Journal of Educational Development 12 (1) (2024): 42-52 p-ISSN 2085-4943 | e-ISSN 2502-4469
Pascasarjana Universitas Negeri Semarang https://journal.unnes.ac.id/journals//jed

Designing an Innovative Educational Framework for "How We Live and Grow" Using the 4D Model

Esty Setyo Utaminingsih[*1], Belita Yoan Intania[2], Hanik Aida[2], Mahi Sultan Salama[2], Izza Melati Sukma[2]

Sekolah Tinggi Agama Islam Muhammadiyah Blora, Indonesia
Master of Primary Education, Sekolah Pascasarjana, Universitas Negeri Semarang, Indonesia

*Corresponding Author: estyutami@staimuhblora.ac.id

Received: 2024-01-05. Accepted: 2024-03-28. Published: 2024-05-07.

Abstract. In the contemporary educational landscape, the need for effective and adaptable evaluation tools is increasingly critical. This study embarked on designing an innovative educational framework for the topic 'How We Live and Grow' using the Research and Development (R&D) method, articulated through the 4D model (Define, Design, Develop, and Disseminate). The objective was to develop a multifaceted instrument that supports primary education by bridging theoretical knowledge and practical application across cognitive domains from basic knowledge (C1) to creative synthesis (C6). The methodology involved collaborative design with educators, iterative development, and rigorous expert validation. Results showed that the framework successfully produced 20 multiple-choice questions, validated with high scores ranging from 86.25% to 91.25% by material and language experts, affirming the tool's reliability and educational value. This study not only enhanced the quality of teaching through tailored, context-relevant assessments but also contributed to educational research by developing a validated instrument that effectively measures and supports diverse cognitive skills in real-world settings. The framework's potential for broad application suggests a significant impact on shaping future educational practices and assessments.

Key words: elementary education, educational framework, 4D model, cognitive evaluation, instrument validation

How to Cite: Utaminingsih, E. S., Intania, B. Y., Aida, H., Salama, M. S., Sukma, I. M. (2024). Designing an Innovative Educational Framework for "How We Live and Grow" Using the 4D Model. The Journal of Educational Development 12 (1) 2024,42-52.

INTRODUCTION

One of the fundamental aspects of the educational process, especially in primary education, is the development of learning evaluation tools or questions (Pomalato et al., 2021). Quality evaluation instruments are not simply measurement tools for learning achievement against the student's learning outcome (Rusilowati, 2018), but they act in a diagnostic manner to indicate the strengths and weaknesses in a learning process and become input material for the renewal and development of more effective curricula and teaching methods (Bahri et al., 2021). In this modern era of education, the problems faced in today's education system are growing complex (Utaminingsih, Ellianawati, et al., 2023), from the diversity of student backgrounds to changes in the curriculum and integration of technology in learning (Sailer et al., 2021). It needs an able evaluation instrument, in its case, to measure not only student cognitive but also affective and psychomotor aspects (Utaminingsih & Puspita, 2023); the latter are indicators quite crucial in achieving student competencies from a holistic perspective (Yasin et al., 2023). Only a few innovative questions were found, which focused not only on the level of understanding of the concept but also on relating it to the student's day-to-day activities (Purnomo & Wilujeng, 2016). The findings are mainly on "How We Live and Grow," which is quite a new topic in the independent curriculum of fifth grade.

The urgency with which full-featured, adaptable evaluation tools should be developed in response to today's educational needs increases (Rokhmah et al., 2017). Quality instruments may provide a more precise picture of the effectiveness of the learning process and the achievement of student competencies at first (Pratiwiningtyas et al., 2017). Second, through well-designed instruments, teachers can get constructive feedback to improve the quality of teaching (Natal et al., 2022). Thirdly, a good instrument can increase students' motivation by providing intellectually challenging questions related to practical life (Astuti et al., 2020). It makes them understand the taught concepts more quickly (Septiani et al., 2022). Another solution to today's educational challenges is the development of innovative evaluation instruments (Hutapea, 2019).

The developed evaluation instruments can be used in the educational process; hence, students will not be based on the final results but on their learning process (Astiwi et al., 2020). Furthermore, the development of evaluation instruments should ensure that they are sensitive to the individual's characteristics (Bernstein et al., 2020) and intellectual ability, giving them an equal opportunity to show their ability (González-López et al., 2020). It means varied and inclusive question designs of whatever the faculty used to assess students' performance, taking into account the diversity of learning styles and intelligence of the students (Utaminingsih, Raharjo, et al., 2023). The questions to be developed have to test various aspects of learning; they should not only test for factual information and knowledge but also enable learners to synthesize their analytical and synthesis skills in line with the relevant learning taxonomy (Bahri et al., 2021).

Everything aims to elaborate the development of effective evaluation instruments requiring good cooperation and coordination (Martin, 2016) between all the sides involved in the education process: the teachers and the students (Arifin, 2017). Such a partnership would develop more relevant instruments sensitive to local needs and conditions while maintaining international quality standards (Ulva et al., 2021). It was the novelties in the world of exams: the multidisciplinary approach used in developing questions (Rusilowati, 2018), with the questions drawn being able to measure knowledge in different disciplines and integrate and apply such knowledge in solving problems (Adib, 2015). This approach has robust bearings on real-world challenges, often requiring cross-cutting understanding to resolve optimally (Nabil et al., 2022). The same secure a psychological look for the students in the context of primary education by developing good evaluation instruments (Astiwi et al., 2020). The questions and activities should be appropriate to students' cognitive and emotional development, building on the confidence and motivation to learn (Natal et al., 2022). Stay away from things that are too difficult, which may bring frustration to the learner, and those that are too easy, which may bring boredom and interference with the learning process (Utaminingsih, 2023).

The development of effective and innovative evaluation instruments would be one solution to improving the quality of education (Herianto et al., 2021). Valid and worthy questions help measure learning outcomes for students and, importantly, result in active, critical, and creative learning processes (Rusilowati, 2018). Hence, the students are readied not only for excelling in examinations but also for the successful realities of life; for example, they can think independently, solve problems, and continue lifelong learning (Pomalato et al., 2021). The description above indicates that developing quality evaluation instruments is a need that cannot be ignored (Septiani et al., 2022). Thus, understanding the urgency and importance of good evaluation instruments by applying innovation and novelty(Bashooir & Supahar, 2018), in their development has helped to make the educational process more influential in shaping future generations (Pratiwiningtyas et al., 2017) not only academically intelligent but also with resilience, adaptive, and prepared to face challenges in the global era (Masitoh & Aedi, 2020). Purpose: The purpose of the study was to develop a Class V testing tool for the topic “Life and Growth” from the cognitive field of Knowledge (C1) to the cognitive realm of Creation (C6).

METHODS

The Research and Development (R&D) method used in this research (Martin, 2016) and the design was a 4D model (Define, Design, Develop, and Disseminate) (Wardani et al., 2019). The 4D model is presented in Figure 1.

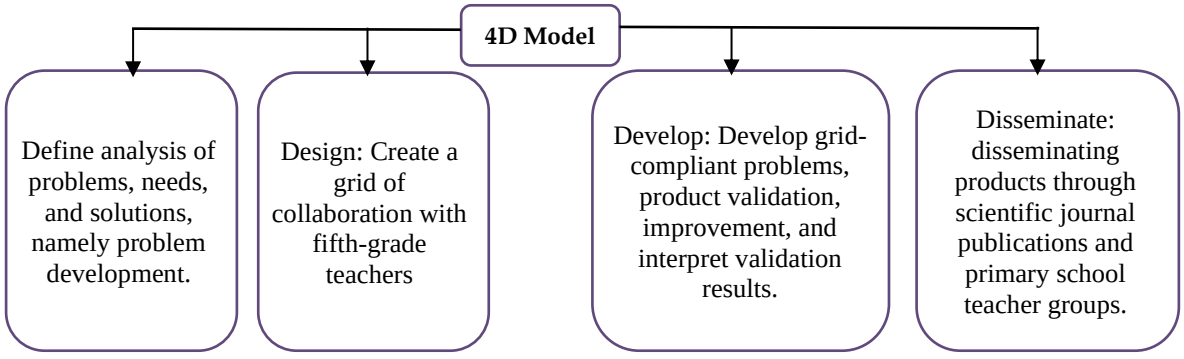

Figure 1. 4D Model Problem Development

The first step was to Define. The problems were defined by the non-availability of effective learning instruments related to 'Living and Growing' for grade V students. The point of a sense of urgency is that there is a great need to augment the students' knowledge regarding basic biological concepts and contribute to more considerable scientific literacy and the application of the knowledge in daily life.

The design was the second stage of 4D models. An innovative and interactive learning instrument for "Living and Growing" is designed through this research in the designing phase. The Development of this set includes a grid of questions that test factual knowledge and the ability to apply the concept to real situations. The questions will include 20 multiple-choice questions comprising six cognitive domains from C1 to C6. The design involves working with Grade V primary teachers to produce an instrument compatible with the needs of learners and compliant with the education standards.

The third stage was Develop. The designing phase leads to the Development of a prototype instrument. The prototype is a development of the designed prototype that has been made. The Development of questions is adopted based on the cognitive realm prepared at the design stage. The prepared instruments consisted of two questions for C1, five for C2, five for C3, three for C4, three for C5, and two for C6. Experts then validate the developed instruments. The expert validators consist of two material experts validators and one linguist. The expert validators consist of two lecturers and one grade V elementary school. The results of this expert validation will be used to revise the product Evaluation instruments developed, namely qualitative and quantitative data. Qualitative data comes in criticism and suggestions, while quantitative data is in product evaluation through evaluation instruments presented by each validator. Content, media, and language experts validate developed products. The assessment result is also part of validating the product for reference using Equation 1.

$$P = \frac{F}{n} \times 100\% \qquad (1)$$

Information:
P = Final grade
F = Score obtained
n = Highest Score

The four criteria presented in Table 1 further interpret the validation results.

Table 1. Product Eligibility Criterion (Arifin, 2017)

Achievement Level (%)	Criterion
85.01-100	Valid/ Eligible
70.01-85	Pretty decent
50.01-70	Less viable
0-50	Not worth it

The last one was Dissemination. In the dissemination phase, the general educational community will be informed of the instruments that will have been developed. In this case, through Education journals and primary school teacher groups, among other publications. The Dissemination aims to utilize learning tools that are held in this, implemented in other schools, and improve the quality of Natural Science learning, specifically the topic “How We Live and Grow”.

RESULTS AND DISCUSSION

Results

Through this systematic approach to the 4D model, the research aims to overcome problems in learning “How we Life and Growth” in fifth grade and improve the quality of science education.

Expert Validation Results

The questions developed are validated by three experts: two material experts and one linguist. The validation results are used as a reference for the questions' feasibility. The validation results of multiple-

choice questions from material and language expert validation are presented in Tables 2 to 4.

Table 2. The First Expert Validation Results

Point	Score
1	4
2	4
3	3
4	3
5	3
6	3
7	4
8	4
9	4
10	4
11	4
12	4
13	3
14	3
15	3
16	4
17	4
18	3
19	3
20	4
Total Score	71
Percentage	88.75%
Criterion	Valid/ highly feasible

Table 3. The Second Expert Validation Results

Point	Score
1	4
2	3
3	4
4	3
5	3
6	3
7	4
8	3
9	4
10	3
11	4
12	4
13	3
14	3
15	4
16	4
17	3
18	3
19	4
20	3
Total Score	69
Percentage	86.25%
Criterion	Valid/ eligible

Table 4. Linguist Validation Results

Point	Score
1	4
2	4
3	4
4	3
5	3
6	3
7	4
8	4
9	4
10	3
11	4
12	4
13	3
14	4
15	4
16	4
17	4
18	4
19	3
20	3
Total Score	73
Percentage	91.25%
Criterion	Valid/ eligible

The results of the validity of the entire aspect are presented in Table 5.

Table 5. Validation Results of All Aspects

Aspects	Value
Lesson 1	88.75%
Lesson 2	86.25%
Language	91.25%
Total Value	88.75%
Criterion	Valid/ highly feasible

Table 7 shows that the multiple-choice questions that have been developed are declared “valid” and “very feasible” for use. These results show that the instruments that have been developed are feasible to be used to evaluate learning outcomes or understanding concepts from students on the topic “How we Life and Growth”. The study results align with research developed by Ulva et al. (2021) development of natural science learning instruments, “valid” and “feasible” to use.

Results of Question Development

The validation results from experts also have input for problem improvement. Suggestions and feedback from validators include:

1. Answer choices do not use the option “all correct.”
2. Add a distractor to the answer options.
3. Options do not go too much “A.”
4. Use language that is easier for students to understand.
5. Fix questions 3, 4, 5, 13, 17, 19, 20.

Suggestions and input from validators were used to improve the questions developed so that the problems developed follow the grid and cognitive domain. In addition, so that the instrument becomes more feasible to be used to evaluate learning outcomes. The results of improvements from the instruments that have been developed are presented in Table 6.

Table 6. Results of Development of the Topic "Life and Growth"

No.	Grille	Cognitive Realm	Question	Answer
1	Breathing function	C1 (Knowledge)	What are the main functions of breathing in the human body? A. To move B. To think C. To get energy D. Sleep	C. To get energy
2	Respiratory organs	C2 (Comprehension)	Which parts of the respiratory system play a role in gas exchange? A. Throat B. Lungs C. Nose D. Mouth	B. Lungs
3	Explanation of the digestive process	C2 (Comprehension)	How does the food we eat become energy? Food gives energy immediately after eating Food is converted into energy through the process of digestion Food becomes energy when we sleep Food becomes energy when we exercise	B. Food is converted into energy through digestion
4	The role of water in the body	C2 (Comprehension)	Why is water so important for our bodies? Water helps us think more clearly Water makes us taller Water helps regulate body temperature and digest food Water eliminates hunger	C. Water helps regulate body temperature and digest food
5	Knowledge of nutrition in food	C3 (Application)	What kind of food should you consume if you want enough energy to play all day? A. Candy B. Fruits C. Vegetables D. Soft drinks	B.
6	The relationship between breathing and activity	C4 (Analysis)	How does breathing support us to carry out daily activities? By providing oxygen for moving muscles By relieving fatigue alone By lowering body temperature By increasing the speed of thinking	A. By providing oxygen for moving muscles
7	Benefits of water for the body	C3 (Application)	How does water help our body's digestive process? By dissolving food to make it easier to digest By making us feel full By reducing weight D. By improving the taste of food	A. By dissolving food to make it easier to digest
8	Nutritional needs to grow	C4 (Analysis)	What factors affect the speed and quality of growth of children? Types of sports performed Quality sleep every night	C. Type and amount of nutrients consumed

No.	Grille	Cognitive Realm	Question	Answer
9	Diet balance	C3 (Application)	Type and amount of nutrients consumed Time spent playing How can a balanced diet affect our health? A. Increase energy and stamina B. lose weight C. Increase the risk of disease D. No effect	A. Increase energy and stamina
10	The role of vitamins and minerals	C2 (Comprehension)	What is the role of vitamins and minerals in the child's growth process? A. To repair skin cells B. Increase height instantly C. Increase running speed D. Helps the formation of bones and teeth	D. Helps the formation of bones and teeth
11	The importance of physical activity	C1 (Knowledge)	Why is physical activity essential for a child's growth? It helps build strong muscles and bones Just for fun To pass the free time Improve academic ability only	A. Helps the formation of strong muscles and bones
12	Respiratory cycle	C3 (Application)	Describe the respiratory cycle and how the body uses oxygen. Carbon dioxide is inhaled, and oxygen is exhaled Oxygen is stored in the lungs for later use Oxygen is inhaled through the nose and used for energy, and carbon dioxide is exhaled Oxygen is converted into food in the body	C. Oxygen is inhaled through the nose and used for energy, and carbon dioxide is exhaled
13	Impact of lack of water	C2 (Comprehension)	What happens if someone needs to drink more water? No effect occurs Boosts energy It may cause dehydration and affect body functions Increase growth speed	C. May cause dehydration and affect body functions
14	Nutrition for the brain	C4 (Analysis)	How does nutrition affect brain ability and learning? Nutrition does not affect the brain Good nutrition improves brain function and learning ability Only specific vitamins are essential for the brain Confectionery increases intelligence	B. Good nutrition improves brain function and learning ability
15	The relationship between sleep and growth	C3 (Application)	How does sleep quality affect a child's growth? Sleep does not affect growth	B. High-quality sleep supports optimal growth

No.	Grille	Cognitive Realm	Question	Answer
16	The function of oxygen in the body during activity	C5 (Evaluation)	When you run, your body needs more oxygen. What is the oxygen used by the body for? A. Make the body cool B. Energizes muscles C. Makes us feel full D. Cleanses the body of impurities	B. Energizes muscles
17	The importance of water and food in everyday life	C5 (Evaluation)	What happens if we drink water for a short time? We will feel very thirsty and tired We will become stronger We will not feel any difference We will feel more refreshed	We will feel very thirsty and tired
18	The function of food for growth	C6 (Creation)	What are the most essential substances in food that help our body grow? A. Sugar B. Fat C. Protein D. Water	C. Protein
19	Evaluation of the impact of nutrient deficiencies on growth	C5 (Evaluation)	A child does not get enough protein from his diet. What is most likely to happen to its growth? The growth will be faster than usual No influence on its growth Its growth will be stunted Will become more creative in thinking	C. Growth will be stunted
20	Creating strategies for healthy living	C6 (Creation)	Ardan wants to ensure his body gets everything it needs to grow strong and healthy. Ardan makes daily plans such as physical activity, healthy food, and adequate rest. Which of the following options is most effective? Play video games, eat pizza, and sleep late. Go for a morning run, have a fruit and vegetable breakfast, and sleep 8 hours every night Watch TV all day, eat snacks, and take naps Read books, eat sweets, and stay up late	B. Morning run, fruit and vegetable breakfast, and sleep 8 hours every night

Discussion

Table 6 showcases the refined set of questions, enhanced through feedback from expert validators, focusing on the “How we Live and Growth” topic for fifth graders. The collection represents a comprehensive educational framework to deepen students' grasp of fundamental biological concepts.

Crafted within the cognitive spectrum from C1 to C6, these questions span knowledge acquisition, comprehension, application, analysis, synthesis, and creation, as outlined in Bloom's revised taxonomy (Yasin et al., 2023). The essence of crafting innovative and practical evaluation tools to elevate the quality of education lies in adopting a holistic question design strategy that spans various cognitive domains while weaving in real-life scenarios (Septiani et al., 2022). The strategy was about deepening students' grasp of biological concepts like respiration, nutrition, hydration, and growth and empowering them to apply, dissect, evaluate, and creatively build upon their acquired knowledge (Setiawan, 2019). The approach aimed to nurture a profound and impactful learning experience that emphasizes theoretical clarity and practical relevance (Masfufah & Ellianawati, 2020).

Starting with the foundational C1 and C2 categories, the questions are tailored to lay a solid groundwork for understanding essential biological functions, such as how we breathe and the role of our respiratory organs. This foundational stage is critical for establishing a solid base from which students can explore more complex topics later on (Rohana et al., 2018). As students' progress to the application and analysis phases (C3 and C4), the questions evolve to challenge them beyond mere memorization (Rusilowati, 2018). They are encouraged to contextualize information, dissect the interconnections between various concepts, and apply their knowledge to real-world situations (Bahri et al., 2021). For example, understanding the impact of dietary choices on energy and growth goes beyond textbook facts; students are expected to relate their theoretical knowledge to everyday life, considering various factors that influence health and growth.

The assessment and creation sections (C5 and C6) allow the students to critically assess several scenarios at the top level of cognitive engagement and develop new solutions or approaches from the students' knowledge repository (Masitoh & Aedi, 2020). It was a critical stage since the development of critical thinking and problem-solving skills is allowed, which may be invaluable in later stages regarding every aspect of an individual's life (Bashooir & Supahar, 2018). It can be brought out by anchoring the questions in the scenarios familiar to students, increasing relatability and learning motivation (Rusilowati, 2018). For example, this establishes a bright link between proper nutrition and everyday energy; therefore, the idea becomes more live and closer to the students to determine how their everyday selection of bread and rolls influences their healthy existence.

In a broad sense, considering use in the wide spectrum of cognitive domains puts educators in a better place to assess student achievements in question formulation (Utaminingsih, Ihsandi, et al., 2023). The process goes far beyond the traditional tests that offer a nuanced insight into understanding the concepts, applying knowledge, analytic powers, and creative problem-solving abilities (Sarwi et al., 2021). Thus, the comprehensive assessment model gives greater insight into the student's understanding by indicating the areas where more clarity or support is required. Such an integrated approach to problem development bridging diverse cognitive areas with real-world applications will enrich conceptual content for the student and help the student gain the skills required to apply this knowledge pragmatically (Sarwi et al., 2019). It lays down solid grounds for students' lifelong learning to perform well in academic careers and emerge as well-informed, participative lives (Sailer et al., 2021). The instruments have to be validly cross-validated and well shared by "Education," a reputed scientific journal, and amongst the networks of Elementary School teachers, thereby sharing its reach and impacting its role in the relevance of data towards shaping paradigms in education.

CONCLUSION

The instruments that get a percentage of the first material expert, 88.75% with the "valid" criteria, the second material expert, 86.25% with the "valid" criteria, and language validation gets a percentage of 91.25% with the "valid" criteria. The validity value of the entire aspect is 88.75%, so the questions were declared "valid" and worthy of use. Its importance embeds the need to design questions holistically across all cognitive domains with the incorporation of real-life contexts, which needs to be improved in most higher education institutions despite the increased overall understanding of the students in the field and the application of the concepts. It not only enforces understanding at a conceptual level but also equips the students for life-long learning, enabling them to do much better in their academics and be informed citizens. The validated instruments were then published in educational platforms so that their results might influence future educational paradigms.

REFERENCES

Adib, H. S. (2015). Teknik Pengembangan Instrumen Penelitian Ilmiah di Perguruan Tinggi Keagamaan Islam. *Seminar Nasional Pendidikan, Sains Dan Teknologi Fakultas Matematika Dan Ilmu Pengetahuan Alam Universitas Muhammadiyah Semarang*, 139–157.

Arifin, Z. (2017). Kriteria Instrumen Dalam Suatu Penelitian. *Jurnal Theorems (the Original Research of Mathematics)*, *2*(1), 28–36.

Astiwi, K. P. T., Antara, P. A., & Agustiana, I. G. A. T. (2020). Pengembangan Instrumen Penilaian Kemampuan Berpikir Kritis Siswa SD pada Mata Pelajaran PPKn. *Jurnal Ilmiah Pendidikan Profesi Guru*, *3*(3), 459. https://doi.org/10.23887/jippg.v3i3.29457

Astuti, A. T., Supahar, Mundilarto, & Istiyono, E. (2020). Development of assessment instruments to measure problem solving skills in senior high school. *Journal of Physics: Conference Series*, *1440*(1). https://doi.org/10.1088/1742-6596/1440/1/012063

Bahri, S., Simbolon, M., & Alhad, K. (2021). Development of Assessment Instrument of Scientific Literacy Ability for Students at Musamus University. *Advances in Social Science, Education and Humanities Research Proceedings of the International Joined Conference on Social Science (ICSS 2021)*, *603*(Icss), 395–398.

Bashooir, K., & Supahar. (2018). Validitas dan reliabilitas instrumen asesmen kinerja literasi sains pelajaran Fisika berbasis STEM. *Jurnal Penelitian Dan Evaluasi Pendidikan*, *22*(2), 168–181. https://doi.org/10.21831/pep.v22i2.20270

Bernstein, K. A., Katznelson, N., Amezcua, A., Mohamed, S., & Alvarado, S. L. (2020). Equity/Social Justice, Instrumentalism/Neoliberalism: Dueling Discourses of Dual Language in Principals' Talk About Their Programs. *TESOL Quarterly*, *54*(3), 652–684. https://doi.org/10.1002/tesq.582

González-López, M., Machin-Mastromatteo, J., & Tarango, J. (2020). Diagnostic evaluation of thinking and information skills through the design and application of three instruments for children at first grade of elementary school. *Revista Electronica Educare*, *24*(3). https://doi.org/10.15359/REE.24-3.21

Herianto, E., Ismail, M., Dahlan, D., Basariah, B., & Tripayana, I. N. A. (2021). Pelatihan Penyusunan Alat Evaluasi Non Tes bagi Guru Madrasah di Mataram. *Jurnal ABDINUS : Jurnal Pengabdian Nusantara*, *5*(2), 428–440. https://doi.org/10.29407/ja.v5i2.16330

Hutapea, R. H. (2019). Instrumen Evaluasi Non-Tes dalam Penilaian Hasil Belajar Ranah Afektif dan Psikomotorik. *BIA': Jurnal Teologi Dan Pendidikan Kristen Kontekstual*, *2*(2), 151–165. https://doi.org/10.34307/b.v2i2.94

Martin, B. R. (2016). R & D policy instruments – a critical review of what we do and don ' t know. *Industry and Innovation*, *2716*, 1–20. https://doi.org/10.1080/13662716.2016.1146125

Masfufah, F. H., & Ellianawati, E. (2020). Peningkatan Literasi Sains Siswa Melalui Pendekatan Contextual Teaching And Learning (CTL) Bermuatan Etnosains. *Unnes Physics Education Journal Terakreditasi SINTA*, *9*(2), 129–138. http://journal.unnes.ac.id/sju/index.php/upej

Masitoh, L. F., & Aedi, W. G. (2020). Pengembangan Instrumen Asesmen Higher Order Thinking Skills (HOTS) Matematika di SMP Kelas VII. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *4*(2), 886–897. https://doi.org/10.31004/cendekia.v4i2.328

Nabil, N. R. A., Wulandari, I., Yamtinah, S., Ariani, S. R. D., & Ulfa, M. (2022). Analisis Indeks Aiken untuk Mengetahui Validitas Isi Instrumen Asesmen Kompetensi Minimum Berbasis Konteks Sains Kimia. *Paedagogia*, *25*(2), 184. https://doi.org/10.20961/paedagogia.v25i2.64566

Natal, S., Murdijanti, E., & Rumiyati, N. (2022). The Instrument for Assessing the Attitude of Mutual Cooperation Elements of Caring Elementary School 1 Candisari Temanggung Has Been Expertly Validated. *Seminar Nasional 100 Tahun Taman Siswa*, 3.

Pomalato, S. W. D., Ismail, R., Amin Otoni Harefa, Imawan, O. R., Ningsi, B. A., & Wulandar, D. (2021). Instrument test development of mathematics skill on elementary school. *Mathematics and Statistics*, *9*(2), 106–111. https://doi.org/10.13189/ms.2021.090204

Pratiwiningtyas, B. N., Susilaningsih, E., & Sudana, I. M. (2017). Pengembangan Instrumen Penilaian Kognitif untuk Mengukur Literasi Membaca Bahasa Indonesia Berbasis Model Pirls pada Siswa Kelas IV SD. *Journal of Educational Research and Evaluation*, *6*(1), 1–9. http://journal.unnes.ac.id/sju/index.php/jere

Purnomo, H., & Wilujeng, I. (2016). Pengembangan Bahan dan Instrumen Penilaian Penyempurnaan Buku Guru dan Siswa Kurikulum 2013. *Jurnal Prima Edukasia*, *4*(1), 12–19.

https://journal.uny.ac.id/index.php/jpe/article/view/14288/pdf

Rohana, I. N., Rusilowati, A., & Khumaedi. (2018). Pengembangan Tes untuk Mengukur Kemampuan Literasi Sains Siswa SMP pada Materi Getaran dan Gelombang. *UPEJ Unnes Physics Education Journal*, *7*(3), 1–10.

Rokhmah, A., Sunarno, W., & Masykuri, M. (2017). Science Literacy Indicators in Optical Instruments of Highschool Physics Textbooks Chapter. *Jurnal Pendidikan Fisika Indonesia*, *13*(1), 19–24. https://doi.org/10.15294/jpfi.v13i1.8391

Rusilowati, A. (2018). Asesmen Literasi Sains: Analisis Karakteristik Instrumen dan Kemampuan Siswa Menggunakan Teori Tes Modern Rasch Model. *Prosiding Seminar Nasional Fisika Universitas Riau Ke-3*, *September*, 2–15. https://snf.fmipa.unri.ac.id/wp-content/uploads/2019/03/0.-300B-2-15NI.pdf

Sailer, M., Stadler, M., Schultz-Pernice, F., Franke, U., Schöffmann, C., Paniotova, V., Husagic, L., & Fischer, F. (2021). Technology-related teaching skills and attitudes: Validation of a scenario-based self-assessment instrument for teachers. *Computers in Human Behavior*, *115*(May 2020). https://doi.org/10.1016/j.chb.2020.106625

Sarwi, S., Baihaqi, M. A., & Ellianawati, E. (2021). Implementation of Project Based Learning Based on STEM Approach to Improve Students' Problems Solving Abilities. *Journal of Physics: Conference Series*, *1918*(5), 1–5. https://doi.org/10.1088/1742-6596/1918/5/052049

Sarwi, S., Ellianawati, E., & Suliyanah. (2019). Grounding Physics and Its Learning for Building Global Wisdom in the 21st Century. *Journal of Physics: Conference Series*, *1171*(1). https://doi.org/10.1088/1742-6596/1171/1/012001

Septiani, A. D., Sjaifuddin, S., & Berlian, L. (2022). Pengembangan Instrumen Evaluasi Tes Two-Tier Multiple Choice Berbasis Literasi Sains Siswa Kelas VII Pada Tema Hujan Asam. *Biodik*, *8*(1), 167–174. https://doi.org/10.22437/bio.v8i1.17305

Setiawan, A. R. (2019). Penyusunan Program Pembelajaran Biologi Berorientasi Literasi Saintifik. *Jurnal Pendidikan Biologi*, *1*(23), 1–8.

Ulva, T. S., Samitra, D., & Kusnanto, R. A. B. (2021). Pengembangan Instrumen Tes Literasi Sains pada Tema 8 Lingkungan Sahabat Kita untuk Siswa Sekolah Dasar. *Jurnal Basicedu*, *6*(4), 7174–7187. https://doi.org/10.31004/basicedu.v5i4.1230

Utaminingsih, E. S. (2023). Social Science Learning in Primary School Responding to The Challenges of 21st Century Education. *Edueksos: Jurnal Pendidikan Sosial Dan Ekonomi*, *XII*(02), 270–282.

Utaminingsih, E. S., Ellianawati, E., Widiarti, N., Sumartiningsih, S., & Puspita, M. A. (2023). A Systematic Review : Digital Literacy for Strenghtening Character in Facing the Era of Society 5.0. *Research and Development Journal Of Education*, *9*(2), 638–647.

Utaminingsih, E. S., Ihsandi, A., & Mutiarawati, I. S. (2023). Pancasila as Integration Philosophy of Education and National Character. *Jurnal Ilmiah Profesi Pendidikan*, *8*(4), 2443–2449. www.ijstr.org

Utaminingsih, E. S., & Puspita, M. A. (2023). Emotional Intelligence and Its Important Role. *Jurnal Ilmiah Profesi Pendidikan*, *8*(November 2021), 2003–2011.

Utaminingsih, E. S., Raharjo, T. J., & Ellianawati. (2023). Development of an E-module Based on STEAM on the Topic of Human Blood Circulation. *Jurnal Penelitian Pendidikan IPA*, *9*(7), 5333–5340. https://doi.org/10.29303/jppipa.v9i7.3719

Wardani, D. L., Degeng, I. N. S., & Cholid, A. (2019). Developing Interactive Multimedia Model 4D for Teaching Natural Science Subject. *International Journal of Educational Research*, *7*(1), 63–72. www.ijern.com

Yasin, M., Nindiasari, H., Sultan, U., & Tirtayasa, A. (2023). *Pengembangan instrumen literasi numerasi konteks sosial budaya di smk plus pakuhaji 1,2,3*. *4*(2).