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THE NEEDS ANALYSIS FOR DEVELOPING DIFFERENTIATED STEAMS LEARNING DESIGN BASED ON DESIGN THINKING TO INCREASE CREATIVITY IN PRIMARY SCHOOL

Nur Aini Ochtafiya[1*], Nadi Suprapto[2], Ganes Gunansyah[3], Hendratno[4], Nurul Istiq'faroh[5]
[1,2,3,4,5]Universitas Negeri Surabaya
[1]24010855077@mhs.unesa.ac.id

Abstract
STEAMS is 21st century learning approach that aims to teach children the new ways of thinking. The development of differentiated STEAMS learning design based on design thinking by integrating Science, Technology, Engineering, Mathematics, Art and Social can improve students' creativity. This research aims to analyze the needs for the development of differentiated STEAMS learning design. This is based on the priority recommendations of the Education Report and Data-Based Planning (PBD) of the Ministry of Education and Research for SD Muhammadiyah Manyar leading to indicators of improving the quality of learning and creative character of students. The research was conducted with a quantitative descriptive analysis method to obtain the initial needs through data analysis. Data were collected through questionnaires, interviews, and tests. The results showed that needs analysis can be used as a reference in developing differentiated STEAMS learning design based on design thinking. The conclusion of this study obtained three findings related with the differentiated STEAMS learning design development. The first finding is the differentiated STEAMS learning design can fulfil student learning needs. Second, STEAMS can be integrated with differentiated learning. Third, students' creative thinking skills can be improved through integrated Science, Technology, Engineering, Mathematics, Art and Social.
Keywords: *Design Thinking; Differentiation Learning; Primary School; STEAMS*

Abstrak
STEAMS merupakan pendekatan pembelajaran abad ke-21 yang bertujuan untuk mengajarkan cara berpikir baru kepada anak-anak. Pengembangan desain pembelajaran STEAMS berdiferensiasi berbasis *design thinking* dengan mengintegrasikan *Science, Technology, Engineering, Mathematics, Art and Social* dapat meningkatkan kreativitas siswa. Penelitian ini bertujuan untuk menganalisis kebutuhan pengembangan desain pembelajaran STEAMS berdiferensiasi. Hal ini berdasarkan rekomendasi prioritas Laporan Pendidikan dan Perencanaan Berbasis Data (PBD) Menteri Pendidikan, Kebudayaan, Riset, dan Teknologi (Mendikbudristek), SD Muhammadiyah Manyar mengarah pada indikator peningkatan mutu pembelajaran dan karakter kreatif siswa. Penelitian dilakukan dengan metode analisis deskriptif kuantitatif untuk memperoleh gambaran kebutuhan awal. Data dikumpulkan melalui angket, wawancara, dan tes. Hasil penelitian menunjukkan bahwa analisis kebutuhan dapat dijadikan acuan dalam mengembangkan desain pembelajaran STEAMS berdiferensiasi berbasis *design thinking*. Kesimpulan penelitian ini diperoleh tiga temuan terkait pengembangan desain pembelajaran STEAMS beridferensiasi. Temuan pertama adalah desain pembelajaran STEAMS yang terdiferensiasi dapat memenuhi kebutuhan belajar siswa. Kedua, STEAMS dapat diintegrasikan dengan pembelajaran yang berbeda. Ketiga, kemampuan berpikir kreatif siswa dapat ditingkatkan melalui integrasi *Science, Technology, Engineering, Mathematics, Art and Social*
Kata Kunci: *Design Thinking;* Pembelajaran Berdiferensiasi; Sekolah Dasar; STEAMS

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Introduction

PISA (Program for International Students Assessment) as an international study measures essential learning outcomes in the 21st century (Sarwi et al., 2023). PISA measures reading literacy, mathematics and science which is organized every 3 years by the OECD (Stacey, 2021). The results of PISA 2022 The State of Learning and Equity in Education Volume I showed a decline in learning outcomes internationally (*PISA 2022 Results (Volume I),* 2023). However, Indonesia increases in several aspects. In this case, researchers focused on the results of math and science literacy. Indonesia's math literacy score fell 13 points. Science literacy increase 6 positions. Indonesia's score on science literacy dropped 13 points. If measured as a whole, Indonesia's ranking is 66 out of 81 countries. With the following details: Indonesia's ranking in PISA 2022 has increased by 5-6 positions compared to 2018 (Ismawati et al., 2023). However, the average score of Indonesian students decreased from 2018. This shows that mathematics and science literacy in Indonesia still needs to be improved.

In addition, the Global Innovation Index (GII) 2023 also recorded Indonesia in rank 61 out of 132 (Organization et al., 2023). The GII provides an annual ranking of the world's economies based on their innovation capacity and success. The GII is published by the World Intellectual Property Organization (WIPO) (Moreira & Jayantilal, 2023). The Innovation strengths and weaknesses in Indonesia GII 2023 table shows that Indonesia's Pisa scale in reading, math and science is still part of the weaknesses at rank 72 (Ika Sari et al., 2024). So, the level of innovation in Indonesia still needs to be improved. Innovation starts from how students can think creatively from every problem they face. By increasing students' creative thinking skill, it is expected to increase Indonesia's innovation ranking.

The priority recommendations of the Education Report and Data-Based Planning (PBD) of the Ministry of Education, Culture and Research for Muhammadiyah Manyar Elementary School lead to indicators of improving the quality of learning and student character (*RAPOR-PBD-SD-MUHAMMADIYAH-MANYAR-20501150-2024 (1),* n.d.). The learning quality achievement score on the problem of learning methods is 65.77. The character achievement value in the creativity aspect is 60.8. This shows that the quality of learning needs to be improved by presenting interactive learning methods to improve the learning process. In addition, increasing competence and policies that support the implementation of learning that can increase student creativity are also needed.

A questionnaire survey was conducted with 49 class teachers, class assistants and subject teachers at Muhammadiyah Manyar primary school to get an overview of learning that can be used to improve these conditions. The questionnaire results show that *kurikulum merdeka* has been used at SDMM since the last 3 years. 95.9% of teachers have conducted non-cognitive diagnostic assessments to know their students' learning needs. The most dominating learning styles are kinesthetic and visual at 83.7% and 85.7%. Students show interest in learning in the fields of Science, Mathematics, ICT and Robotics, Arts and Sports with a percentage above 69.4%. STEAMS has not been widely applied at SD Muhammadiyah Manyar; this can be seen from 32 teachers answering that they have not implemented this learning in the classroom. This happens because many teachers do not know the stages of design thinking in STEAMS learning (69.4%). The questionnaire results show 89.8% of teachers stated that STEAMS can be integrated with differentiated learning in *kurikulum merdeka*.

Tests were conducted to measure the level of student creativity with indicators of fluency, flexibility, originality and elaboration. The results of the test conducted to measure students' creative thinking showed 14.29% of students were classified as very creative, 32.14%

of students were creative, 35.72% of students were moderately creative and 17.85% of students were less creative. By looking at the test results, efforts are needed to improve student creativity.

The study shows that STEAMS (Science, Technology, Engineering, Arts, Mathematics dan Social) can be used to improve the gap of the problem (Belbase et al., 2022). STEM at the beginning stand from science, technology, engineering dan mathematics. The National Science Foundation in United State of America around 1990 introduce STEAM (Shernoff, 2024). STEM born as a respond of needs to increase the competence in science, technology and problem solving. This concept pushed education to integrated and fit with the relevance of industrial competence. At 2000, the educators, artist and policy maker felt important to add arts in STEM (Hughes et al., 2022). The creativity, innovation and imagination were the important element to produce an innovative and aesthetic product (Bertacchini et al., 2024). Rhode Island School of Design (RISD) in America being one of the first institution to promote the changing of STEM became STEAM (Yoh et al., 2021). At around 2010, social studies became parts of interdisciplinary approach (Perales & Aróstegui, 2024). Social studies helped students to know the impact of technology and innovation for the society. Social study encourages a solution-based society for global problem like climate exchange, social unbalancing and sustainable development (Visconti, 2023). It also focusing on 21 century competence development like collaboration, communication, creativity, critical thinking, citizenship and character (Celume & Maoulida, 2022). That's why STEAMS nowadays is used in some schools. STEAMS encourage the relevancy of education and the real life, including the development of project-based community with the integration of some aspects.

STEAM (Science, Technology, Engineering, Arts, Mathematics) learning is very urgent to be apply in elementary schools (Hughes et al., 2022). The development of differentiated STEAM learning design based on design thinking is relevant with student's needs (Hawari & Noor, 2020). By integrating Science, Technology, Engineering, Mathematics, Art and Social, students can apply multidisciplinary learning as a mini laboratory of life (Rafiuddin et al., 2024). This is also a solution to increase student creativity. With increased innovation and multidisciplinary understanding, STEAMS will contribute to the increase of PISA and GII index in the coming year.

STEAMS and Kurikulum Merdeka in Indonesia has strong relationship. Both of STEAMS and Kurikulum Merdeka curriculum are contextual learning, interdisciplinary approach and student-centered learning (Ismiati, 2024). STEAMS emphasizes the application of knowledge in real life. This aligns with the Merdeka Curriculum's approach, which encourages project-based learning (PjBL) to develop 21st-century skills such as creativity, collaboration, communication, and problem-solving. The STEAMS learning model integrates various disciplines into a single learning framework (MF & Palennari, 2024). This supports the Merdeka Curriculum's principle of breaking down barriers between subjects, it gives a chance for teachers to design thematic and cross-disciplinary learning relevant to the needs of students and society. STEAMS prioritizes exploration, creativity, and innovation by students in learning (Perignat & Katz-Buonincontro, 2019). This aligns with the philosophy of the Merdeka Curriculum, which gives students the freedom to determine their learning paths based on their interests, talents, and needs (Yaqin et al., 2024). STEAMS involves activities that foster critical thinking, creativity, collaboration, and digital literacy, which are key focuses of the Merdeka Curriculum (Utami et al., 2024). This helps students prepare for future challenges. The Merdeka Curriculum allows teachers to adapt learning based on the characteristics of students

(Fauzan et al., 2023). STEAMS-based learning, especially differentiated approaches support the flexibility by providing various learning pathways based on students' needs. The social component in STEAMS supports the strengthening of Pancasila Student Profile dimensions, such as mutual cooperation, critical thinking, and global diversity (Sari et al., 2024). This aligns with the Merdeka Curriculum's goal of producing students with strong character and global competencies. By integrating STEAMS, Indonesia's curriculum not only enhances students' academic competencies but also sharps the practical skills and character that relevant to the modern era.

STEAMS is a learning approach in 21st century and society 5.0 that aims to teach children about new ways of thinking (Rafiuddin et al., 2024). This is a revolutionary development of thinking in finding the source of problems, solving problems, creativity, and encouraging innovation (Colucci-Gray et al., 2019). Students are expected to be able to see problems and utilize them as a source of creative ideas. *Kurikulum merdeka* with differentiated learning integrated with STEAMS encourages students to become the young inventors in their fields of interest. So that this design thinking-based differentiated STEAMS learning innovation is very relevant to be implemented (Elbashir et al., 2024).

The urgency of STEAM learning related to 21st century skills in the era of society 5.0 is to make students more literate by integrating cultural and civic literacy, digital literacy, science literacy, numeracy literacy and literacy (Alman et al., 2024). As well as developing 6C skills in students, namely problem solving, creativity, critical thinking, collaboration, communication and citizenship (Zainil et al., 2024). STEAMS learning is an interactive and effective learning method that combines independent learning and collaboration based on complex thinking and empathy (Belbase et al., 2022). Students can find the source of the problem and try to solve it independently in a creative innovation project.

The students need related to STEAMS learning are academic needs, creativity and innovation needs, psychological and social needs, pratical needs and characher development needs (Shatunova et al., 2019). Students needs to understanding the basic competence of science technology, engineering, arts, mathematics and social that integrated into STEAMS design activity. The critical thinking skill to analyze, evaluate and solve problem is essential. Students to improve their creativity and innovation through idea exploration (Lakkala et al., 2021). Students require space and opportunities to develop creative idea without fear or failure. A supportive environment is needed to encourage teamwork in generating innovative solution. Psychological and social needs also required for students (Zainuri & Huda, 2023). To buil up students instrictic motivation teacher to provide strategies to fostering the curiosity and interest in interdisciplinary learning. STEAMS design can buil up students' self-confidence. Students need encouragement to feel capable of overcoming challenge involving STEAMS aspects (Conradty & Bogner, 2020). Students need to learn and practice in learning. Supporting device such as e-modul and students activity sheets, teaching aids and technology are necessary to gain students comprehension. Students need direct experience such as experiments, projects or prototype creation to make learning more contextual. Character development like collaboration skill, resilience and adabtability can be sharping with STEAMS learning. Students need to learn how to work in teams to solve project-based challenges (Hussein, 2021). The ability to face new challenges and learn from failure is essential. STEAMS is the great design to enhance students needed.

A previous study conducted by Firdausi Nuzula, titled *"Demonstration of Online STEAM Learning through Arduino Uno-Based Automatic Trash with Ultrasonic Sensor"* using the research and development method, showed that an automatic trash bin integrated with the STEAM

approach can serve as a learning option to enhance students' critical, creative, and logical thinking skills, as well as their scientific work (Nuzula et al., 2024). STEAM learning fosters students' enthusiasm to continuously create solutions for problems in their surrounding environment. This automatic trash bin is also expected to inspire and educate people to dispose of waste properly.

In addition, research conducted by Arsy & Syamsulrizal, 2021 on the Effect of STEAM Learning (Science, Technology, Engineering, Arts, and Mathematics) on Student Creativity shows that STEAM learning is very important. It not only improves cognitive abilities, but it also develops students' creativity to face future challenges (Arsy & Syamsulrizal, 2021). With STEAM, students learn from various disciplines at once, practicing problem solving with various points of view (Perignat & Katz-Buonincontro, 2019). This approach prepares students to be ready to face the challenges of a complex world. The STEAM method has a positive influence on student creativity (Rizki & Suprapto, 2024)

Form the preliminary study, the researcher found that STEAMS is the suitable approach to solve the problem of lack method and to increase students' creativity (Prahani et al., 2024). The different between the researcher and the previous study are at the first study use STEM to prove the effectiveness of improving student collaboration skills. The second study prove the effect of STEAM Learning (Science, Technology, Engineering, Arts, and Mathematics) on Student Creativity. In this study researcher try to add social study in STEAMS and collaborate it with differentiation learning to improve students' creativity.

Based on the results of previous study, observations and problems faced, the researcher concludes that a needs analysis for the development of differentiated STEAMS learning design based on design thinking to increase the creativity of elementary school students is needed. The aim of the research is to determine the initial needs in developing a differentiated STEAMS learning design based on design thinking. The results of the needs analysis will be used as the basis for preparing a differentiated STEAMS learning design based on design thinking.

Research Methods

The research method is descriptive quantitative. The quantitative descriptive analysis method is used to obtain an overview of initial needs, describe and analyze the results (Taherdoost, 2022). This method is expected to capture the initial needs in designing differentiated STEAMS learning to increase student creativity. The purpose of descriptive research is to solve the problem and collect the data, described and analyses (Siedlecki, 2020).

The data used in the study are questionnaires, teacher interview results and test results of 28 third grade students. Questionnaires were distributed to 49 teachers at SD Muhammadiyah Manyar to see teachers' perspectives on *kurikulum merdeka*, non-cognitive diagnostic analysis, differentiated learning and STEAMS learning based on design thinking. Interviews were conducted with teacher from 6th grade SDMM, who also as curriculum coordinators and PPG *prajabatan* teachers. Interviews were conducted to measure the learning needs of students and learning methods that apply. Test was conducted to measure students' creativity before STEAMS learning design was developed.

Qualitative research consists of three stages: preparation stage, research stage, and data analysis stage (Lim, 2024). In the preparation stage, researcher prepared questionnaire and interview questions for teachers. In addition, researchers also prepared student creativity test instruments. At implementation stage, researchers collected data from the results of

questionnaires, interviews and student tests. Questionnaires are used to determine student learning needs including learning styles, learning readiness, and interest of students. In addition, the questionnaire is also used to find out the teacher's perception related to STEAMS learning with differentiated learning and 21st century skills that need to be mastered by students. Interviews used to find the learning designs needed to be developed and implemented and how to implement them. Test is used to determine the level of students' creative thinking.

This research uses data analysis with the stages of data collection, data reduction, data presentation (data display) and conclusion drawing (Mezmir, 2020). Data were collected using questionnaires, interviews and tests. Data reduction is done by selecting data and focusing the data to get meaningful results (Ayesha et al., 2020). Displaying data by using tables, diagrams of questionnaire and test results and their analysis (Kent, 2020). Then draw conclusions.

Result and Discussion

Student Learning Needs

Student learning needs can be analysed from the results of questionnaire. Researcher distributed questionnaires to 49 teachers at SD Muhammadiyah Manyar. The 49 teachers consist of 17 classroom teachers, 16 classroom assistant teachers and 16 subject teachers from grades 1 to 6 who teach various subjects. There are 18 questions in the questionnaire with multiple choice questions, more than one answers and open-ended questions.

The questionnaire results are presented in the form of bar charts. The first bar chart illustrates the non-cognitive diagnostic assessment to determine students' learning needs.

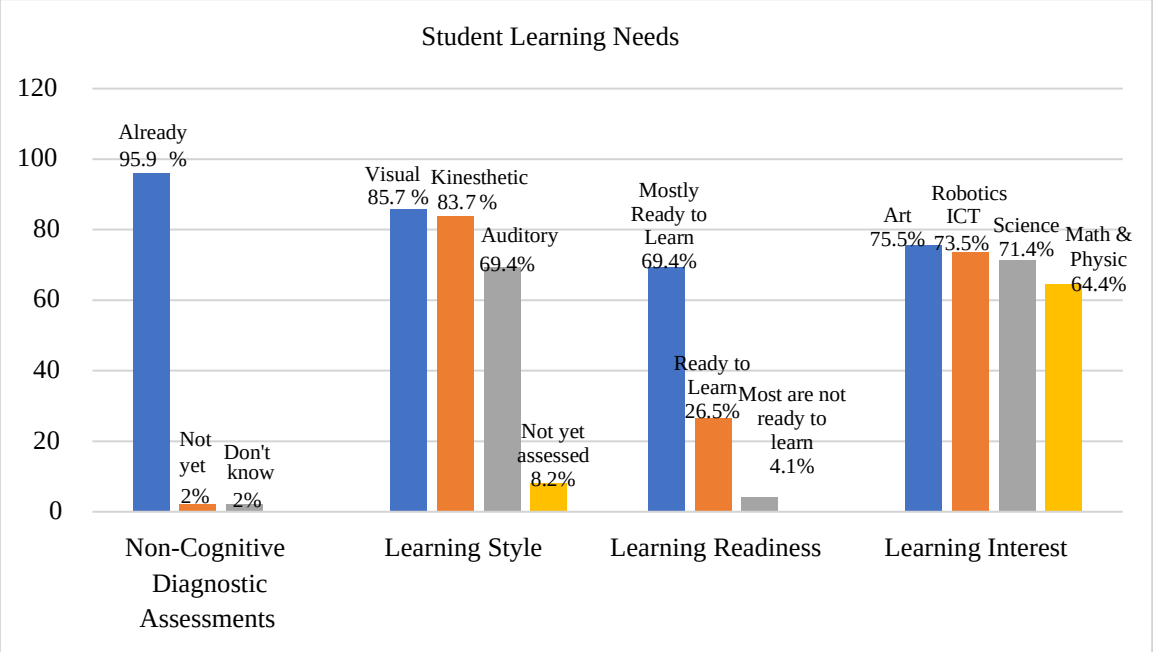

Figure 1. Diagram Student Learning Needs

The findings from the diagram reveal significant insights into the implementation of diagnostic assessments and the categorization of student learning needs at SD Muhammadiyah Manyar, which align with the principles of differentiated learning as emphasized in the *Kurikulum Merdeka*. A substantial 95.9% of teachers have conducted non-

cognitive diagnostic assessments to identify student learning needs. This practice aligns with the theory of differentiated learning, which emphasizes tailoring education to meet the unique needs of students. From the results of the diagnostic assessment that has been carried out, there are three aspects of student learning needs that need to be considered, namely learning styles, learning readiness and student learning interests. Tomlinson in his book entitled How to Differentiate Instruction in Mixed Ability Classroom said that we can categorize student learning needs, at least based on 3 aspects, namely learning readiness, interest and student learning profile (Tomlinson & Jarvis, 2023). The learning profile of students at SD Muhammadiyah Manyar is dominated by visual learning with 85.7% and kinesthetics learning profile with 83.7%. Students with auditor learning profile are 69.4%. Student learning readiness is divided into 3, namely most students are ready to learn 69.4%, students are ready to learn 26.5% and most students are not ready to learn 4.1%. Students also show their interest in learning in certain fields. Students' learning interests are dominated in the fields of art 75.5%, ICT and robotics 73.5%, Science 71.4%, Mathematics and Sports 64.4%.

These findings provide a comprehensive overview of the student learning needs and profiles at SD Muhammadiyah Manyar. They underscore the importance of differentiated instruction, where teaching strategies are adapted to accommodate diverse learning profiles, readiness levels, and interests. This ensures that students are engaged and able to optimize their potential in a supportive and responsive learning environment. Students with different learning styles, learning interests and learning readiness become an opportunity in organizing differentiated learning according to student interests. Students show interest in several fields such as art, ICT and robotics, science, math and sports. These student learning interests can be integrated in STEAMS learning.

Perceptions of STEAMS and Differentiated Learning

Further findings from the questionnaires and interviews show how teachers' perception about STEAMS learning and the learning method that has been done in the classroom. This second bar diagram illustrates the perception of the relationship between STEAMS learning and differentiated learning.

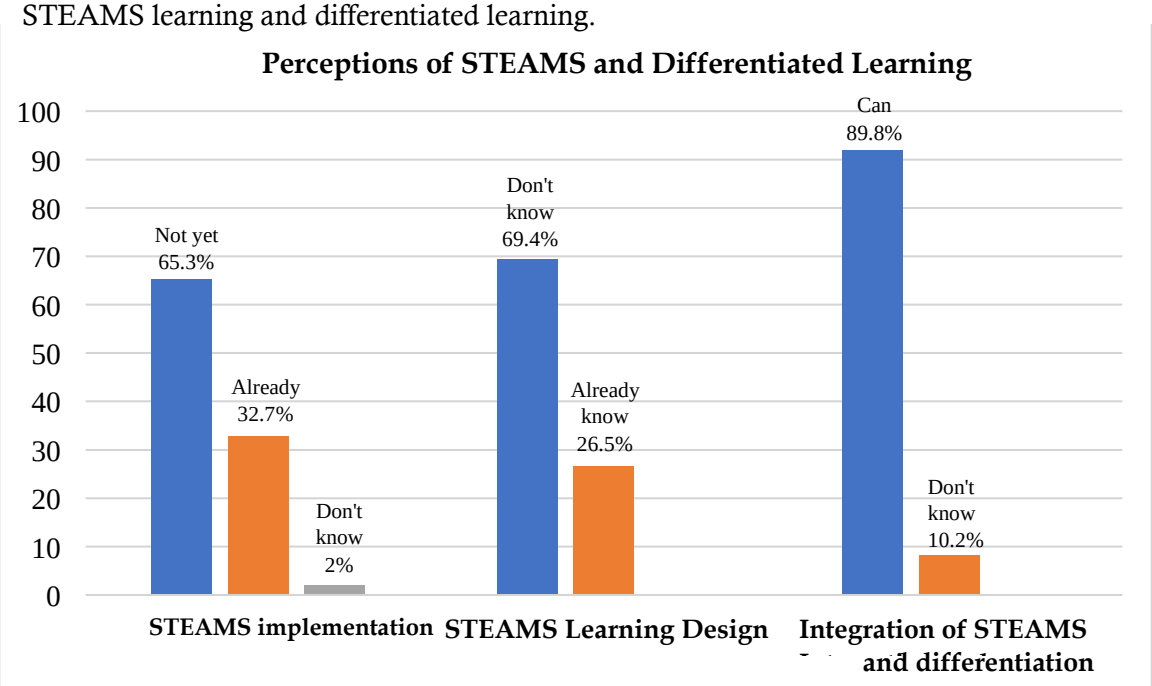

Figure 2. Diagram Perceptions of STEAMS and Differentiated Learning

From the bar chart above, it can be explained that 65.3% of teachers have not implemented STEAMS learning in the classroom. 32.7% of teachers have implemented STEAMS learning in the classroom. And the remaining 2% do not know. This is because 69.4% of teachers do not know how to implement STEAMS learning design. While 26.5% of teachers answered that they already knew how the STEAMS learning design was. According to the answers of some teachers who already know the learning design, STEAMS learning design are find problems and solutions (ask), imagine, plan, create and improve. The STEAMS stages proposed by the teacher are in line with the Engineering Design Process (EDP) theory. EDP is an educational pedagogy applied to students (Bertrand & Namukasa, 2023). EDP not only produces abstract concepts but applies design skills to students, through a problem-solving approach and basic concepts (Sudrajat et al., 2023). EDP itself in integrated STEM contributes to curriculum development from kindergarten to K-12 education (Galanti & Holincheck, 2024). This is not in line with the STEAMS design thinking approach because it does not touch on the art or aesthetics of the product and social aspects. In addition, these stages also do not allow to produce differentiated STEAMS products. This is not in line with the questionnaire results which state that STEAMS learning can be integrated with differentiated learning (89.9% of respondents stated it could). Design thinking is a mindset methodology for designing innovative products that are not only effective in terms of function but also prioritize aesthetics (Nakata & Hwang, 2020). There are 5 stages of the thinking process in design thinking according to Plattner (2018). The five stages are: (1) Empathy, (2) Define, (3) Ideate, (4) Prototype, and (5) Test (Taimur et al., 2023). The application of the design thinking stages in the STEAMS project can be seen in table 1 below.

Table 1. Differentiated STEAMS *design thinking* stages

No.	Stages	Activity Description
1	Empathy	1. The teacher invites students to observe things around them that they can feel with their senses. 2. Students search for information according to the problems they find (can be through interviews, literature studies, *googling*, etc.). 3. The teacher invites students to write down the results of observations at the empathy stage
2	Define	1. Students convey the main problems found based on observations or sources of information. 2. The teacher guides students to find the cause of the problem. 3. The teacher and students determine alternative problem-solving solutions.
3	Ideate	1. Teachers and students determine creative problem-solving solutions using appropriate technology. 2. Teachers relate the chosen technology to the learning outcomes. 3. Students write down their ideas in the form of a poster of differentiated STEAMS product design.

4	Prototype	1. Students start assembling STEAMS products based on the design that has been made.
		2. The teacher guides and facilitates students in realizing their products.
		3. The teacher monitors students' creative process in producing STEAMS products.
5	*Test*	1. Students present and test the products they have made.
		2. Teachers and other students gave feedback on the products.
		3. Students improve the product based on the feedback and make a report.

Empathy is the gateway to design STEAMS. Empathy is the spirit of design thinking process. Empathy means the willingness and ability to understand other people's feelings why and how they do things (Bailey, 2022). Empathy as a way of understanding a person's physical, psychological and emotional needs in living life, so that with empathy we can find something meaningful to change their lives (Bailey, 2022). The thinking process based on empathy will produce appropriate products because they really suit the needs of the users (Krueger, 2022).

Define is the problem limitation stage. It is the stage of determining which problems are considered the most urgent to be followed up to the next stage (Pande & Bharathi, 2020). This stage is carried out by taking inventory of what is needed and focusing on thinking the ways solve the targeted problem. Define is the phase of finding the core point of view of the problem (Pande & Bharathi, 2020). This is the stage to determining the point of view. Define can do by analyzing the information found in the empathy stage. The way to determine the point of view at the define stage can be helped by answering essential questions that lead to the root of the problem (Cross, 2023).

Ideate phase is the contemplation phase to find a solution. The ideation phase is interpreted as the birth of creative ideas that may arise from the imagination process or the refinement of pre-existing ideas. Plattner (2018) states: "Ideate is the mode of the design process in which you concentrate on idea generation (Taimur et al., 2023). Mentally it represents a process of "going wide" in terms of concepts and outcomes. Ideation provides both the fuel and also the source material for building prototypes and getting innovative solutions. Ideate phase is doing by combining conscious and unconscious mind, and rational thoughts with imagination (Dell'Era et al., 2020). It's a relation between imagine, research, and ponder to solve the problem". Brainstorming is a technique to accommodate various inputs from other people's thoughts in solving problems (Paulus et al., 2023). Each person or member is given the same opportunity to express their opinions openly and freely. The ideas that emerge are discussed to find out their advantages or disadvantages.

The meaning of prototype in Indonesian is *purwarupa*. Prototype means an initial form that describes the design, concept, and working system of a product (Triatmaja, 2020). Prototype is interpreted as a real embodiment of an idea before it is made on a large scale or mass produced (Hansen & Özkil, 2020). The prototype stage is the activity of designing, compiling, and modelling a product that is ready to be tested for feasibility (Hansen & Özkil, 2020).

The last stage in the design thinking is Test (Pande & Bharathi, 2020). Test is the feasibility/readability/acceptance of a prototype which will be developed into a final product

or made in large quantities (Da Silva et al., 2020). The feasibility and effectiveness test aims to determine the extent to which the prototype is able to solve the problems and according to the needs of users (Da Silva et al., 2020). The five stages of design thinking in differentiated STEAMS learning are used to improve students' thinking skills. So that the STEAMS products are appropriate and according to the needs.

Figure 3. Interview With Resource

Interview with Athiq Amiliyah, S.Pd. - Grade 6th teacher, Curriculum Coordinator of SDMM and Pamong Teacher of PPG Prajabatan Kemendikbudristek

This is in line with the findings in interviews conducted with grade 6th SDMM teachers who also serve as curriculum coordinators and PPG *Prajabatan* teachers Athiq Amiliyah, S.Pd.. The interview results show that SDMM has implemented *kurikulum merdeka* since the 2022/2023 academic year until now. Teachers conduct assessment non-cognitive to find out students' learning needs, related to students' interests, learning readiness and learning profile. The difficulty faced in differentiated learning is when dealing with some learning materials that may be difficult to differentiate. The solution is to share or discuss together with study group practitioners in order to design learning together. Student competencies that need to be improved are critical thinking and creativity. STEAMS learning design has not been widely used by teachers at SDMM. This learning design is considered to increase students' creativity and collaboration skills. Not only that, differentiated STEAMS learning based on design thinking is also claimed to be able to improve students' 21st century abilities in 6C abilities, namely critical thinking**,** creativity, collaboration, communication, citizenship, character (Dinsmoor, 2023). In the future, the development of differentiated STEAMS learning design based on design thinking can be carried out at SDMM through research and training.

Creative Thinking Skills

Creative thinking skills can be seen from the questionnaire and test results. The questionnaire results show some of the skills that students are expected to have in the 21st century through differentiated STEAMS learning as follows.

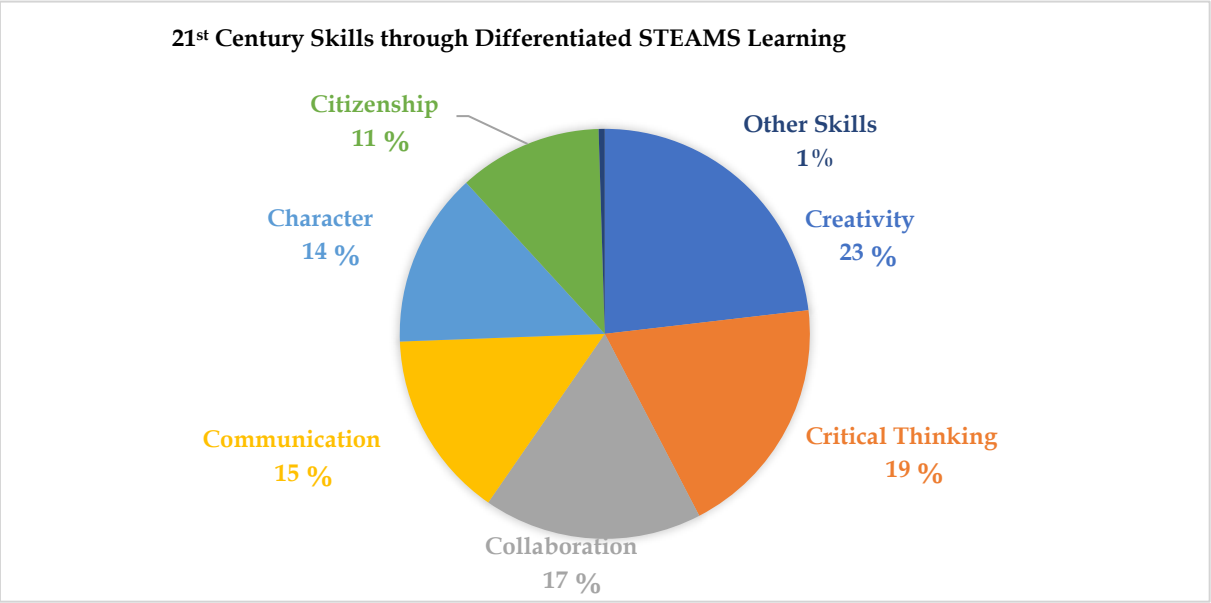

Figure 4. Diagram 21st Century Skills through Differentiated STEAMS Learning

From 6 of 21st century skills, there are five skills with the highest percentage: creativity, critical thinking, collaboration, communication, and character. These five skills are expected to increase in students when STEAMS learning design is applied. With creative thinking skills occupying the highest percentage of 23%. One of the 21st century abilities is creative thinking, creative thinking ability is a person's ability to use their thinking process to generate new ideas and knowledge (Binkley et al., 2012). Creative thinking skills need to be developed in all subjects so that students can see a problem as an opportunity to produce creative solutions. Creativity is needed by students in thinking process to solve a problem (Sirajudin et al., 2021). STEAM learning is an educational approach that integrates various disciplines. By implementing STEAM teachers can invite students to think creatively, solve problems, and actively participate in learning (Jesionkowska et al., 2020).

The test was conducted to determine students' ability in creative thinking. The creative aspects are fluency, flexibility, originality, and elaboration.

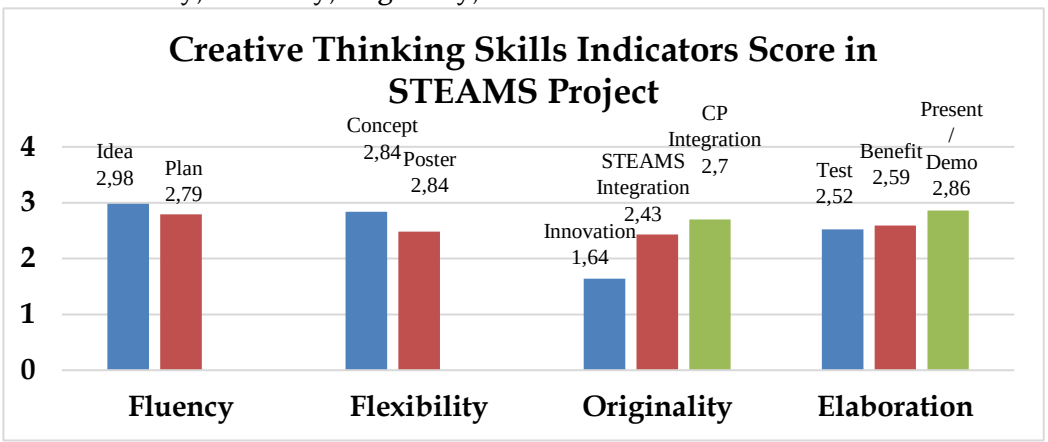

Figure 5. Diagram Creative Thinking Skill Indicators Score in STEAMS Project

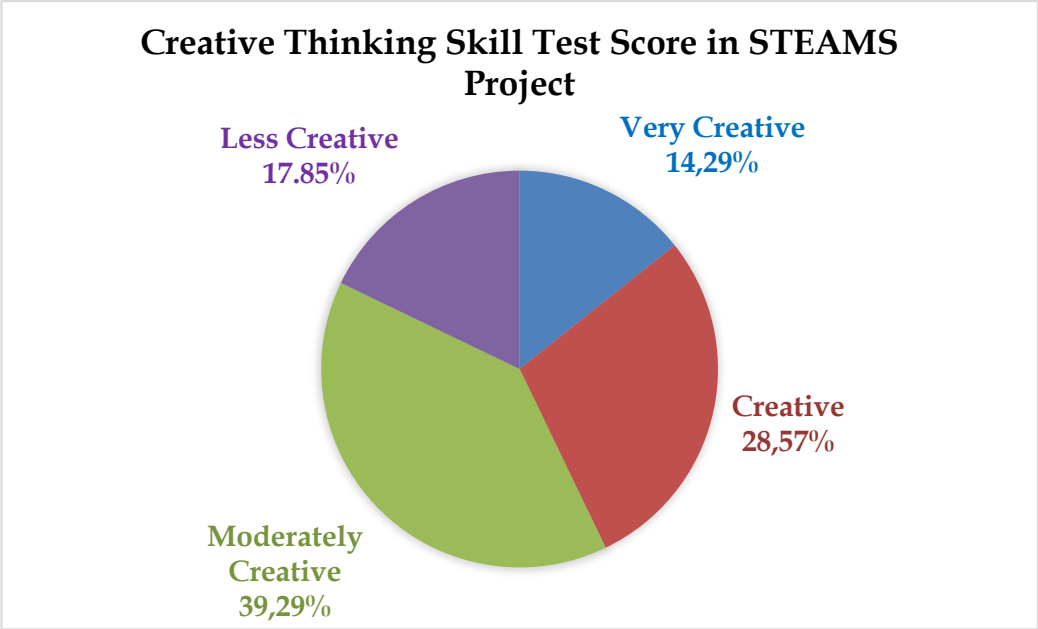

Figure 6. Diagram Creative Thinking Skill Test Score in STEAMS Project

The interval of assessment criteria used are 25 - 43 less creative, 44 - 62 moderately creative, 63 - 81 creative and 82 - 100 very creative. Respondents in the test consisted of 28 third grade students with 14 male students and 14 female students. The test results show that 4 students are classified in the very creative category with a percentage of 14.29%. 8 students are in the creative category with a percentage of 28.57%. 11 students are included in the moderately creative category with a percentage of 39.29%. And the remaining 5 students are classified in the less creative category with a percentage of 17.85%. The test results show that most students belong to the moderately creative category with a percentage of 39.29%. Based on the test researcher know that students lack of flexibility on how to design the poster of project. Students made manual poster without integrate of technology. The description product and picture in the student's poster was uncomplete. Students lack of innovation to create a STEAMS product. Students only integrate one until tree competence of STEAMS science, technology, engineering, arts, mathematics and social in their product.

The research findings indicate that the development of differentiated STEAMS learning design based on design thinking can be an effective solution to enhance students' creativity while addressing their learning needs. These findings align with the theory of differentiated learning proposed by Tomlinson, which emphasizes that teaching strategies should be tailored to students' learning profiles, interests, and readiness to create meaningful and effective learning experiences. Additionally, the findings reinforce the theory of design thinking, which supports creative and innovative problem-solving processes in learning environments.

A previous study by Firdausi Nuzula, which utilized the STEAM approach through the development of an *Arduino Uno-Based Automatic Trash with Ultrasonic Sensor*, also demonstrated the effectiveness of STEAM learning in improving students' critical, creative, and logical thinking skills. This study supports the findings that STEAMS-based learning provides interdisciplinary learning experiences and encourages students to create practical solutions to problems in their surrounding environment. The needs analysis in this research also revealed that students have diverse learning styles, such as visual (85.7%), kinesthetic

(83.7%), and auditory (69.4%). These findings are consistent with the study by Dunn and Dunn (1978), which stated that the success of learning is significantly influenced by the alignment of teaching methods with students' learning styles. By integrating this theory, the developed STEAMS learning design accommodates individual student needs, supports more personalized learning, and encourages their active participation.

Therefore, this differentiated STEAMS learning design is very necessary to be developed in order to increase student creativity. Indicators of creative thinking skills consist of fluency, flexibility, originality and elaboration (Syarifatul luthfia, 2024). The indicators that need to be improved are fluency, originality and elaboration. This happens because the differentiated learning carried out in the classroom is not yet at the stage of making products creatively. So that student learning products still tend to be the same. The learning process tends to be compartmentalized in each subject. This happens because teachers do not know how the STEAMS learning design thinking stages. Teachers also have not been able to design learning that can carry out student creativity to produce differentiated products. Therefore, research to determine the initial needs analysis for the development of differentiated STEAMS learning design is needed. Differentiated STEAMS development design is carried out so that learning is more meaningful and fun (Perignat & Katz-Buonincontro, 2019). So that students can participate in STEAMS learning with the stages of design thinking to produce differentiated creative products (Perignat & Katz-Buonincontro, 2019). Overall, these research findings not only confirm the relevance of theoretical studies and previous research but also contribute new insights by integrating differentiation, STEAMS, and design thinking approaches. This combined approach not only enhances students' creativity but also creates a holistic learning environment aligned with 21st-century education goals.

Conclusion

Based on the results of the analysis and discussion, it is found that both teachers and students need the development of differentiated STEAMS learning design based on design thinking to increase student creativity. The aim of this research is to know the need analysis for developing STEAMS differentiation learning design. With these needs analysis, researcher hope it can be use as reference in developing the learning design for the next study. The developed learning design effectively addresses the diverse needs of students by emphasizing critical and creative thinking, collaboration, and innovative problem-solving skills. The findings suggest that STEAMS learning design combined with differentiation learning and design thinking, not only enhances students' creativity but also promotes a holistic learning environment that integrates interdisciplinary knowledge. Furthermore, the results of this need analysis indicate for researcher to develop the differentiated instruction within this learning design which encourages active participation, supports individual learning styles, and aligns with 21st-century education goals. The impact of this needs analysis can be as a reference for teachers to implement differentiated STEAMS learning based on design thinking. For the future, the suggestion that can be recommended is the existence of training to applicant this learning design.

Based on the research findings, the next step is to develop a differentiated STEAMS learning design based on design thinking that aligns with students' needs. This learning design will be aimed at enhancing student creativity by emphasizing critical thinking, creative thinking, collaboration, and innovative problem-solving skills. Additionally, the design will accommodate diverse learning styles, readiness levels, and student interests, thereby creating a

holistic and inclusive learning environment. The initial steps include designing learning resources such as e-modules, student activity sheets, and implementation guides to support the application of this learning design. To ensure successful implementation, teacher training is essential to familiarize them with the concepts of differentiated learning, the STEAMS approach, and the practical application of design thinking. Subsequently, the learning design can be piloted in classrooms, accompanied by monitoring and evaluation to ensure its effectiveness in fostering student creativity. The findings of this research can also serve as a reference for developing educational policies, particularly to encourage the implementation of differentiated STEAMS learning in schools. In the future, further research can focus on the long-term impact of implementing this learning design on students' creativity, readiness, and abilities to face 21st-century challenges.

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