizing it well (Nisa, et al., 2019; Yunawan, 2014).

Niroake is an activity to imitate what is understood, seen, heard, felt in the form of a good example. This imitating is a not wrong behavior, imitating is defined as duplicating oneself on an existing work, which is to be "exemplified" by its method, enthusiasm, how to process problems into good works, which are easy to digest and easy to understand according to their functions. However, it is not just an omission in the practice of plagiarism, it is a learning process. The observing stage is the initial stage in the inspired process called the introduction stage in the *niroake* step (Nisa, et al., 2019; Yunawan, 2014).

Nambahake or add/develop is an advanced process of *niroake*. In this process, there is a creative and innovative process to give a new color to the imitated model. This adding process is expected to occur in students. In this case, Ki Hadjar Dewantara stated that we do not merely imitate, but cultivate. *Nambahake* is an end point, not just an imitation activity but there is already an element of adding or modifying, an activity of complementing, perfecting according to individual desires through processing, changing,

innovating, improving, adding, subtracting, and creative thinking processes in order to bring out the elements (Nisa, et al., 2019; Yunawan, 2014).

Tri N and STEAM-based learning is expected to be the perfect combination to develop 21st century skills of students in preparing human resources in the era of industrial revolution 4.0. For this reason, researchers developed learning tools based on Tri N and STEAM to develop 21st century skills of students, especially elementary school students (Mariano & Chiappe, 2021; Perignat & Katz-Buonincontro, 2019; Rahardjo, 2019; Sibaweihi et al., 2021). Based on the explanation above, it is necessary to innovate learning design that can develop 21st century skills for elementary school students. This study aims to innovate Tri N based learning design integrated with STEAM to develop 21st century skills of elementary school students.

2. METHOD

This type of research is Research and Development. Research and Development is a research method used to produce certain products and test the effectiveness of the product (Fitria Hidayat & Nizar, 2021; Sugiyono, 2016). The model used in this research is ADDIE. The ADDIE model serves as a guide in building and infrastructure training programs that are effective, dynamic and support the performance of the training itself. This model has 5 stages of development, which include: analysis, design, development, implementation, and evaluation (Hidayat & Nizar, 2021; Rustandi & Rismayanti., 2021). The learning tools that have been compiled are then validated by validator through focus group discussions. Data collection techniques using questionnaires, interview sheets, observation sheets and documentation. Data collection instrument using a questionnaire sheet. The tools that have been validated and revised are then tested on a limited and extensive basis. Data analysis techniques using qualitative and quantitative descriptive analysis. A grid of validation sheets for implementing lesson plans that are integrated with Tri N and STEAM showed in Table 1. Furthermore, to measure aspects of the 21st century skills of students, teachers and observers using observation sheets with indicators presented in Table 2. The results of the validation and testing are then analyzed and then converted to the following conversion criteria showed in Table 3.

Table 1. Grid of lesson plan validation sheet

No	Lesson Plan (RPP) Components	Item Number
1	Lesson Plan (RPP) Identity	1
2	Basic Competencies and Indicators	2,3,4,5,6,7,8
3	Learning Objectives	9,10
4	Learning Materials	11,12,13
5	Selected learning method	14
6	Learning Media used	23
7	Use of relevant learning resources	24,25
8	Learning Activities show the steps of Tri N and STEAM	15,16 a, b, a), b), c, 17,18,19
9	Assessment of learning outcomes	20,21,22

Table 2. 4C skill indicators

No	Aspect	Indicators
1	Critical thinking	Information and Discovery; Interpretation and analysis; Building Arguments
2	Creative	Design and improvement ideas; Creative production; Openness and Courage to explore
3	Communication	Engage in conversations and discussions; Communicating in Diverse Environments; Delivering an oral presentation
4	Collaboration	Cooperation; Responsibility; Responsive

Table 3. Assessment Clasification

Average Data	Classification
3.50-4.00	Very good
3.00 -3.49	Good
2.50-2.99	Fair
2.00-2.49	Poor
≤ 2.00	Very poor

3. RESULT AND DISCUSSION

Result

This research resulted in learning design innovations consisting of lesson plans, student worksheets and assessment sheets integrated with Tri N and STEAM. This development is carried out on the basis of a needs analysis which shows that 39,3% percent of the learning process carried out has not integrated 21st century skills in the learning process. The results of the needs analysis also show that this occurr due to 23% of teachers have not mastered on how to integrate 21st century skills in the learning process. The results of the needs analysis also show that teachers have not developed learning tools that can optimize 21st century skills of students and 100% of these teachers need learning tools that can develop 21st century skills of students to the fullest. Based on the needs analysis above, a learning design that can develop 21st century skills is a learning design integrated with Tri N and STEAM.

Researchers determine learning materials, core competencies, and basic competencies based on 2013 curriculum syllabus, and formulate indicators of achievement of appropriate competencies. This analysis aims to identify and systematically compile relevant material content to be used as learning materials. At this stage, the researcher analyzed the thematic book material for the sixth grade of elementary school in the first semester, especially on Theme 4 on Globalization, Sub-theme 2 of learning 3 contains Electrical material.

In designing learning tools, researchers designed learning tools based on TRI N and STEAM in which the learning steps in lesson plan were designed based on the syntax of STEAM and TRI N approaches, while the student worksheets were based on learning objectives and adapted to the syntax of Tri N and STEAM. The assessment instrument is designed as an observation sheet that is used to assess 21st century skills.

Development of lesson plan is carried out referring to the principles and components of lesson plan contained in the Regulation of the Minister of National Education Number 22 of 2016. The structure of lesson plan writing consists of subject identity, competency standards, basic competencies, competency achievement indicators, learning objectives, learning materials, learning methods, activities learning which consists of opening, main activity, and closing, and learning assessment techniques. The steps and learning activities carried out are adjusted to learning steps based on TRI N and STEAM. Student worksheet was developed by taking into account the student worksheet components which include Identity, format, content, and language, taking into account their compatibility with TRI N and STEAM-based components for *Niteni, Niroake* and *Nambah*ake activities for TRI N, Science, Technology, engineering, art and mathematics for STEAM. STEAM approach and TRI N method can be seen in the problems presented and the activities carried out in student worksheets. The development of an assessment instrument in the form of an observation sheet composed of a user guide sheet, an assessment sheet and a rubric.

After the learning tools have been developed, expert lecturers validate them through focus group discussions (FGD). This FGD was attended by three expert lecturers as validator, researcher and supervisor. After the learning tools were validated and revised based on suggestions from the validator, the learning tools were tested. The FGD resulted in the validation of learning tools showed in Table 4.

Table 4. Recapitulation of learning tools validation by validator

No	Developed Learning Tools	Validator Assesment	Predicat
1	Lesson Plan (RPP)	3,70	Highly Valid
2	Student Worksheet (LKS)	3,92	Highly Valid
3	Assessment	4,00	Highly Valid
Average		**3,87**	

From the table above, it can be seen that the validation value of each validator shows a very good validity value. Thus, the learning tool is valid and feasible to use with some revision notes from the validator. At the implementation stage, a trial of learning tools was carried out both on a limited basis and in a broad trial. The validated learning tools were tested on a limited basis to the sixth-grade students with a total of 12 students. The researcher asked for the help of colleagues to observe the ongoing learning activities and take notes on certain activities/events that are considered important and are used as suggestions for improving the developed Lesson Plan, Student Worksheet and Assessment Instruments. From the observations of the observer teacher, it was found that there was the development of 21st century skills in students showed in Figure 1.

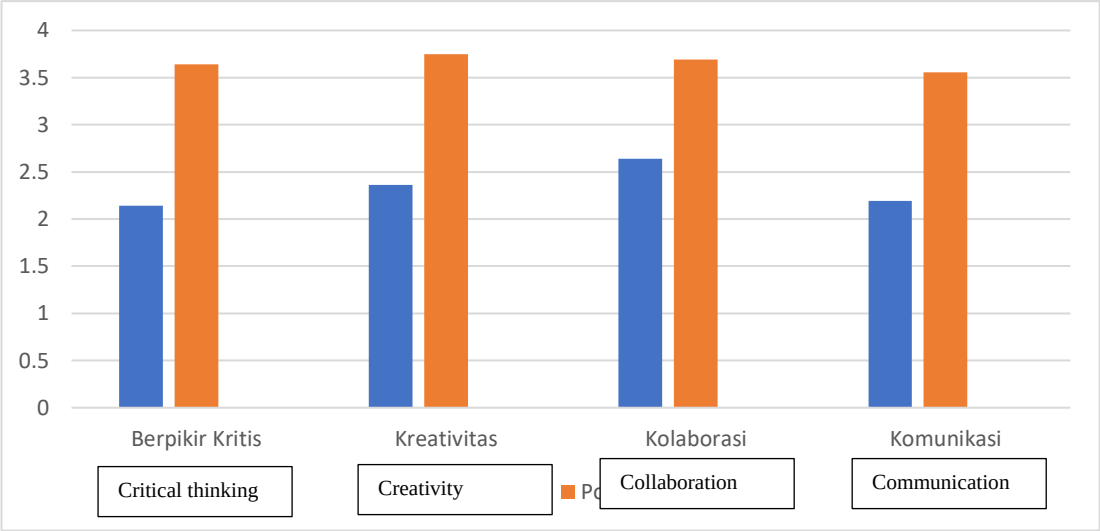

Figure 1. Average Observation Results on 21st Century Skills in Limited Trials

There is a development/an improvement of 21st century skills in students of SDN Nitikan, which is indicated by an increase in the average score for each type of skill, showed in Table 5.

Table 5. Average of 21st Century Skill Improvement in Limited Trials

No	Aspect	Average Before	Average After
1	Critical thinking	2,139	3, 639
2	Creative	2,361	3,75
3	Collaborative	2,639	3,694
4	Communicative	2,194	3,556
Average		**2, 333**	**3,659**

Based on the diagram above, it can be concluded that there is a development/an improvement of 21st century skills in students of MA Elementary School which is indicated by an increase in the average score for each type of skill showed in Table 6.

Table 6. Average od 21st Century Skill Improvement in Extensive Trial

No	Aspect	Average before	Average after
1	Critical thinking	2, 738	3, 845
2	Creative	2,917	3,952
3	Collaborative	2,869	3,393
4	Communicative	2,845	3,798
Average		**2,842**	**3,747**

Discussion

21st century skills need to be developed from an early age, including in the learning process. These four 21st century skills are indispensable in the development of this era. Based on the results of the research above, it can be concluded that the development of learning tools based on Tri N and STEAM can develop students' 21st century skills. STEAM also can develop 21st century skills and be used as an innovation in the learning process (Peters-burton & Stehle, 2019; Sigit et al., 2022). The first skill is critical thinking, this skill is developed through thinking, analyzing, finding information and building arguments. Students strive to provide critical thinking in understanding and making complex choices, understanding the interconnections between systems (Aguilera & Ortiz-Revilla, 2021; Degeng et al., 2021). Students also use their abilities to try to solve the problems they face independently, students also have the ability to compile and express, analyze, and solve problems (Pasani & Amelia, 2021; Sibaweihi et al., 2021). Activities used to ignite critical thinking skills begin with *niteni*. In critical thinking skills, learning begins with students observing pictures, comparing and analyzing the impact that will be caused, then students are required to find solutions to problems found by providing alternative problem solving, and this will be very useful in

their daily life and become an important element in the modern education model (Karakoç, 2016; Lucia et al., 2017).

The second skill is creativity, this skill is carried out through delivering problems to students. Students are led to create new ideas that are different from those that already exist, either in the form of new works or in combinations of existing works (Aguilera & Ortiz-Revilla, 2021; Sibaweihi et al., 2021). In this study, high creativity is needed when students determine the design of an energy-efficient house according to the concept they choose. Teachers need to open space for students to develop their creativity and appreciate the slightest role or student achievement. *Niroake* and *Nambahake* activities are activities that strongly support the creative skills. This activity raises creativity and also form liberating children in learning activities and these skills are very important in children's lives (Forster, 2015; Supriyoko et al., 2022).

The third skill is Cooperative, this skill is developed through group activities designed in learning, so that it grows if we respect each other and work together in the learning process (Perignat & Katz-Buonincontro, 2019; Sartono et al., 2020). In learning activities, collaborative skills are developed with discussion activities and projects to make *'Rumah Hemat energi'*. This activity requires solid cooperation, responsibility and responsiveness to group members. In *niroake* and *nambahake* activities, students are required to cooperate between group members, so that the resulting product is maximal. This collaboration skill is also conveyed as the core of inter-organizational activities (Castaner & Oliveira, 2020; Priyono et al., 2018). The fourth skill is communicative, this skill is developed when students conduct group discussions. In these activities, students develop communication skills both in one group and in one class through presentation activities. Effective communication is also very important for a person's success in social relationships, in the world of work or in organizations (Ekeowa Kelvin-Iloafu, 2016).

Based on the results of the research that has been done, it can be concluded that the implementation of *tri n* and STEAM-based learning tools is proven to be able to develop 21st century skills of elementary school students. Other research explained that the STEAM approach is suitable for use in the learning process to develop students' 21st century skills especially in elementary school (Mariano & Chiappe, 2021). Another study which states that STEAM which is integrated with project based learning can improve students' 21st century skills and at the same time make a good learning experience for students (Zayyinah. et al., 2022). This research contributes to providing quality learning alternatives through learning innovations, especially in developing 21st century skills. Dalam implementasinya, pendekatan STEAM ini juga dapat memfasilitasi pembelajaran yang berdiferensiasi, yaitu pembelajaran yang mampu memfasilitasi keberagaman peserta didik (Fajari, Sarwanto, 2020)..

4. CONCLUSION

Design innovations of learning tools were developed on the basis of a needs analysis which shows that there are still many learning processes that have not integrated 21st century skills into the learning process due to there are still teachers who do not have knowledge in developing learning tools. Alternative solutions that can be done in developing 21st century skills in the learning process are through the development of learning tools based on TRI N and STEAM. The results of the limited trial and the extensive trial show an increase in the average 21st century skills after teachers use learning tools that are integrated with Tri N and STEAM. So that it can be concluded that Tri N and STEAM-based learning design innovations are effective for developing 21st century skills of elementary school students.

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