



Study of STEM Based on Local Wisdom in Hoening Science Process Skills in the 21st Century Era

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Abstract: The purpose of this study was to examine the topic of STEM based on local wisdom in honing science process skills in the 21st century era. This study used a literature review research design. The population of this article is 100 journals found both internationally and nationally. The sample of this article is 15 journals found based on criteria with 10 international journals and 5 national journals. The results of this study are STEM learning based on local wisdom can increase creativity, critical thinking, process skills, and can train students for skills in Indonesia. The conclusion of this study is that STEM learning based on local wisdom can be an alternative in honing process skills in the 21st century era.

Keywords: STEM; Local wisdom; Science process skills; 21st century era

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Introduction

Presently, we have entered the era of the 21st century or commonly called the era of digitalization which is the impact of changes in the pattern of human life from increasing science and innovation (Science and Technology). The 21st century requires each person to have indications and abilities, have the choice to work together, have the choice to think fundamentally and inventively, have the ability to master and advance, be talented in utilizing innovation and data, also have choices to work and survive using their skills (Yanuarni et al., 2021). This opinion is in line with Pramudita et al., (2021) that 21st century skills have 4C skills, namely correspondence, cooperation, reasoning and critical thinking (Critical reasoning and critical thinking), and imaginative (Creativity). Lestari (2021) also argues that the main abilities in life in the 21st century combine basic abilities, mentalities, imaginative, cooperative, and overt. So it can be concluded that 21st century capabilities incorporate the 4Cs in particular correspondence, cooperation, decisive reasoning, and imagination.

Khoiri et al. (2020) said that students' 21st century skills are the outcome of Indonesian science education. NSES (National Science Education Standards) ensures in science education plans that student engage effectively with science utilizing the SCS (Science Process Skills) approach or commonly known as the science process skills approach (Hidayah, 2016). This approach has changed the central point of science training, from defending ideas and realities in learning to learn science process skills, then, at that time students seek to pay all due respect to understanding or potentially dealing with a problem (Supartono et al., 2011). Rahayu et al. (2011) added that in the learning system students must be directly involved so that students gain insight from the science process skills learning system.

Science process skills are a core aspect in instructing to achieve good insight (Hikmah et al., 2018). During the learning process, science process skills are not only used as the basis for scientific methods but also learn about the characteristics of knowledge (Hikmah et al., 2018). There are two scientific process abilities, namely fundamental and integrated science process abilities. Subali and Mariyam (2016) argue that science process

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skills should be taught to students, especially in basic science process skills for the elementary school level. After mastering basic science process skills, students can take a step forward towards integrated science process skills (Subali & Mariyam, 2016). One of the learning approaches with science process skills is STEM education (Science, Technology, Engineering, and Mathematics). In this regard, Rifandi & Laila Rahmi (2019:2) argue that STEM (Science, Technology, Engineering, and Mathematics) education is one way to face the challenges of the 21st century.

STEM (Science, Technology, Engineering, and Mathematics) is a learning approach between at least two STEM sections or between one STEM section and different fields of science (Becker & Park, 2011). The reason for mastering STEM is to further develop students' abilities in four fields of science, namely specific science skills, innovation work skills, critical thinking design skills, and numerical abilities that are appropriate to be applied in facing the difficulties of the 21st century (Widya et al., 2019). STEM is considered an important education, an education that needs to be done from an early age. Huber (2020: 2) argues that STEM can equip students in a career. This is because STEM learning can prepare students to tackle complex problems that appear to be fundamentally and innovatively certifiable problems (Izzah et al., 2021). Exercises like this train various 21st century skills, such as critical thinking skills, assertive reasoning, inventive reasoning, and cooperation (Fatmawati et al., 2015: 10). STEM is a learning trend that was initiated by the United States (Mulyani, 2019).

We can follow the trend of the latest learning model, namely STEM, but we must not forget the identity and national identity. Schools not only provide an educated and intelligent age, but also cultivate students' personalities according to the lifestyle or wisdom of the country's environment (Oktavianti et al., 2017). Local wisdom is characterized as the closest thinking that is intelligent, full of ingenuity, and has good value in the public arena, which is inserted and followed by local individuals and so on (Prasetyo & Kumalasari, 2021). The findings of Cole (2015) underline that the use of the community environment, customs, practices, beliefs, and local dialects can help improve students' perspectives on science. From the local wisdom of the area around students, students can be more aware of science. Therefore, this scientific paper will discuss studies on STEM studies based on local wisdom in honing science process skills in the 21st century era.

Method

This article uses a literature review. The Literature review is a method involved with organizing, obtaining, researching, and assessing research writings related to

the benefit of scientists (Borden & Abbott, 2005; Manzalati, 2017: 34). The literature review is a significant step in the early stages of exploration because this interaction is carried out in a variety of practical examinations, both subjective and quantitative examinations.

The benefits of a literature review are expanded information about the field being explored, find out the consequences of related and completed explorations (related investigations), know the progress of science in our chosen field (cutting edge research), explain the examination problem, and finding the latest strategy proposed by the analyst to address the research problem (best-in-class technique).

In this article, researchers analyze STEM based on local wisdom in honing science process skills in the 21st century era. There are two variables in this review, namely the autonomous variable (X) and the dependent variable (Y) or also called the autonomous (free) or environmental (bound) variable. So that the independent variable in this study is STEM based on local wisdom and the dependent variable is science process skills. The population of this study was taken from articles that were explored on the topic of STEM, local wisdom, and science process skills in the 21st century era. Furthermore, the samples in this study are research articles on the topic of STEM, local wisdom, and science process skills in the 21st century era.

The reference articles taken in this study are research that discusses the topic according to the title of this literature review research. The topics in this study discuss STEM, local wisdom, and science process skills in the 21st century era. In addition, the reference articles taken must have similarities in independent and environmental factors in the review. Reference articles taken must also have significant research results. Furthermore, the reference articles taken must come from licensed institutions, and are also interesting to be used as literature review materials. The references for this article are 10 international articles and 5 national articles in the last 5 years. Next is the development of the review in the written audit which will be clarified as shown in the attached image.

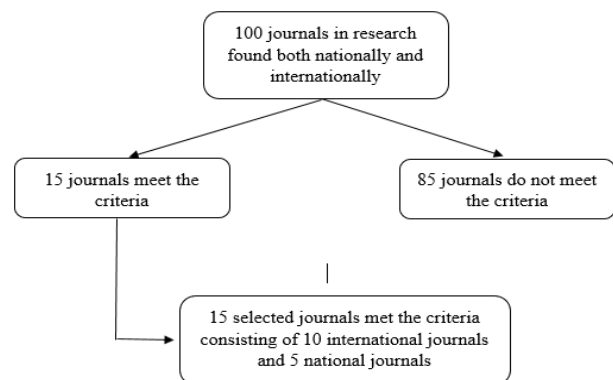


Figure 1. Literature review research flow

Result and Discussion

A critical analysis of 15 articles, namely 10 international articles and 5 national articles from this research were the samples in the literature review. The following table is in the form of the identity of the articles that are included in the literature review criteria for this research.

Table 1. International Articles

Researcher	Variable
Septiani dan Rustaman (2016)	Performance Assessment in STEM, science process skills
Widya, et al. (2019)	STEM, 21st century skills
Kinboon et al. (2019)	21st century skills, STEM, solution to problem
Simsek, (2019)	STEM, science process skills, attitude and student interest
Bhakti et al. (2020)	STEM, science process skills
MacDonald et al. (2020)	STEM, early childhood
Haryadi et al. (2020)	STEM-based bungee jumping, science process skills
Akcanca, (2020)	21st century skills, STEM education, PBL
Apaivatin et al. (2021)	STEM, science process skills
Barquilla dan Cabili, (2021)	21st century skills, module and STEM

Table 2. National Articles

Researcher	Variable
Priyani dan Nawawi, (2020)	Ethno-STEM-based Science Learning, Science Process Skills
Mahjatia et al. (2020)	STEM-based worksheets, science process skills, and guided inquiry
Laisnima dan Siregar, (2020)	STEM-based learning modules, Learning Outcomes and Science process skills
Almuharomah et al. (2019)	Development of STEM physics module based on "Beduk" local wisdom and creative thinking skills
Dewi et al. (2017)	Critical thinking skills, process skills, local wisdom

The research articles that are the samples of this research study are varied. There were 15 articles found according to the criteria, namely 10 international articles and 5 national articles. Based on these results, each article has used different types and research methods. Among them are 4 articles descriptive qualitative research, 3 articles RnD research, 3 articles experimental research, 1 literature review article, 1 quantitative and qualitative article, 1 correlation survey article, and 1 class action research article.

First international journal by Septiani & Rustaman (2016), this study indicates that the use of assessment of the implementation of STEM learning on plant media can distinguish students' science interaction abilities better than individual perceptions. The population in

this article is class X students. The type and method of this research are quantitative, with instruments and data collection techniques using observation, performance appraisal task rubrics, science process skills tests. The data analysis in this article uses descriptive and SPS test. The relationship of the 1st international journal with this research is discussing the same topic STEM and science process skills.

In the second international journal by Widya et al. (2019), the research results of this article are the STEM education is a new system that tries to integrate 4 components in learning. Through the application of these 4 components, students can obtain information to take care of problems in daily life and following the demands of today's work. Therefore, in this study, it was found that STEM is a step to answer the challenges of the 21st century. The population in this article is all articles related to STEM, science, and mathematics learning. The type and method of this research is the literature review, with data collection techniques namely literature study. The data analysis in the research used is a literature review. The relationship of the 2nd international journal with this research is to discuss the topic of the same variable, namely STEM and 21st century skills.

Third international journal Kinboon et al. (2019), the results of this study are; 1) the ability of technology adoption behavior to solve problems in science learning is found in 5 aspects, namely finding, using, collecting, selecting, and writing information skills. From the overall behavioral assessment, the level of knowledge in technology and technology skills for communication was found to be at a high level, 2) human resource development methods to improve and apply technological knowledge and skills in solving problems in science learning in schools were implemented effectively by adopting an approach STEM. The population in this study was 2,185 teachers. The type and method of this research article are descriptive qualitative, with instruments and data collection techniques using semi-structured questionnaires, triangulation approaches, surveys, and sample feedback. Data analysis in this article uses descriptive statistics, percentages, mean, and standard deviations. The relationship between the 3rd international journal and this research is discussing STEM education where in this journal it is found that solving problems in science learning is found in 5 aspects, namely finding, using, collecting, selecting, and writing information skills, this is relevant to several science process skills.

Fourth international journal by Imşek (2019), this study indicates that the application of STEM activities to students' science process skills, attitudes, and interests is applied in the experimental class more effectively than the control class in the science practice class. The population of the article is all 7th grade students in Duzici, Osmani Province. The types and research

methods used are experimental research, instruments and data collection using the BSB scale, science attitude scale, interest scale, and interviews. Data analysis of this research article uses SPSS. The relationship between the 4th international journal and this research is that there are similarities in the discussion in which the journal discusses STEM and scientific/science skills relevant to this research which discusses STEM and science process skills.

Fifth international journal by Bhakti et al. (2020), this study indicate that students have all the signs of science processability in the large classification. Students respond well to STEM learning because students feel serious about getting inspiration and the interest of learning increases. The type and research method used are qualitative, with instruments and data collection techniques using observation sheets and tests. The data analysis in this research article is descriptive. The relationship of the 5th international journal with this research is discussing the same topic of STEM and science process skills.

Sixth international journal by MacDonald et al. (2020), this article research are finding that learning using STEM can increase self-confidence, students are also more aware of knowledge in STEM through independent investigation and exploration. The population in this study is early childhood. The types and methods in this research are descriptive qualitative, with data collection techniques through interviews. The research analysis used is an evaluation/framework. The relationship between the first journal and this study is that they both discuss the topic of STEM education and in this study, the findings that students' self-confidence increases through independent investigation and exploration in STEM learning. This finding is relevant to this study that is one of the science process skills is observing.

Seventh international journal by Haryadi & Pujiastuti (2020), this study shows that making bungee jumping through the application of the STEM method increased the science process skills of students in the good category by 79.13%. The population in this article is all 8th graders in Serang. The type and research method of this article are experimental research, with instruments and data analysis techniques using tests and observations. The data analysis of this article is statistical analysis and SPSS. The relationship of the 7th international journal with this research is discussing the same topic regarding the effect of applying STEM on science process skills.

Eighth international journal by Akcanca (2020), this study shows that the attitudes of prospective preschool teachers about STEM and PBL education have a moderate and meaningful relationship with their perception of skills towards 21st century skills. In addition, it was found that candidates' attitudes toward

STEM and PBL explained 20% of their perceived proficiency in 21st century skills. The population in this article is prospective teachers who are studying at the Faculty of Education at Anakkale Onsekiz Mart University for the 2019-2022 academic year. The type and research method of this article are a correlation survey, with instruments and data collection techniques using the 21st century skills and competency scale, the STEM education attitude scale, and the PBL attitude scale. The data analysis in this article is SPSS 20.00 and linear regression analysis. The relationship of the 8th international journal with this research is discussing the same topic regarding STEM and 21st century skills.

Ninth international journal by Apaivatin et al. (2021), this study shows that STEM education on students' science process skills is 1.69. the standard deviation is 1.99. This means that STEM education can affect students' science process skills. The population in this article is all Thai university students. The type and research method of this article are quantitative, with data collection instruments and techniques using data recording. The data analysis in this article uses frequency, percentage, and meta-analysis. The relationship between the 9th international journal and this research is discussing the same topic regarding the effect of applying STEM on science process skills.

Tenth international journal by Barquilla & Cabili (2021), show that students in the experimental group i.e., STEM not only develop and improve their 21st century skills with the help of upgraded modules but also significantly improve their skills, their conceptual understanding and level of performance compared to the control group. The population in the article is class X students. The type and research design used are experimental and qualitative, data analysis techniques using achievement tests, design rubrics, ICT materials, modules, and STEM learning plans. Data analysis in this article uses the mean to measure central tendency, score dispersion, paired t-test and non-parametric test, and also data coding. The relationship of the 10th international journal with this research is to discuss the topic of the same variable, namely 21st century skills and STEM.

First national journal by Priyani & Nawawi (2020), this article show that Ethno-STEM learning assisted by basic advanced magnifying tools can further develop the Science Process Skills of students at SDN 29 Idai. The population of this article is all students of SD N 29 Idai. The type and method of this research article are classroom action research, with instruments and data collection using Science Process Skills observations and Student Worksheets. The data analysis of this article uses qualitative and quantitative descriptive. The relationship between the 1st national journal and this research is discussing the same topic regarding STEM and science process skills.

Second national journal by Mahjatia et al. (2020), this article shows that the STEM-integrated student worksheet to develop student science process skills (SPS) through the use of direct requests at public schools in Banjarmasin is functioning and successful and substantially tested by achieving very good science process skills (SPS) and science process skills (SPS). STEM-based student worksheet research for the preparation of student science process skills (SPS) through guided inquiry has several limitations, causing many shortcomings. STEM-based student worksheet materials on the use of Guided Inquiry can be used to further develop students' science process skills (SPS) to become better, teachers deliver material and become student facilitators to achieve learning objectives. This innovative work of STEM-based student worksheet can be considered or developed further to prepare student science process skills (SPS) by utilizing Guided Inquiry learning. Actually, the STEM-based student worksheet should be improved, this is the substance of the Technology, Engineering, and Mathematics segment.

Third national journal by Laisnima & Siregar (2020), this article shows that the increase in student learning outcomes n-Gain is normal by 0.53 in the medium class. The improvement of students' cycling ability by utilizing the STEM-Red module on redox materials and electrolysis cells in gifted classes is (78%). The population of this article is all science students at YABT Christian High School. Types and plans of the exam using RnD, with instruments and methods of collecting information using STEM-based modules and learning outcomes tests, surveys. Examination of exploratory information makes use of both subjective and quantitative. The third public diary's connection with this exploration is that both articles using the same theme in terms of STEM and science process capability.

Fourth national journal by Almuharomah et al. (2019), this article show that this module can be used based on of master's approval with classes that are fully achievable and supported by student reactions inappropriate classifications. The students' inventive reasoning capacity increased with an N-gain of 0.92 in the high grade. The STEM Physics module that coordinates the closest insight "beduk" to further develop imaginative reasoning abilities is worthy of being used as a companion for reading courses at school.

Fifth national journal by Dewi et al. (2017), this article show that there is a very large difference in reasoning ability and interaction ability between students who are shown the 7E learning cycle model in a virtuoso environment view and those who are use the regular model. The connection between this diary and this exploration is that it examines a similar subject concerning environmental acumen and process skills.

Conclusion

Based on the review of the articles that have been reviewed in the discussion above, it can be concluded that there are 10 international journals and 5 national journals that discuss STEM, local wisdom, science process skills, and the 21st century. In the 15 journals, it was found that STEM learning can increase students' self-confidence through investigation and also improve science process skills. STEM also performs problem solving in everyday life so that STEM is also believed to be a step to answer the challenges of the 21st century. In addition to STEM can develop and improve 21st century skills, STEM can also improve student understanding through the process skills carried out.

The implementation of STEM based on local wisdom in honing science process skills in the 21st century from 15 journals that have been described also found that students responded positively to learning because students felt more understanding, motivation and learning interest increased. This is also considered much more effective because students learn to explore themselves based on the culture or habits that exist in their environment so that students more easily understand the material. STEM learning based on local wisdom in addition to increasing students' creativity, critical thinking skills, and science process skills. Can also train students to preserve culture in Indonesia.

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