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Analysis of E-SWS Development: Integrating Ethnoscience and Joyful Learning to Enhance Students' Creative Thinking and Knowledge

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ABSTRACT

21st-century education demands creative thinking skills, yet physics learning at SMAN 1 2X11 Enam Lingkung still faces serious obstacles. The use of Information and Communication Technology (ICT) in learning media remains low, measurement materials are difficult for students to understand, and there is a lack of integration of local wisdom (ethnoscience) and joyful learning methods. This study aims to analyze the needs for developing an Electronic Student Worksheet (E-SWS) that integrates ethnoscience and joyful learning to enhance students' knowledge and creative thinking skills regarding physics measurement concepts. This research employs a descriptive statistical analysis method to provide a comprehensive overview of the research data. Data were collected through a teacher questionnaire (15 items), a student questionnaire (12 items), and an analysis of the learning outcomes of 31 Grade X students.

Keywords : E-SWS, *Measurement Concept , Etnosains and joyfull Learning, knowledge, Think creatively.*

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I. INTRODUCTION

The rapid development of science and technology (IPTEK) in the 21st century requires students to understand and use technology wisely in order to produce quality human resources. This can be achieved through improving the quality of education. [2]. The demands of the 21st century emphasize students' competence in investigating, describing problems, thinking logically, and collaborating to achieve meaningful learning. Integration of cultural science in the learning process and reconstruction of indigenous knowledge into scientific knowledge are important factors [21]. 21st century learning requires essential competencies, one of which is the ability to be creative and innovative [14].

Students in this digital era grow up familiar with technology. They are used to electronic devices and digital information. E-SWS offers more efficient and interesting learning tools, reducing the boredom that often occurs in conventional learning. [1]. E-SWS Innovation is an important need as teaching material, practical work, and technological developments in accordance with the demands of the times [11]. E-SWS offers a more efficient and interesting learning tool, while reducing the boredom that often occurs in conventional learning methods. In response to the demands of the times and technological developments, E-SWS Innovation is an important need that functions not only as teaching material, but also as a practical guide[24]. The Independent Curriculum emerged in response to the demands of 21st-century education. It emphasizes the development development of essential competencies and student character.

This curriculum provide educators with the flexibility to tailor learning to students' needs, resulting in deeper and more meaningful learning [25]. Furthermore, the Independent Curriculum also seeks to strengthen the development of the Pancasila Student Profile, which encompasses dimensions such as faith, devotion to God Almighty, noble character, global diversity, mutual cooperation, independence, critical thinking, and creativity [8]. Thus, the Independent Curriculum is expected to produce a young generation that is not only academically intelligent but also possesses strong character and is ready to face global challenges [17]. One effective way to achieve the goals of the Independent Curriculum, particularly in creating deep and meaningful learning and

strengthening student character, is through an ethnoscience approach. Ethnoscience, which integrates scientific knowledge with local wisdom and community culture, can be a strong bridge to link 21st-century competencies with the nation's noble values reflected in the Pancasila Student Profile.

E-SWS can be designed with an attractive appearance, combining colors, images, writing, animation and video [3]. This makes the material clearer and more in-depth, creating a fun and interactive learning experience, so that it can attract students' interest and motivation to learn as well. increase creativity they [6]. Positive response from students towards E-SWS shows that this device is very worthy to be used as an effective learning tool.

Student Worksheet (SWS) are sheets containing assignments that must be completed by students, which usually consist of instructions or steps to complete a task. SWS The ideal should contain information that inspires students to do the task, not too little or too much so that it reduces their space for creativity [10].Besides that, SWS Quality must meet didactic, construction, and technical requirements, such as inviting students to be active, emphasizing concept discovery, using language that is appropriate to their maturity level, and having an attractive appearance with a combination of clear writing and images. The main goal is to make it easier for teachers to carry out learning and help students learn independently and understand written assignments [4]. Student Worksheet (SWS) A good one is one that meets the writing criteria and has the appropriate components. According to the Ministry of National Education, in general the structure of SWS, namely: Title, Learning instructions, Competencies to be achieved, Supporting information, Tasks and work steps and Assessment[12].

The reality in the field has not yet described the expected conditions based on the real conditions carried out. This is known from the initial study conducted at SMAN 1 2X11 Enam Lingkung. The initial study conducted analyzed various problems and needs in the physics learning process. After conducting the field study, there were 4 real conditions obtained in this study, the first being the problem with teachers. The instruments provided were filled in by 2 physics teachers at SMAN 1 2 X 11 Enam Lingkung.

This needs analysis consists of several components, namely problems in the ideal structure E-SWS, characteristic features E-SWS the good one, Integration of ethnoscience in physics learning, and the application of joyful learning in physics learning. Based on the results of the questionnaire, it was found that teachers had difficulty in making SWS at school with an average 42% and is included in the low category. Based on the average value obtained, SWS has been used, but The SWS used is not adequate to support the physics learning process, the SWS used by students is still not interesting and motivating for students, the SWS used is still in printed form, the SWS used by students is not aimed at facilitating students' knowledge and creative thinking skills, and the SWS used by students does not use electronic SWS so that it cannot be accessed anytime and anywhere. Secondly, based on the results of the analysis of the distribution of needs analysis instruments in the form of questionnaires for students, problems were found in the measurement material with an average value of 34.16% in the low category. This is not in line with the ideal conditions expected because this material needs to be studied and integrated into the independent curriculum.makes it easier for teachers to provide more efficient and measurable evaluations. Thus, E-SWS offers a modern learning alternative that is relevant to the needs of students and teachers.

The third real condition is related to students' creative thinking skills as seen from the needs analysis instrument for students in the form of discourse where students tend not to be interested in reading discourse questions based on the needs analysis carried out, the results of student knowledge were 54.03% which is in the low category. The fourth real condition is the problem of student knowledge. The students' knowledge score is seen from the Mid-Semester Assessment (MSA) achievement of odd-semester students in class X.E1 as many as 31 students with an average score of student learning outcomes of 51.96% which is in the low category. E-SWS is present as an effective solution in education because the digital platform presents interactive learning materials that attract students' attention[19]. The use of E-SWS allows flexible access to materials anytime and anywhere, supporting independent learning. The interactive features of E-SWS can increase students' active involvement in the learning process, thereby deepening understanding. In addition E-SWS.

E-SWS that integrates ethnoscience aspects can be an effective strategy in physics learning, especially in measurement material, because it is able to connect scientific concepts with local wisdom and student culture [15]. This approach supports students to build their knowledge from the surrounding environment, so that learning becomes more meaningful and contextual [16]. Ethnoscience is an activity that transforms indigenous scientific activities which consist of knowledge originating from hereditary beliefs and still contains myths [7].Ethnoscience-based learning involves creating and designing learning environments that integrate culture into the learning process. This aligns with the implementation guidelines for the Indonesian elementary school curriculum, which also prioritizes maximizing the cultural background of students and the school environment [18]. When ethnoscience is integrated as the main theme of learning, the learning process becomes more

effective and can create a joyful learning atmosphere [13]. This joyful learning atmosphere, which is fun and dynamic, will encourage students to build material concepts independently and formulate conclusions, which are important indicators in developing creative thinking skills [5]. The combination of E-SWS with ethnoscience and joyful learning has great potential to stimulate students' creativity in understanding measurement concepts through their own cultural context. The integration of E-LKPD with ethnoscience and joyful learning has great potential to stimulate students' creativity in understanding measurement concepts through their own cultural context. Joyful learning not only increases students' intrinsic motivation but also creates a positive emotional atmosphere that is essential to facilitate better information processing and memory retention [20].

Despite the recognized potential of digital tools like E-SWS, there is a clear research gap in integrating indigenous knowledge into such digital platforms within the framework of the Independent Curriculum. Current digital learning materials often remain generic and lack a deep reconstruction of cultural knowledge into scientific concepts. Therefore, this study aims to develop and evaluate the effectiveness of an E-SWS innovation that integrates cultural science to enhance students' logical thinking and creativity in alignment with 21st-century educational demands.

Despite the potential of E-SWS, initial studies at SMAN 1 2X11 Enam Lingkung reveal a significant: the current Student Worksheets (SWS) remain in printed form, are uninteresting, and do not integrate ethnoscience or joyful learning to support the Independent Curriculum. This gap has resulted in very low student mastery of measurement materials (34.16%) and inadequate creative thinking skills (55.6%). Therefore, this study aims to address these deficiencies by developing an innovative E-SWS that integrates ethnoscience and joyful learning to enhance students' knowledge and creative thinking skills specifically within the context of physics measurement concepts

II. METHOD

This research employs descriptive statistical analysis methods. Descriptive statistical analysis is an approach used to provide an overview, summarize, and present research data without generalizing or drawing conclusions for a wider population. This analysis focuses on the characteristics of the collected data, such as frequency distribution, measures of central tendency (e.g., mean, median, and mode), and measures of data spread (range and standard deviation). The objective is to transform raw data into information that is easier to understand and interpret through tables, graphs, or narratives, allowing readers to gain a comprehensive overview of the analyzed problem. Thus, descriptive statistics serve as a crucial initial step in detailing variable characteristics before further analysis is conducted.

The data required for analysis include E-SWS measurement results, observation sheets of student learning activities, and questionnaires assessing teacher and student responses to E-SWS. Additionally, data includes results from students' creative thinking ability tests before and after the intervention. Collecting this data is essential to test the effectiveness of E-SWS in enhancing students' creative thinking skills through a joyful learning approach. All collected data will be analyzed descriptively to provide a comprehensive picture of the study.

This study specifically examines the E-SWS measurement tool, designed to integrate ethnoscience as a learning context and the principle of joyful learning in its presentation. The primary object of observation is the E-SWS and its implementation in the classroom. The focus of the study is on how the use of E-SWS affects students' creative thinking skills in understanding physics measurement concepts. Consequently, the research objects encompass innovative learning media, student interaction processes, and the resulting impact on developing essential 21st-century competencies.

The primary data collection instruments are closed-ended questionnaires designed to measure the feasibility and effectiveness of E-SWS. The researcher utilized two types of instruments: a teacher questionnaire consisting of 15 items and a student questionnaire consisting of 12 items. Both instruments focus on four primary indicators of creative thinking: (1) fluency, (2) flexibility, (3) originality, and (4) elaboration. Responses are measured using a **5**-point Likert scale, categorized as follows: 1 (Excellent), 2 (Good), 3 (Fair), 4 (Poor), and 5 (Very Poor).

Data collected through these questionnaires are analyzed using descriptive percentages. The average score for each indicator is calculated and converted into feasibility categories (Excellent, Good, Fair, Poor, and Very Poor) based on predetermined criteria. This procedure ensures a systematic and objective interpretation of the E-SWS implementation in the classroom.

The data analysis technique u sed in this study is descriptive statistical analysis. Descriptive statistics are statistics used to describe a research project through research objects through data obtained as is [9]. The resulting data describes quantitative data more precisely. The data from the needs analysis are then analyzed

descriptively to obtain a value. The interpretation categories of the needs analysis results can be seen in Table 1. The following:

Table 1. Interpretation categories

Category	
Very less	0-20
Not enough	21-40
Enough	41-60
Good	61-80
Very Enough	81-100

III. RESULTS AND DISCUSSION

1. Results of SWS Analysis

Results of SWS Analysis The following is a contextual analysis comparing the ideal and actual conditions of the Student Worksheet (LKPD), as illustrated in Figure 1 :

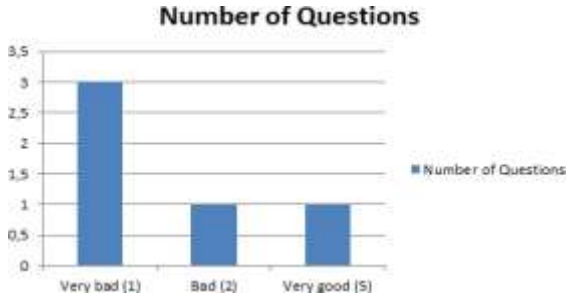

Fig. 1. Graphical Analysis of SWS Quality Problems in Schools, highlighting the dominance of "Very Poor" quality indicators.

As shown in **Figure 1**, there is a significant gap between the expected standards and the actual situation on the ground. Graphical analysis reveals that the average student score is only 40%, with a clear dominance of "very poor" quality indicators. This data confirms the urgent need for strategic intervention. In this context, the development of E-LKPD (Electronic Student Worksheet) acts as a potential solution, offering interactive features and accurate automatic assessment to address these areas of weakness.

2. Results of Problem Analysis on Measurement Material

The following is an analysis of the problems in the measurement material, presented in graphic form to provide a clear and concise picture. This graph describes the various obstacles faced by students and teachers in understanding and teaching the concept of measurement as shown in Figure 2. Here:

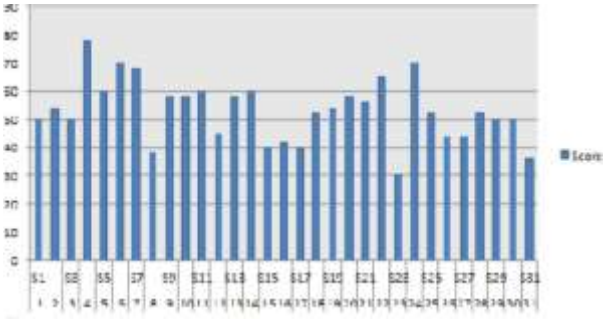

Fig. 2. Results of Measurement Material Problems

The actual condition of students related to problems in measurement material shows a significant gap. The average score obtained was only 34.16%, so that students' understanding is in the very low category. This figure is far from the ideal conditions expected, considering that measurement material is an important foundation in physics that must be mastered well. Moreover, with the emphasis on material integration in the Independent Curriculum, the ability to master measurement material becomes increasingly crucial. Therefore, immediate intervention is needed to improve students' understanding of the material so that it is in accordance with the demands of the modern curriculum.

3. Results of Analysis of Creative Thinking Needs and Knowledge

The following are the results of the analysis of students' creative thinking needs and knowledge, which are presented based on data processed using statistical formulas in Table 3. This analysis provides a quantitative picture of the level of students' mastery of concepts and innovation abilities in related materials. The findings of this analysis will be a strong basis for designing more targeted learning interventions.

No	Statistical parameters	Student Abilities	
		Knowledge	Creative Thinking Skills Students
1.	Number of Students	31	31
2.	Average Value	66.1%	55.6%
3.	Mode	55	50
4.	Median	70	55
5.	Highest Value	100	75
6.	Lowest Value	0	40
7.	Reach	100	35

Fig. 3. Statistical Parameters

4. Results of Ethnoscience integration

Based on the results of the researcher's observations at SMAN 1 2X11 Enam Lingkung, it was found that teachers had not used an ethnoscience approach in the learning process. This real condition shows a gap between practices in the field and the need for learning innovations that are relevant to the Merdeka Curriculum.

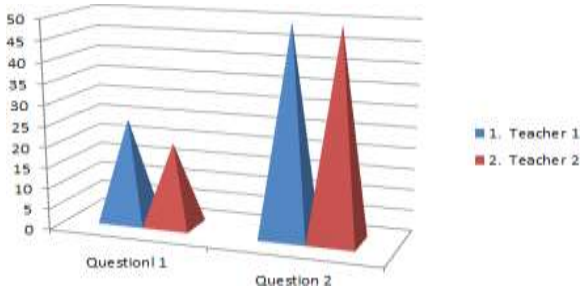

Fig. 4. Statistical Parameters

Based on an initial survey at SMAN 1 2X11 Enam Lingkung, it was found that teachers had not used an ethnoscience approach in their learning process, a clear indication of a significant gap between current teaching practices and the need for innovation according to the Independent Curriculum. This finding is reinforced by the results of a questionnaire survey which showed that 36.2% were in the low category, confirming that the application of ethnoscience that integrates culture and local wisdom in science is still very minimal. In fact, this approach is crucial to making learning more contextual, meaningful, and relevant to the students' environment, in line with the vision of the Independent Curriculum. E-SWS that integrates ethnoscience aspects can be an effective strategy in learning physics, especially in measurement material, because it is able to connect scientific concepts with local wisdom and students' culture. This approach also supports students to build their knowledge from their surroundings, so that learning becomes more meaningful and contextual. When ethnoscience is integrated as the main theme of learning, the learning process can be more effective and create a joyful learning atmosphere, which in turn can encourage students to build material concepts independently and develop creative thinking skills. Therefore, it is important to integrate ethnoscience in the development of E-SWS to improve the understanding and creative thinking skills of students at SMAN 1 2X11 Enam Lingkung.

5. Results of Joyfull Learning integration

Based on the needs analysis conducted at SMAN 1 2X11 Enam Lingkung, it was found that teachers had not implemented joyful learning-based learning in their teaching and learning process, this can be seen in Figure 5. Below:

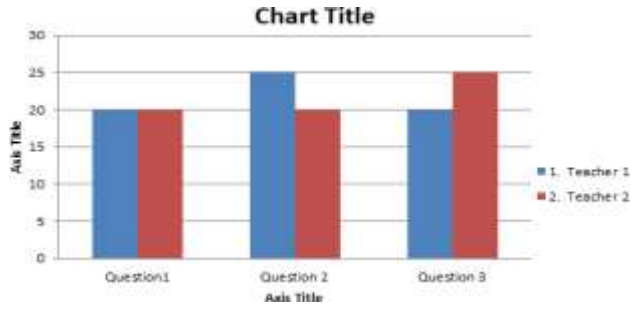

Fig. 5. Application of Joyfull Learning in physics learning

Based on the initial survey conducted by the researcher using a data collection instrument in the form of a questionnaire at SMAN 1 2X11 Enam Lingkung, it was found that teachers were not optimal in implementing joyful learning-based learning, a fact reinforced by questionnaire data showing that only 21.1% of teachers were in the low category in implementation, indicating that most educators still have not integrated fun and interesting learning methods for students. This very low percentage highlights the urgent need for interventions, such as training or workshops, to equip teachers with the understanding and skills needed to create a more positive and effective learning environment. Teachers are indicated to still be unfamiliar with this learning concept, although the joyful learning method has been proven to increase student learning motivation and create a fun and dynamic learning atmosphere. In fact, this joyful learning atmosphere is very important because it can encourage students to build material concepts independently and formulate conclusions, which are crucial indicators in developing creative thinking skills. The integration of joyful learning in E-SWS has great potential to stimulate student creativity and make the material clearer and deeper, creating a fun and interactive learning experience, so as to attract students' interest and motivation to learn. Therefore, the implementation of joyful learning is crucial to improve the quality of learning and achieve the goals of the Independent Curriculum in the school.

IV. CONCLUSION

Analysis of the SWS Used: The SWS used at SMAN 1 2X11 Enam Lingkung currently has several significant weaknesses, including its unattractive appearance, printed form, and not explicitly facilitating the development of students' knowledge and creative thinking skills. This indicates the need to develop more innovative and relevant SWS.

Students' understanding of measurement material is still very low, indicated by an average score of only 34.16%. This condition is far from ideal expectations, considering that measurement material is an important foundation in physics and crucial in the Independent Curriculum.

Based on descriptive statistical analysis of 31 students, the Knowledge aspect has an average score of 66.1% with a range of 100 (lowest score 0, highest 100), while the Student Creative Thinking Ability aspect shows an average score of 55.6% with a range of 35 (lowest score 40, highest 75). Overall, the data shows that students have a low level of knowledge and creative thinking skills.

Teachers at SMAN 1 2X11 Enam Lingkung have not implemented an ethnoscience approach in learning. In fact, the integration of ethnoscience in E-SWS has the potential to be an effective strategy in physics learning, especially measurement material, because it can connect scientific concepts with local wisdom, make learning more meaningful, contextual, and effective, and create a pleasant learning atmosphere that supports the development of creative thinking skills.

Teachers at SMAN 1 2X11 Enam Lingkung have not implemented joyful learning-based learning and are even indicated to be unfamiliar with the concept. The application of joyful learning is very important because it can increase student learning motivation, encourage students to build concepts independently, formulate conclusions, and stimulate creativity, so that it can improve the quality of learning and is in line with the objectives of the Independent Curriculum.

These needs analyses serve as a fundamental blueprint for the next stage of research and development. Following these findings, the next phase will focus on developing, validating, and testing an integrated E-SWS that incorporates ethnoscience measurement concepts and a joyful learning approach. This subsequent development aims to address identified weaknesses by providing interactive, contextually relevant learning media that can effectively enhance students' knowledge and creative thinking skills in line with the Independent Curriculum standards.

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