Journal of Education, Teaching, and Learning
Volume 9 Number 1 March 2024. Page 106-114
p-ISSN: 2477-5924 e-ISSN: 2477-8478

Journal of Education, Teaching, and Learning is licensed under
A Creative Commons Attribution-NonCommercial 4.0 International License.

EXPLORING ANALYSIS TEACHING MATERIALS NEEDS ON OPTIMALIZING NATURAL SCIENCE LEARNING

Septi Budi Sartika[1)], Suyidno[2)] Akbar Wiguna[3)]

[1)] *Universitas Muhammadiyah Sidoarjo, Indonesia*
E-mail: septibudi1@umsida.ac.id
[2)]*Universitas Lambung Mangkurat, Banjarmasin, Indonesia*
E-mail: suyidno_pfis@ulm.ac.id
[3)]*Universitas Muhammadiyah Sidoarjo, Indonesia*
E-mail: akbarwiguna@umsida.ac.id

Abstract. In learning, teachers must prepare teaching materials to support the implementation of learning, it is necessary to analyze the needs of teachers for teaching materials that support their routine activities. The participants were 144 natural science teachers', using random sampling techniques. Data collection techniques using a questionnaire are distributed via google form links with WhatsApp groups. An descriptive statistics, by describing the preferences of analysis teaching materials needs on 11 statements: current natural science learning system, support for teaching materials, types of teaching materials, current natural science teaching materials, level of difficulty of materials in teaching materials, development of teaching materials, contextual teaching materials, teaching materials based on local wisdom, smartphone-based teaching materials, development of electronic modules based on local wisdom, and plans for science materials integrated with local wisdom. This research contributes to explore initial data related to teachers' needs for relevant teaching materials that can be used as a basis for developing further teaching materials.

Keywords**:** Teachers' Needs, Optimizing Learning, Natural Science

I. INTRODUCTION

In the era of globalization, various science and technology products have colored various fields of human life (Kossybayeva et al., 2022), including the field of education. This changes the way science educators perceive and access information, media and technology, and opens up new opportunities in implementing science learning in schools (Haleem et al., 2022). Teachers must facilitate the development of students' critical, creative, communicative and collaborative thinking in understanding and evaluating science issues in local and global contexts (Asrizal et al., 2022). Learning is emphasized through case studies and science projects relevant to current global challenges (Markula & Aksela, 2022; Martinez, 2022). The use of technology makes science learning more engaging, facilitates virtual experiments and visualizes complex concepts (Wang et al., 2022). In addition, science educators must master various innovative teaching strategies and create creative environments to facilitate students as critical, creative, and innovative science learners in facing the challenges and opportunities in the era of globalization (Wu et al., 2023).

Globalization has increased interconnectedness and interdependence between nations and between people around the world through trade, investment, travel, popular culture, or other forms of interaction that make the boundaries of a country increasingly narrow (Ma & Dang, 2023). In line with the demands of the globalization era, the purpose of science learning is to integrate the understanding of science concepts and their applications in a global context, the development of higher order thinking skills, science and technology literacy, and relevant problem solving (Asrizal et al., 2022). Students can apply science concepts to develop local wisdom that has global competitiveness (Lubis et al., 2022). Students are accustomed to working like a scientist in solving global problems such as climate change, sustainability, global health, and so on (Guerrero & Torres-Olave, 2022). Students use big data, media and technology to conduct independent exploration and deepen their science understanding through various sources (Tang et al., 2023; Wang et al., 2022). In this case, students are familiarized with science literacy, criticizing and evaluating the science information found (Rochmah et al., 2023). Through science learning, students are prepared to become critical and creative individuals in managing local wisdom and ready to face challenges in a changing global society (Martinez, 2022).

Journal of Education, Teaching, and Learning
Volume 9 Number 1 March 2024. Page 106-114
p-ISSN: 2477-5924 e-ISSN: 2477-8478

In recent years, several review studies have been conducted to determine the various problems of science learning in the era of globalization. The results show that educators have difficulty teaching science concepts that are relevant to the latest developments (Kadıoğlu-Akbulut et al., 2023); difficulty providing practical experience due to limited laboratory facilities and equipment (Sanchez et al., 2023); lack of ICT mastery and difficulty applying it in science learning (Aidoo et al., 2022; Hennessy et al., 2022). In addition, Gupta et al. (2022) and (Tohri et al., 2022) found that science educators struggle to find or develop science learning materials that integrate global content with students' local realities. This is reinforced by the results of the researcher's initial study on the difficulties of educators in integrating local wisdom in science learning, namely: (1) the existence of local wisdom that is difficult to access or has not been integrated in science learning; (2) the potential of local wisdom is not fully recognized or understood by educators, especially if they come from different cultural backgrounds; (3) in an effort to keep up with global demands, sometimes science learning approaches tend to be based on global content, thus ignoring existing local wisdom. As a result; students find it difficult to understand and appreciate the contribution of local wisdom in the context of science; and (4) educators generally use existing learning media and are less interested in developing local wisdom-based media. As a result, the science learning approach used tends to ignore the values and local knowledge that exist in the environment around students.

Previous research results have shown various benefits of integrating local wisdom in science learning in schools. This integration is believed to be able to help students relate science concepts to their daily experiences (Wahyudiati* & Qurniati, 2023) ; maintain and preserve culture and the surrounding environment (M. A. Pratiwi & Wikantiyoso, 2022); improve unique skills related to local wisdom (Abas et al., 2022; Dermawan, 2023); and inspire students to create innovations in a sustainable manner and relevant to their local context (Parhan et al., 2023; Saphira, 2022). Thus, this integration is expected to be able to provide preference needs for educators in developing local resources to face opportunities and challenges in a global society.

Based on the description above, the purpose of this study is to analyze the preferences of teachers' needs in maximizing science learning in the era of globalization. With the achievement of this research objective; educators are expected to facilitate students to develop critical, creative, collaborative, and communicative thinking in applying science concepts in technological products and problem solving in local and global contexts. Through collaborative efforts and awareness of local wisdom, educators can overcome the problem of local wisdom-based natural science learning resources and create a more diverse, inclusive and meaningful learning environment.

In accordance with the above, the following research questions were posed:

1. How the current natural science learning?
2. How is the needs analysis of teaching materials in science learning in secondary school?

Technology is considered to be a powerful driving force for educational reform and innovation. In 2017, Educause Center for Analysis and Research identified the learning environment supported by technology as the strategic investment of institutions (Brook, 2017; Li et al., 2019). Educational service industry institutions, can survive in this era of digital revolution only through certain transformation, and smart classrooms can become a bridge to the future (L. S. Huang et al., 2019). Therefore, with the rapid development of intelligent technology to improve the learning environment. They believe that smart classrooms can play an important role in efficiently spreading knowledge (Guinard et al., 2010), adapting to new learning paradigms and teaching methods (Ha & Kim, 2014; Segredo et al., 2017), obtaining learning resources (R. Huang et al., 2013), improving teaching interaction (Akhrif et al., 2020; Jin et al., 2019) and collecting feedback data (Cebrián et al., 2020).

However, there are few studies on the preferences of teachers and students in the learning environment of smart classroom. Learning environment preference refers to the attitude or liking of learners for many elements such as learning activities, learning resources, software and hardware equipment in the environment after having the learning experience in the environment. So, that students get meaningful learning experiences, teachers need to pay attention to and arrange teaching materials to optimize learning activities. Therefore, the subject that plays an important role in the implementation of learning is the teacher (Dai et al., 2023).

The teacher as one of the determinants of learning success, plays a very important role in designing the learning process including teaching materials, methods, and learning media to achieve the expected goals. For this reason, it is absolutely necessary to have a teacher who is creative, active, and has sufficient competence to prepare meaningful learning for students. Learning will be more meaningful if students experience what they learn by activating more senses than just listening to the teacher's explanation. Incorporating experiences into the learning that students learn is one of the processes of gaining knowledge in science learning.

Philosophically, natural science is concerned with finding out about nature in a systematic manner. Science is a collection of systematic theories, its application is generally limited to natural phenomena, born and develops through scientific methods such as observation and experimentation and demands scientific attitudes such as curiosity, openness, honesty, and so on. Natural science is a branch of science that bases the scientific development of its knowledge. The application of the scientific approach in science learning in the 2013 curriculum is an affirmation of the scientific approach to learning. Learning with a scientific approach plays a major role in fostering the ability to think, work, and be scientific, and communicate as an important aspect of life skills. Science learning in junior high schools should

Journal of Education, Teaching, and Learning
Volume 9 Number 1 March 2024. Page 106-114
p-ISSN: 2477-5924 e-ISSN: 2477-8478

emphasize providing direct learning experiences through the use and development of process skills and scientific attitudes (Dewi et al., 2021).

Research by (Kirchoff et al., 2014) explained that Scientific expertise in many disciplines depends on learning to accurately classify novel (unstudied) examples into categories. Activities in training to optimize students' analytical skills have been undertaken by science teachers at Nganjuk Regency. The results of the training was very good where teachers can master student analytical concept, it is recorded that an improvement was achieved higher for 82.40% compared to their skill prior to the training score. Thus, it is to remark that this traning has received a positive responses from the participants (Yakub et al., 2021).

Teachers with pedagogic competence, for example, can design and implement learning and must create fun learning; one way is by using learning media. Learning media is an intermediary or channelling messages and information from sources that will be received by the recipient of the message that occurs in the learning process. Media use in learning activities is essential to facilitate the learning process to achieve maximum results; the material can be well received when delivered with suitable media. The use of media in learning must consider students in terms of the needs and readiness of the students themselves, so care is needed in choosing media. In addition to making it easier for teachers to deliver subject matter, the media is also expected to improve student learning outcomes (Hardiansyah & Wahdian, 2023).

II. Method

Participants

The participants in this study 144 natural science teachers' at secondary school in Indonesia, with random sampling techniques.

The participants were selected using random sampling, with share link google form through whatsapp message. The participants come from Java, Sumatera, Kalimantan, Sulawesi, Papua, Bali, dan Nusa Tenggara. google form opened for a week via whatsapp chain message.

Instrument

The questionnaire instrument uses selected and reasoned statements that have been validated by experts consisting of 2 natural science education academics and 1 secondary school natural science teacher practitioner, which are declared valid and suitable for use as research instruments.

Procedure and analysis

The author compiled a questionnaire instrument with 11 statements to analyze the needs of teachers' teaching materials in maximizing science learning in junior high school. The questionnaire was then validated by 2 academics and 1 practitioner and declared valid and suitable for use. The questionnaire was compiled on google form and then distributed by Whatsapp application. Questionnaire filling was carried out for one week. The questionnaire data was then analyzed using descriptive statistics.

III. Result And Discussion

First, to determine current of natural science learning in secondary school, then respondents will fill in the current science learning, which has been done face-to-face 100% by still using online platforms and applications to facilitate students in understanding natural science teaching materials.

Nowdays, we are in the post-covid-19 pandemic or it has been stated that we are entering the covid-19 pandemic-free era (Nur, 2022). This is enough to bring changes to all sectors of life, as well as the education sector (Eliyinus Waruwu, Ayler Beniah Ndraha, 2022). One level of education that has experienced considerable changes after the covid-19 pandemic is secondary School (Ramadhan et al., 2022). This secondary school level cognitively also experiences a transition phase from the real operational stage to the concrete operational stage (Islamadina & Winingsih, 2022). Subjects that are indicated to be influential are Natural Science subjects. At the secondary school level, science is delivered in an integrated form between biology, physics, and chemistry (Agustami et al., 2017). The following are the results of a questionnaire of secondary school natural science teachers' needs with teaching material to optimalizing natural science learning:

1. Current Natural Science Learning Process

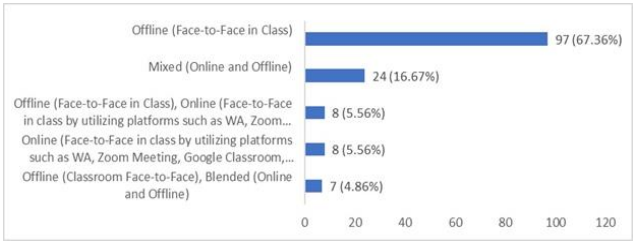

Fig 1. Graph of Current Natural Science Learning Process

Based on Figure 1, it was found that 67.36% implemented offline learning with face-to-face in class, 16.67% implemented a mixture of online and offline, 5.56% implemented offline and online learning by utilizing platforms such as Whatsapp, Zoom Meeting, Google Meet, Google Classroom, 5.56% implemented online learning in class by utilizing platforms such as Whatsapp, Zoom Meeting, Google Meet, Google Classroom, and 4.86% with offline learning and a mixture of offline and online with platforms such as Whatsapp, Zoom Meeting, Google Meet, Google Classroom.

Science learning in junior high schools is carried out face-to-face in the classroom, this is in accordance with the Ministry of Education and Culture's policy instructions that face-to-face learning activities began to be implemented after the co-19 pandemic (Ningsih et al., 2022). Learning from the covid-19 pandemic, educators and students have been able to adapt to changes in the development of educational facilities and infrastructure appropriately due to demands (Suhandi & Robi'ah, 2022). Educators are still comfortable with technological support, for example

Journal of Education, Teaching, and Learning
Volume 9 Number 1 March 2024. Page 106-114
p-ISSN: 2477-5924 e-ISSN: 2477-8478

teaching materials that can assist educators in delivering material in class (Zahwa & Syafi'i, 2022). This teaching material must of course be truly developed based on the real needs of students and educators, so that it can improve learning outcomes.

2. Use of Teaching Material in Natural Science Learning

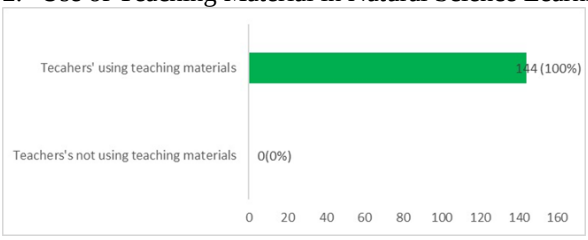

Fig 2. Diagram of Teaching Material in Natural Science Learning

Based on Figure 2, it is obtained that 100% of teachers use teaching materials in science learning. The teaching materials used are quite varied in type. Teachers tend to choose teaching materials that make it easier for teachers and students to understand the teaching material.

A good educator, of course, will facilitate students rather than burden them in the learning process. This is what is further indicated will cause students' trust in educators. The use of teaching materials in learning activities is absolutely necessary (Qondias et al., 2019), with the aim of helping students understand teaching materials. Teaching materials that are interactive and communicative and user-friendly are special references in the development of teaching materials (Wardani & Susilowibowo, 2021).

3. Teaching Material Used Natural Science Learning Process

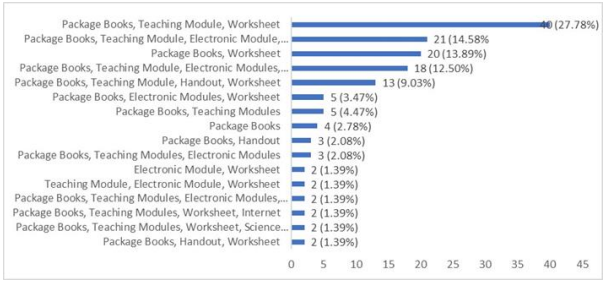

Fig 3. Teaching Material Used Natural Science Learning Process

Based on Figure 3, it was found that 27.78% used Package Books, Teaching Modules, Worksheets, 14.58% used Package Books, Teaching Modules, Electronic Modules, Handouts, Worksheets, 13.89% used Package Books, Worksheets, 12.50% used Package Books, Teaching Modules, Electronic Modules, Worksheets, 9.03% used Package Books, Teaching Modules, Electronic Modules, Worksheets, 3.47% used Package Books, Electronic Modules, Worksheets, 3.47% used Package Books, Teaching Modules, 2. 08% used Package Books, Handouts, 2.08% used Package Books, Teaching Modules, Electronic Modules, 1.39% used Electronic Modules, Worksheet, 1.39% used Teaching Modules, Electronic Modules, Worksheet, 1.39% used Package Books, Teaching Modules, Electronic Modules, Handouts, Student Worksheet, Practical Tools, 1.39% used Package Books, Teaching Modules, Worksheet, Internet, 1.39% used Package Books, Teaching Modules, Worksheet, Science Laboratory Tools, and 1.39% used Package Books, Handouts, Worksheet.

Package books have become the main learning resource for students, this is because educators always make the basis for learning activities at school. There is nothing wrong with the presence of package books, where along with the development of globalization the presence of paper will be replaced with enough in one hand, namely the gadget. Some educators, indicated to have followed the global flow due to the impact of the covid-19 pandemic, others still persist with packet books as a source of learning for most students. For this reason, it is necessary to follow changes if it is felt to be good, it should still be done as well as the benefits of information technology and digital learning media after the covid-19 pandemic.

4. Teaching Materials Support in Natural Science Learning Process

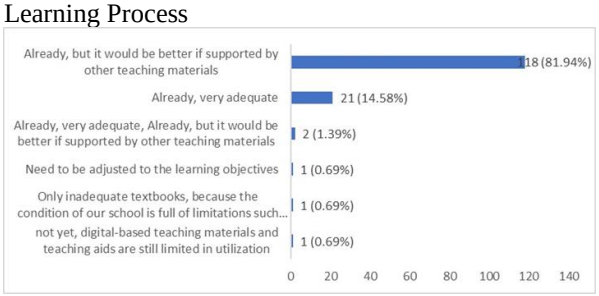

Fig 4. Graph of Teaching Materials Support in Natural Science Learning Process

Based on Figure 4, it was found that 81.91% of teaching materials support the science learning process but should be supported by other teaching materials, 14.58% of teaching materials support science learning, 1.39% of teaching materials support science learning and should be supported by other teaching materials, 0.69% of teaching materials need clear learning objectives, 0.69% of teaching materials are only textbooks due to limited internet networks, and 0.69% of teaching materials do not support learning due to limited practical equipment.

Generally, an educator is equipped with skills in developing teaching materials that function to support learning activities (Ramadhani et al., 2020). Some types of educators tend to be quickly adaptive to changing times or vice versa (Asriati, 2012). Technological adaptation is carried out throughout life, because technology continues to develop and make human work easier (Hidayah & Syahrani, 2022). Educators who are adaptive to technology will have an impact on the quality of learning.

Journal of Education, Teaching, and Learning
Volume 9 Number 1 March 2024. Page 106-114
p-ISSN: 2477-5924 e-ISSN: 2477-8478

5. Ease of Understanding Material in Natural Science Materials

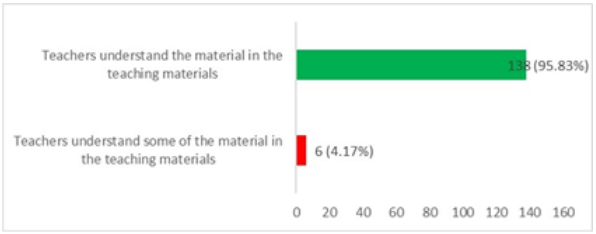

Fig 5. Graph of Ease Understanding Materials in Natural Science Materials

Based on Figure 5, it was found that 95.83% of teachers understood the material in the teaching materials and 4.17% of teachers did not fully understand the science teaching materials. Reasons related to why they do not understand the material in the teaching materials can be further revealed.

Teaching materials are said to be a supporting element in the learning process. Teaching materials that are suitable for use should pay attention to the criteria of validity, practicality, and effectiveness when developed. A prototype will be suitable for use if it is valid, practical, and effective (Nieveen, 2021). Teaching materials that are difficult to understand can be said that they have not in detail reviewed the validity, practicality, and effectiveness.

6. Developing Teaching Materials to Support Natural Sciences Learning

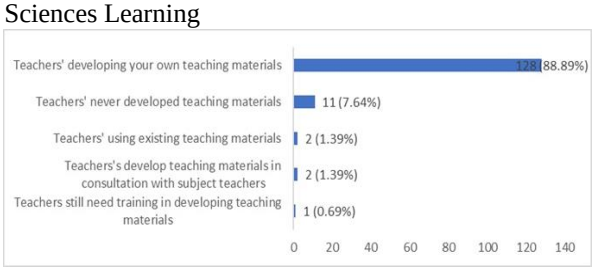

Fig 6. Diagram of Developing Teaching Materials to Support Natural Science Learning

Based on Figure 6, it was found that 88.89% of teachers developed their own teaching materials, 7.64% of teachers had never developed teaching materials, 1.39% of teachers used existing teaching materials, 1.39% of teachers developed teaching materials through subject teacher meetings, and 0.69% of teachers had never developed teaching materials at all.

The professional association of educators is always a forum for sharing good practices towards the development of Science and Technology. Educators through MGMP are given a forum to exchange knowledge in one subject (Najri, 2020). This encourages educators to continue to learn and develop, to achieve common goals, namely learning outcomes. These learning outcomes are also supported by the development of teaching materials (Farhana et al., 2021).

7. Developing Natural Science Teaching Materials Based Contextual

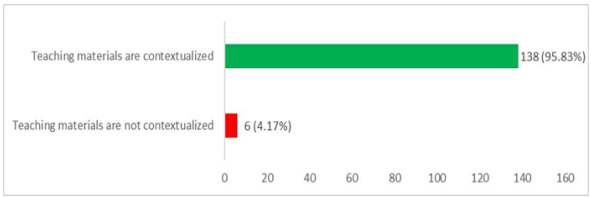

Fig 7. Graph of Developing Natural Science Teaching Materials Based Contextual

Based on Figure 7, The results obtained were 95.83% of teachers developed contextual-based teaching materials and 4.17% of teachers had not developed contextual-based teaching materials. The reason for not developing contextual-based teaching materials needs further research.

The development of contextual teaching materials will be more easily accepted by students than textual (N. A. Pratiwi & Listiadi, 2021). Contextual refers to examples in everyday life and an environment that is not much different from the environment of learners. Contextual will be much more meaningful, and provide a better picture of information processing (Sinaga & Silaban, 2020).

8. Use of Natural Science Teaching Maaterials Based on Local Wisdom

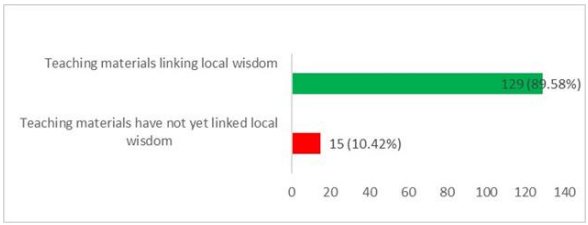

Fig 8. Diagram of Use of Natural Science Teaching Materials Based on Local Wisdom

Based on Figure 8, the results obtained are 89.58% of teachers have linked learning with local wisdom and 10.42% of teachers have never linked learning with local wisdom.

Learning with local wisdom is not new. This has long been done with the aim that local wisdom is not extinct. Learning with local wisdom will improve students' science literacy skills (Khery et al., 2020).

9. Development Natural Science Teaching Materials Based
Smartphone

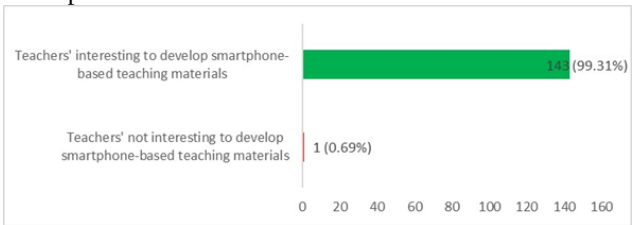

Fig 9. Development Natural Science Teaching Materials Based Smartphone

Journal of Education, Teaching, and Learning
Volume 9 Number 1 March 2024. Page 106-114
p-ISSN: 2477-5924 e-ISSN: 2477-8478

Based on Figure 9, 99.31% of teachers were interested in developing smartphone-based teaching materials and 0.69% were not interested in developing smartphone-based teaching materials due to inadequate internet facilities.

The use of smartphones in the past few years has been quite widespread due to the tendency of necessity (Sawitri et al., 2019). Humans need one hand in the hand to be able to access everything. The development of teaching materials with smartphones is very possible, because it is considered quite effective and efficient (Failasuf et al., 2022), which of course will pay more attention to the advantages and disadvantages of the smartphone application product.

10. Development Electronic Modules Based Local Wisdom

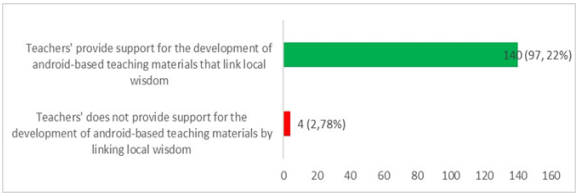

Fig 10. Development Electronic Modules Based Local Wisdom

Based on Figure 10, it was found that 97.22% were in favor, and others were prohibited from bringing smartphones, unrelated, not yet having electronic modules, and limited adequate facilities and infrastructure to access the internet.

The development of teaching materials by utilizing smartphone features provides a good response by educators (Jazuli et al., 2018). Smartphones are able to summarize material, also making it easier for educators to evaluate the learning process. Features in smartphones that show questions, not textual questions but case questions where questions have many alternative answers, thus reducing copy and paste through Google

Table 1
Educators Response to Natural Science Materials Integrates Local Wisdom

Category of Local Wisdom	Local Wisdom	Natural Science Material
Specialty Food	Soto Banjar, Nasi Jagung, Roti, Mie Habang, Songko-songko Jangang, Opak, Dodol, Jamu	Additive & Addictive Subtances
Typical Fauna	Kupang, Milkfish, Shrimp	Animal Breeding
Typical Flora	Local Plant Cultivation, Herbal Plant Cultivation	Plant Reproduction
Local Tourism	Lapindo Mud, Waterfall, Bendo Reservoir, Floating Market, Nias Island Stone Jumping, Mountains, Natural Sites, Brebes Mangrove Beach, Boats in Pantura, Pine Forest, Harvest Festival, Sea Alms, Barito River, City of a Thousand Rivers	Pressure, Energy, Momentum
Local Food Industry	Fish Processing, Salted Egg Making, Tofu Making, Tempeh, Tape	Natural Preservatives
Local Industry	Making brooms from head fibers, making brooms from Glagah Arjuna	Eco-Friendly Technology
Local Agriculture	Peatland, Wetland, Mina Padi, Empon-empon Cultivation, Watermelon Cultivation, Oil Palm Plantation, Onion Cultivation, Sugarcane Plantation, Sustainable Agriculture	Natural Ecosystem
Culture Heritage	Batik, Syawalan Tradition	Natural Dyes, Classification of Living Things
Traditional Games	Tug of War, Engkle, Tenggedi Lo Buawu	Force & Motion
Traditional Arts	Dug-dug Madura, Reog Ponorogo	Vibration & Sound Wave
Traditional Fisheries	Cage Fish Farming, Pond Fish Farming	Nature Ecosystem
Traditional Environmental Processing	Inorganic Waste Recycling, Composting	Nature Concervation

Based on Table 1, it is obtained that the category of local wisdom from the results of the response of science educators includes typical food, typical flora, typical fauna, local tourism, local food industry, local industry, local agriculture, cultural heritage, traditional games, traditional arts, traditional fisheries, and traditional environmental processing.

Local wisdom integrated into this science subject will attract students' deeper interest (Andriana, et al, 2017), because human daily activities have science concepts. This local wisdom content will make the nation's cultural heritage sustainable and continue to exist until the next generations (Lestari & Maulida, 2022). Maintaining local wisdom, means helping to protect the nation from the extinction of civilization.

IV. Conclusions

Based on the results and discussion, it can be concluded as follows 1) science learning in junior high schools is carried out by face-to-face and online methods using online platform applications such as WhatsApp, Zoom Meeting, Google Meet, Google Classroom, and others, 2) science learning uses teaching materials, 3) science teaching materials used include package books, teaching modules, electronic modules, and handouts, 4) educators have used teaching materials to support science learning, 5) science teaching materials make it easier for educators to deliver

material, 6) educators develop science teaching materials, 7) the development of science teaching materials is contextual, 8) most educators have known local wisdom-based science teaching materials, 9) smartphone-based science teaching materials are very interesting to develop, 10) most educators support the development of local wisdom-based teaching materials, and educators' responses related to local wisdom categories include typical food, typical flora and fauna, local tourism, local food industry, local industry, local agriculture, cultural heritage, traditional games, traditional arts, traditional fisheries, and traditional environmental processing.

REFERENCES

Abas, A., Aziz, A., & Awang, A. (2022). A Systematic Review on the Local Wisdom of Indigenous People in Nature Conservation. *Sustainability (Switzerland)*, *14*(6). https://doi.org/10.3390/su14063415

Agustami, R. P., Wiyanto, & Alimah, S. (2017). Persepsi Guru dan Siswa Terhadap Pembelajaran IPA Terpadu Serta Implikasinya di SMP. *Journal of Innovative Science Education*, *6*(1), 96–103.

Aidoo, B., Macdonald, M. A., Vesterinen, V. M., Pétursdóttir, S., & Gísladóttir, B. (2022). Transforming Teaching with ICT Using the Flipped Classroom Approach: Dealing with COVID-19 Pandemic. *Education Sciences*, *12*(6). https://doi.org/10.3390/educsci12060421

Akhrif, O., Benfares, C., El Bouzekri El Idrissi, Y., & Hmina, N. (2020). Collaborative approaches in smart learning environment: A case study. *Procedia Computer Science*, *175*, 710–715. https://doi.org/10.1016/j.procs.2020.07.105

Asrizal, Yurnetti, & Usman, E. A. (2022). Ict Thematic Science Teaching Material With 5E Learning Cycle Model To Develop Students' 21St-Century Skills. *Jurnal Pendidikan IPA Indonesia*, *11*(1), 61–72. https://doi.org/10.15294/jpii.v11i1.33764

Cebrián, G., Palau, R., & Mogas, J. (2020). The smart classroom as a means to the development of ESD methodologies. *Sustainability (Switzerland)*, *12*(7), 2005–2014. https://doi.org/10.3390/su12073010

Dai, Z., Xiong, J., Zhao, L., & Zhu, X. (2023). Smart classroom learning environment preferences of higher education teachers and students in China: An ecological perspective. *Heliyon*, *9*(6), e16769. https://doi.org/10.1016/j.heliyon.2023.e16769

Dewi, W. S., Mairizwan, M., Afrizon, R., & Hidayati, H. (2021). The Improvement of The Competency of Science Teachers Using Science KIT: Optimizing Scientific Learning. *Indonesian Journal of Science and Mathematics Education*, *4*(1), 89–98. https://doi.org/10.24042/ijsme.v4i1.7956

ELIYUNUS WARUWU, AYLER BENIAH NDRAHA, D. L. (2022). Peluang Dan Tantangan G20 Dalam Transformasi Manajemen Pendidikan Di Era Revolusi Industri 4.0 Dan Civil Society 5.0 Pasca Pandemi Covid-19. *Jurnal Ilmiah Maksitek*, *7*(3), 26–32.

Failasuf, C., Ihwan Rahman Bahtiar, & Ilham, A. (2022). Analisis Kebutuhan Pengembangan Bahan Ajar Sintaksis Arab Berbasis Android Terintegrasi Keterampilan Memecahkan Masalah. *Jurnal Educatio FKIP UNMA*, *8*(1), 157–163. https://doi.org/10.31949/educatio.v8i1.1822

Farhana, F., Suryadi, A., & Wicaksono, D. (2021). Pengembangan Bahan Ajar Berbasis Digital Pada Mata Pelajaran Bahasa Inggris Di Smk Atlantis Plus Depok. *Instruksional*, *3*(1), 1. https://doi.org/10.24853/instruksional.3.1.1-17

Guerrero, G. R., & Torres-Olave, B. (2022). Scientific literacy and agency within the Chilean science curriculum: A critical discourse analysis. *Curriculum Journal*, *33*(3), 410–426. https://doi.org/10.1002/curj.141

Guinard, D., Fischer, M., & Trifa, V. (2010). Sharing using social networks in a composable web of things: Pervasive computing and communications workshops. *8th IEEE International Conference*, 702–707.

Ha, I., & Kim, C. (2014). The research trends and the effectiveness of smart learning. *International Journal of Distributed Sensor Networks*, *2014*. https://doi.org/10.1155/2014/537346

Haleem, A., Javaid, M., Qadri, M. A., & Suman, R. (2022). Understanding the role of digital technologies in education: A review. *Sustainable Operations and Computers*, *3*(May), 275–285. https://doi.org/10.1016/j.susoc.2022.05.004

Hennessy, S., D'Angelo, S., McIntyre, N., Koomar, S., Kreimeia, A., Cao, L., Brugha, M., & Zubairi, A. (2022). Technology Use for Teacher Professional Development in Low- and Middle-Income Countries: A systematic review. *Computers and Education Open*, *3*(December 2021), 100080. https://doi.org/10.1016/j.caeo.2022.100080

Hidayah, A., & Syahrani, S. (2022). Internal Quality Assurance System Of Education In Financing Standards and Assessment Standards. *Indonesian Journal of Education (INJOE)*, *3*(2), 291–300. https://doi.org/10.54443/injoe.v3i2.35

Huang, L. S., Su, J. Y., & Pao, T. L. (2019). A context aware Smart classroom architecture for smart campuses. *Applied Sciences (Switzerland)*, *9*(9). https://doi.org/10.3390/app9091837

Huang, R., Yang, J., & Zheng, L. (2013). The Components and Functions of Smart Learning Environments for Easy, Engaged and Effective Learning The Demands on Rebuilding Learning Environments in Information Society. *International Journal for Educational Media and Technology*, *7*(1), 4–14.

Jazuli, M., Azizah, L. F., & Meita, N. M. (2018). Pengembangan Bahan Ajar Elektronik Berbasis Android Sebagai Media Interaktif. *LENSA (Lentera Sains): Jurnal Pendidikan IPA*, *7*(2), 47–65. https://doi.org/10.24929/lensa.v7i2.22

Jin, N., Yang, F., Yan, M., Feng, Y., Zhuang, Y., Liu, H.,

Kwok, P. K., & Wen, K. (2019). User perceptions of smart class services in teaching and learning interactions. *Procedia CIRP*, *83*(March), 785–788. https://doi.org/10.1016/j.procir.2019.04.329

Kadıoğlu-Akbulut, C., Cetin-Dindar, A., Acar-Şeşen, B., & Küçük, S. (2023). Predicting Preservice Science Teachers' TPACK through ICT usage. *Education and Information Technologies*, 11269–11289. https://doi.org/10.1007/s10639-023-11657-0

Khery, Y., Rosma Indah, D., Aini, M., & Asma Nufida, B. (2020). Urgensi Pengembangan Pembelajaran Kimia Berbasis Kearifan Lokal dan Kepariwisataan untuk Menumbuhkan Literasi Sains Siswa. *Jurnal Kependidikan: Jurnal Hasil Penelitian Dan Kajian Kepustakaan Di Bidang Pendidikan, Pengajaran Dan Pembelajaran*, *6*(3), 460. https://doi.org/10.33394/jk.v6i3.2718

Kirchoff, B. K., Delaney, P. F., Horton, M., & Dellinger-Johnston, R. (2014). Optimizing learning of scientific category knowledge in the classroom: The case of plant identification. *CBE Life Sciences Education*, *13*(3), 425–436. https://doi.org/10.1187/cbe.13-11-0224

Kossybayeva, U., Shaldykova, B., Akhmanova, D., & Kulanina, S. (2022). Improving teaching in different disciplines of natural science and mathematics with innovative technologies. *Education and Information Technologies*, *27*(6), 7869–7891. https://doi.org/10.1007/s10639-022-10955-3

Li, Y., Yang, H. H., MacLeod, J., & Dai, J. (2019). Developing the rotational synchronous teaching (RST) model: Examination of the connected classroom climate. *Australasian Journal of Educational Technology*, *35*(1), 116–134. https://doi.org/10.14742/ajet.4010

Lubis, S. P. W., Suryadarma, I. G. P., Paidi, & Yanto, B. E. (2022). The Effectiveness of Problem-based learning with Local Wisdom oriented to Socio-Scientific Issues. *International Journal of Instruction*, *15*(2), 455–472. https://doi.org/10.29333/iji.2022.15225a

Ma, J., & Dang, H. (2023). Thinking About Globalizaton as an Integration Process. *Journal of Global Information Management*, *31*(6), 1–14. https://doi.org/10.4018/jgim.321175

Markula, A., & Aksela, M. (2022). The key characteristics of project-based learning: how teachers implement projects in K-12 science education. *Disciplinary and Interdisciplinary Science Education Research*, *4*(1). https://doi.org/10.1186/s43031-021-00042-x

Martinez, C. (2022). Developing 21st century teaching skills: A case study of teaching and learning through project-based curriculum. *Cogent Education*, *9*(1). https://doi.org/10.1080/2331186X.2021.2024936

Najri, P. (2020). MGMP Dalam Meningkatkan Keprofesionalan Guru Mata Pelajaran. *AKTUALITA Jurnal Penelitian Sosial Dan Keagamaan*, *10*(1), 130–144. www.ejournal.annadwahkualatungkal.ac.id

NINGSIH, W., Yani, A., & Wati, E. (2022). Tantangan Dan Kesulitan Guru, Orang Tua Dan Siswa Dalam Pelaksanaan Pembelajaran Tatap Muka pada Era New Normal Pandemi Covid-19. *Al-Mafahim: Jurnal Pendidikan Guru Madrasah Ibtidaiyah*, *5*(1), 1–7. https://doi.org/10.53398/jm.v5i1.116

Nur, Z. (2022). Efektivitas Pembelajaran Pasca Pandemi covid-19 di MTs Negeri 1 Makassar. *Educandum*, *8*(1), 121–128. http://jurnal.stkipalmaksum.ac.id/index.php/Sintaksis/article/view/183/183

Parhan, M., Febriansyah, D., & Dwiputra, K. (2023). *A Systematic Literature Review on Local Wisdom Actualization in Character Education to Face the Disruption Era*. *4*(3), 371–379. https://doi.org/10.46843/jiecr.v4i3.675

Pratiwi, M. A., & Wikantiyoso, R. (2022). Local Wisdom as Cultural Resilience on Tourism Activities (Case Study: Penglipuran Bali Traditional Village). *Local Wisdom : Jurnal Ilmiah Kajian Kearifan Lokal*, *14*(1), 95–105. https://doi.org/10.26905/lw.v14i2.6857

Pratiwi, N. A., & Listiadi, A. (2021). Pengembangan Bahan Ajar Elektronik Mata Pelajaran Praktikum Akuntansi Lembaga/ Instansi Pemerintah Kelas XI SMK Berbasis Kontekstual. *Jurnal Pendidikan Akuntansi (JPAK)*, *9*(2), 220–231. https://doi.org/10.26740/jpak.v9n2.p220-231

Qondias, D., Ada Winarta, I. K., & . S. (2019). Pengembangan Bahan Ajar Berbasis Pendekatan Saintifik pada Mata Kuliah Metodologi Penelitian. *Jurnal Penelitian Dan Pengembangan Pendidikan*, *3*(2), 145. https://doi.org/10.23887/jppp.v3i2.17393

Ramadhan, I., Hardiansyah, M. A., Firmansyah, H., Ulfah, M., Syahrudin, H., & Suriyanisa, S. (2022). Pelaksanaan Pembelajaran Tatap Muka Terbatas : Strategi Pembelajaran Di Smp Swasta Pasca Pandemi Covid 19. *Jurnal Muara Pendidikan*, *7*(2), 316–326. https://doi.org/10.52060/mp.v7i2.848

Ramadhani, A. I., Vebrianto, R., & Anwar, A. (2020). Upaya Integrasi Nilai-Nilai Islam dalam Pembelajaran IPA di Madrasah Ibtidaiyah. *Instructional Development Journal (IDJ)*, *3*(3), 188–202. http://ejournal.uin-suska.ac.id/index.php/IDJ

Rochmah, A. A., Marianti, A., & ... (2023). Science Literacy Ability of High School Students in the Integration of Steam Learning with Mind Mapping Techniques on Virus Materials. *Journal of Innovative …*, *12*(37), 97–106. https://journal.unnes.ac.id/sju/index.php/jise/article/view/66050%0Ahttps://journal.unnes.ac.id/sju/index.php/jise/article/download/66050/24211

Saphira, H. V. (2022). Integrating Local Wisdom-Based Learning To Preparing The Pancasila Students' Profile, Yes or No? *International Journal of Current Educational Research*, *1*(1), 18–35. https://doi.org/10.53621/ijocer.v1i1.136

Sawitri, Y., Yannaty, I. A., Widyastika, S. I., Harumsih, T. D., & Musyarofah, H. F. (2019). Dampak penggunaan smartphone terhadap perkembangan anak usia dini.

"Pengembangan Sumberdaya Menuju Masyarakat Madani Berkearifan Lokal," 691–697. https://semnaslppm.ump.ac.id/index.php/semnaslppm/article/view/108

Segredo, E., Miranda, G., & León, C. (2017). Hacia la educación del futuro: El pensamiento computacional como mecanismo de aprendizaje generativo. *Education in the Knowledge Society (EKS)*, *18*(2), 33–58. https://doi.org/10.14201/eks2017182335

Sinaga, M., & Silaban, S. (2020). Implementasi Pembelajaran Kontekstual untuk Aktivitas dan Hasil Belajar Kimia Siswa. *Gagasan Pendidikan Indonesia*, *1*(1), 33. https://doi.org/10.30870/gpi.v1i1.8051

Suhandi, A. M., & Robi'ah, F. (2022). Guru dan Tantangan Kurikulum Baru: Analisis Peran Guru dalam Kebijakan Kurikulum Baru. *Jurnal Basicedu*, *6*(4), 5936–5945. https://doi.org/10.31004/basicedu.v6i4.3172

Tohri, A., Rasyad, A., Sururuddin, M., & Istiqlal, L. M. (2022). The urgency of Sasak local wisdom-based character education for elementary school in East Lombok, Indonesia. *International Journal of Evaluation and Research in Education*, *11*(1), 333–344. https://doi.org/10.11591/ijere.v11i1.21869

Wahyudiati*, D., & Qurniati, D. (2023). Ethnochemistry: Exploring the Potential of Sasak and Javanese Local Wisdom as a Source of Chemistry Learning to Improve the Learning Outcomes of Pre-Service Teachers. *Jurnal Pendidikan Sains Indonesia*, *11*(1), 12–24. https://doi.org/10.24815/jpsi.v11i1.26790

Wardani, D. A., & Susilowibowo, J. (2021). Pengembangan Bahan Ajar Elektronik Berbasis Flipbook Sebagai Pendukung Implementasi Pembelajaran Scientific Approach Dalam Pembelajaran Daring Pada Materi Persediaan Kelas XI di SMK Yapalis Krian. *Jurnal Pendidikan Ekonomi: Jurnal Ilmiah Ilmu Pendidikan, Ilmu Ekonomi, Dan Ilmu Sosial*, *15*(2), 231–241. https://doi.org/10.19184/jpe.v15i2.26410

Yakub, P., Puspitawati, R. P., & Bashri, A. (2021). Developing analytical skills through optimizing the learning process by science teachers in Nganjuk Regency. *Journal of Community Service and Empowerment*, *2*(2), 77–82. https://doi.org/10.22219/jcse.v2i2.16750

Zahwa, F. A., & Syafi'i, I. (2022). Pemilihan Pengembangan Media Pembelajaran Berbasis Teknologi Informasi. *Equilibrium: Jurnal Penelitian Pendidikan Dan Ekonomi*, *19*(01), 61–78. https://doi.org/10.25134/equi.v19i01.3963