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The Role of Scientific Literacy Instruments For Measuring Science Problem Solving Ability

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ABSTRACT

A critical aspect of measuring judgment in the 21st century is scientific literacy. In addition to the scientific literacy aspect as part of the grade 21 skills assessment, there are other essential aspects, namely student problem-solving skills. Based on the articles collected, it can be concluded that to meet the necessities of life in various situations in the global era, Literacy ability is a fundamental thing that all students must own. The role of scientific literacy instruments is needed to measure students' science problem-solving abilities. Because scientific literacy is an individual's ability to identify, explain and conclude scientific evidence by using the ability to solve problems based on how to understand, plan, solve, and reassess. This can be seen from the many theories and teaching methods that support the results obtained from the forty-four journals reviewed. The criteria for the articles used are those published in 2017-2022. The purpose of this article review is to determine the role of scientific literacy instruments in measuring students' problem-solving abilities by using a literature review that gathers sources from several previous articles.

INTRODUCTION

In the 21st century, scientific literacy is an essential assessment aspect for students to determine the quality of education in a country. In the current era of information and globalization, students need good scientific literacy skills to have sufficient competence to compete in solving problems for each individual (Shohib et al., 2021). Scientific literacy is essential for students to understand, identify, explain and utilize scientific findings to solve problems faced by modern society (Budiarti & Tanta, 2021; Karimah et al., 2021). In solving real problems, scientific literacy is essential in involving scientific thinking skills and overcoming community problems, such as developing life skills, where reasoning skills are needed in the context of society (Oktalia et al., 2021).

Scientific literacy instruments were analyzed using expert review from 4 validators and analysis of classical tests, including item validity, reliability, discriminatory power, and difficulty level (Oktalia et al., 2021). As for some basic concepts of scientific literacy that have functional. The indicators are 1. Students can explain basic science concepts in the text; 2. Students can explain science concepts correctly, but their understanding needs to be improved (low) (Muhariyansah et al., 2021). The OECD states that scientific literacy includes the ability to (a) explain scientific phenomena, (b) evaluate and design scientific investigations, and (c) interpret data and evidence scientifically (Rosana et al., 2020).

In addition to aspects of scientific literacy as part of 21st-century skills, there are other essential aspects, namely student problem-solving skills. This skill is needed for students because every individual is constantly dealing with various problems.

It must be solved daily (Rosana et al., 2020). The problem-solving ability instrument has five indicators: visualizing problems, describing problems, planning, implementing plans, and checking or evaluating (Apriyani et al., 2019).

The application of problem-solving skills should be trained and developed early in learning by setting aside contextual problems. While students must solve these problems independently of the material taught (Kurniawan & Sofyan, 2020), problem-solving abilities must be owned by students after the learning process so that the concept becomes meaningful (Yulianawati et al., 2018). As a mental and intellectual process in problem-solving abilities, students can unite their knowledge or recall the problem-solving experience with the problems they will face. Problem-solving ability is one of the competencies that students must have (Apriyani et al., 2019).

Based on the explanation described above, the authors took the initiative to conduct a journal study entitled "The Role of Natural Science Instruments for Measuring Natural Science Problem-Solving Ability." This can be seen from the many theories and teaching methods that support the results obtained from the forty-four journals reviewed. The criteria for the articles used are those published in 2017-2022. The purpose of this article review is to find out the role of scientific literacy instruments in measuring students' problem-solving abilities using a literature review by collecting sources from several previous articles. This literature review can serve as a reference for readers aligned with the topics discussed in this article.

RESEARCH METHOD

This article study uses the literature review method by collecting sources from several previous authors to describe and analyze, which can later be used as a reference. A literature review can be a simple summary of sources but usually has a pattern of organization and combines summary and synthesis (Ramdhani et al., 2014). The criteria for the articles used are those published in 2017-2022. The sources used in this study were forty-two journals related to scientific literacy and problem-solving skills.

Table 1. Defining the types of sources for a review.

Source	Definitions
Primary source	Usually, a report by the original researchers of a study
Secondary source	Description or summary by somebody other than the original researcher, e.g., a review article
Conceptual/ theoretical	Papers concerned with the description or analysis of theories or concepts associated with the topic
Anecdotal/ opinion	Views or opinions about the subject that are not researched, reviewed, or theoretical.

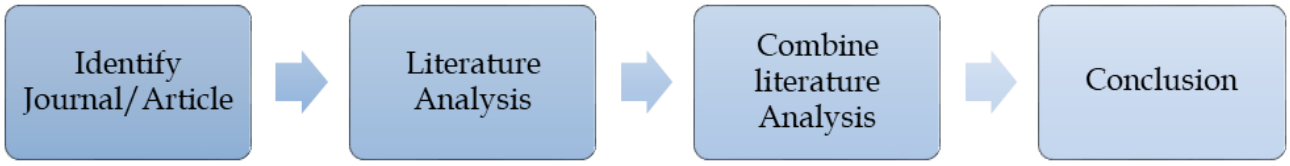

Figure 1. Flowchart literature study research

RESULTS AND DISCUSSION

Based on the results of the articles collected explained that Scientific literacy is essential for students to understand, identify, explain and utilize scientific findings to solve problems faced by modern society. In solving real problems, scientific literacy is essential in involving scientific thinking skills and overcoming community problems, such as developing life skills, where reasoning skills are needed in society.

The Role of Scientific Literacy Instruments

An approach that can help online learning is that it can facilitate students to learn 21st-century skills, namely STEM. Module-based STEM in improving scientific literacy skills in distance learning through e-learning. Following the stages of the R&D method developed by Barg and Gall, including introduction, product planning, development, validation (validation by experts), revision, and field testing. Shows that the feasibility of STEM-based modules in the distance learning model to improve students' skills in scientific literacy is valid, with an average score of 4.28 by two experts. In addition, the application of integrated STEM teaching materials through e-learning has a moderate effect on students' scientific literacy abilities because the N-gain value is 0.6 (Shofiyah et al., 2021).

The monotonous physics learning media makes online learning methods less effective in the 4.0 revolution era. To determine the validity and reliability of students' initial competency instruments in developing physics learning that contains scientific literacy. By using a voluntary sampling technique. The number of instruments tested is 35 items/questions. Instrument trials were analyzed using SPSS and Excel applications. From the results of the analysis that has been done, 16 questions are valid and reliable, and four questions have been revised. Thus, some of the students' initial competency instruments for developing physics learning games that contain scientific literacy are valid and moderately reliable, so they can be used to determine students' initial competencies (Afrizon et al., 2022).

In order to support 21st-century learning that the government has proclaimed. There have been many developments in digital books, but it is different from BDFAR2 (Physics Digital Book Based Augmented Reality) so that learning becomes more real. This study used the Hannafin & Peck media B D F-AR 2 model (Digital Physics Book Based on Augmented Reality) on global warming material classified as very valid (93.5%). Practicality (using BDF-AR2 media in learning) is 83.29% and is very good. Effectiveness (students' scientific literacy skills) found that students' scientific literacy abilities in 36.67% of students were in a suitable category, 56.67% of students had a moderate level, and 6.96% of students had a less category for scientific literacy competence in explaining the phenomenon (Kholiq, 2020).

Table 2. Aspects of scientific literacy.

Aspect	Component
Science knowledge	Facts, concepts, principles, laws, hypotheses, theories, and models of science.
Science investigation	Using scientific methods and processes such as observation, measuring, classifying, inferring, recording, and analyzing data, communicating using various means such as writing, speaking, using graphs, tables, making calculations, and experimenting.
Science as a way of knowing	Emphasis on thinking, reasoning, and reflection in building scientific knowledge and the work of scientists; The empirical nature of science;

Aspect	Component
	Ensuring objectivity in science; Use of assumptions in science; inductive and deductive reasoning; Causality; The relationship between evidence and evidence; The role of self-examination in science; explain how scientists experiment.
The interaction of science, technology, and society.	The impact of science on society; The relationship between science, society, and technology; Career; Social problems related to science; Personal use of science to make everyday decisions, solve everyday problems, and improve one's life; Science deals with moral and ethical issues.

Source: (Susongko et al., 2020).

To develop scientific literacy instruments on global warming for high school students. The instrument was adapted from The Program for International Student Assessment (PISA) framework. The research method uses a 4D learning model (define, design, develop and disseminate) limited to 3D points (define, design, and develop). (1) The define stage includes literature studies and field studies, (2) the design stage includes designing scientific literacy instruments based on the PISA framework, and (3) the development stage includes expert reviews and trials for students. The instrument consists of tests for aspects of context, competency, and knowledge and non-tests for aspects of attitude. This research was conducted in class XI Science at a high school in Bandung City, and the subjects of this study were 37 students. Scientific literacy instruments were analyzed using expert review from 4 validators and analysis of classical tests, including item validity, reliability, discriminatory power, and difficulty level (Nasution et al., 2019).

In the assessment conducted at 5th State JHS Jayapura. Using a purposive sampling technique on 33 grade 8 students who became respondents and testes. The average percentage of competency aspects with indicators of identifying scientific problems, explaining scientific phenomena, and utilizing scientific findings is below 80%. The average percentage of aspects of knowledge about the concept of motion, with the sub-concepts of regular motion, force, and Newton's laws, is below 90%. The average percentage of human, animal, and plant movement systems is below 70%. The highest score, mean, median, mode and the lowest cognitive score of students' scientific literacy ability are 100; 68.33; 75; 80; and 30 (Budiarti & Tanta, 2021).

Meanwhile, in the research that aims to develop and analyze the integration instrument of the scientific literacy skill scale (SLS) for high school science program students, there are 310 grade XII students with the Rasch Model Analysis. The Messick validity approach consists of five aspects, namely content, substantive, structural, external, and consequential for scientific literacy competencies according to the 2015 PISA standard. The research design uses the ADDIE procedural model (Analysis, Design, Development, Implementation, Evaluation). Constructive validation with Rasch modeling gives the following results. As many as 95.16% of student responses matched the modeling. The ISLS consists of 14 items and is suitable for measuring the Integration of Scientific Literacy Skills for high school science program students (Susongko et al., 2020).

Scientific literacy is one aspect of the assessment that is required in the K-13 curriculum. In order to describe the scientific literacy abilities of grade X high school students on the material of work and energy in learning physics and to find out the characteristics and quality of scientific literacy instruments using a virtual test. Using

the 4D development method: Define, Design, Development, Disseminate. Shows that the scientific literacy ability of high school students is 65.2% for the contextual aspect, 65.1% for the knowledge aspect, and 69.5% for the competency aspect (Oktalia et al., 2021). To describe the scientific literacy profile of high school students on global warming material and to test the practicality of scientific literacy instruments in the ADDIE model. The subjects of this limited trial study used 24 new physics education students at a state university in the city of Surabaya to determine the feasibility of a scientific literacy assessment instrument and 33 students of class XI Science 3 at a private high school in Krian to conduct field trials. Demonstrates a feasible scientific literacy assessment instrument, with 10 of 20 items developed. The average student achievement of scientific literacy as a whole is 38. Meanwhile, students' abilities in every aspect, namely explaining scientific phenomena, designing and evaluating scientific investigations, and interpreting data and scientific evidence, could be improved by less than 50%. The practicality of the developed instrument, with a value range of 62% -74%, is in a suitable category (Nadhifah & Jauhariyah, 2021).

Scientific literacy is a skill that pre-service teachers or prospective teachers must possess. The data sources are scientific literacy tests with social-scientific issues and open-ended question description tests. The validity of the data was tested using data triangulation techniques, in which researchers compared data obtained through test instruments and interview results (Muhariyansah et al., 2021). Furthermore, the GI-BL (Guided Inquiry-Blended Learning) learning tools consist of magnetic textbooks, worksheets, lesson plans, and scientific literacy instruments. The quasi-experimental method in this study used a pretest and posttest control group design. GI-BL learning tools were developed and validated in terms of content and instruments. Testing this learning tool's effectiveness was conducted on 163 junior high school students. GI-BL learning tools were developed to improve students' scientific literacy, especially in solving problems related to phenomena related to magnetism. This teaching material has increased students' scientific literacy in magnetic material. This is indicated by the N-Gain score of 63%, which is categorized as quite effective (Gunawan et al., 2021).

Scientific literacy is needed in 21st-century learning to produce learning tools based on local wisdom and to increase students' scientific literacy using the Plomp Model with several stages, namely 1) Analysis, 2) Design, 3) Development, 4) Evaluation, and 5) Implementation. The instruments used in this study were product validation questionnaires and instruments for measuring scientific literacy. The results showed that (1) the identification of local wisdom in Yogyakarta, which is used in science learning and following the topic of environmental pollution, is the utilization of batik waste resulting from the process of making batik in Yogyakarta, (2) learning tools based on local wisdom have been produced. Namely lesson plans and worksheets in excellent categories, and (3) integrating local wisdom in science learning, namely developing scientific literacy in the excellent category (Hastuti et al., 2020). Furthermore, integrated science teaching materials with guided inquiry models are suitable for increasing students' scientific literacy, also developing syllabuses, lesson plans, and scientific literacy instruments. Researchers used the Dick & Carey model in one of the *MTs NW* in West Lombok Regency. The results of the feasibility study of integrated science teaching materials using the guided inquiry model obtained an average value of 94% with very valid criteria. Syllabus gets an average score of 87%, lesson plans get an average score of 92%, and scientific literacy instruments get an average score of 82% (Karimah et al., 2021).

An assessment instrument that uses the ADDIE model to measure scientific literacy abilities in students' cognitive and psychomotor assessment instruments. Referring to the indicators developed by Gormally, the authentic assessment instrument developed is feasible to use with a validity value of 4.43. Empirical validity data for multiple choice were analyzed using biserial point correlation. The results show 76% in the excellent category with a reliability value of 0.82. For essay and psychomotor assessment, it shows 100% in the excellent category. The difficulty index of multiple choice cognitive assessment instruments is 24% for the difficult level, 44% for the medium level, and 32% for the easy level, while for essays, the difficulty index is 40% for the medium level and 60% for the easy level (Bedduside et al., 2021).

Furthermore, to determine students' scientific literacy skills through ethnoscience-based learning using the quasi-experimental method with a non-equivalent control group design. It can be seen that ethnoscience-based learning can improve students' scientific literacy skills. Because of this, it can be seen in the scientific literacy competency scores of students in the experimental and control classes, respectively, getting 72% in the high category and 65% in the medium category, and the t_{count} is -3.551, and the t_{table} is 1.995. The N-gain value in the experimental class is 0.47 (moderate category), while the control class is 0.28 (low category). (Wibowo & Ariyatun, 2020).

Using the Rasch model, measure students' ability to complete scientific literacy instruments. Shows that MNSQ clothing is 0.94 and ZSTD clothing is 0.05. People reliability is 0.58 in the weak category, Cronbach's alpha reliability is 0.92, separation value is 1.17 with two groups with research subjects, 29 students of class XI Science 2 in ^{sixth} state SHS Banjarmasin uses a quantitative descriptive research design with a survey method (Mahtari et al., 2021). Furthermore, in the learning activities and scientific literacy abilities of Basic Education Students using the PjBL model. The instruments used are HOTS tests and rubrics. The indicators of the success of the action are the activities of lecturers and students in the teaching and learning process using PjBL in the excellent category and the percentage of students who demonstrate the attitude, context, knowledge, and competence of science fulfill the excellent category of at least 80% (Winarni & Purwandari, 2020).

The literacy profile of junior high school students regarding static electricity and electricity in living things uses a descriptive research method. Shows that the average scientific literacy ability of junior high school students regarding static electricity and electricity in living things, in general, is in the low criteria. Achievement of scientific literacy skills in the first indicator explaining scientific phenomena scores 28.76% higher when compared to the second indicator evaluating and designing scientific investigations obtaining a score of 15.73%. In contrast, the third indicator interprets data and scientific evidence. Obtain the lowest average score. of 10.13%. Generally, all indicators' scientific literacy criteria are shallow (Shohib et al., 2021).

Furthermore, textbooks based on collaborative learning models can be an alternative that improves students' scientific literacy abilities. Textbooks based on collaborative learning models describe scientific literacy skills and student responses. This study showed that the scientific literacy skills test scores increased with an N gain of 0.67, sig 0.05, and 95% of students responded positively (Dewi et al., 2021).

Science Problem Solving Ability

In addition to aspects of scientific literacy as part of 21st-century skills, there are other essential aspects, namely student problem-solving skills. This skill is needed for

students because every individual is constantly dealing with various problems that must be solved in everyday life (Rosana et al., 2020). The 21st-century learning paradigm requires teachers to provide teaching materials that can develop students' thinking skills. Furthermore, to determine the effect of the integrated science web module on the potential of local batik on the thinking abilities of junior high school students. Using a quasi-experimental design method with posttest-only design. In data analysis using the Kruskal Wallis test and Effect Size. The results of this study explained that there were differences in students' thinking abilities between the experimental and control classes, as indicated by the Kruskal Wallis test, which gave significant results. The web science module integrated with the potential of local batik has a significant influence on students' thinking skills, as indicated by the Cohen effect size score of 0.8 (Putri & Aznam, 2019).

Table 3. Problem-solving ability based on polya's steps.

Stages of Solving Problems	Indicator
Understanding the problem	Students can mention the information from the statements given.
Planning problems	Students plan the problem-solving that they use and the reasons for using it.
Solve the problem	Students can solve problems based on the problem-solving steps they use with the right results.
Review	Students re-examine the problem-solving steps used and re-check the results they have obtained.

Students must own problem-solving abilities after the learning process to make the concept more meaningful. Therefore, to describe their problem-solving abilities. Metacognition contributes to physics learning to students' success in solving problems. The instrument used was the Heat and Temperature Problem Solving Ability Test (HT-PSAT), which consisted of twelve questions from three problem contexts conducted on 37 science students (30 girls and seven boys) in class XI from a middle school in Bandung. Shows that the average value of the test is 8.27 out of a maximum total value of 36 (Yulianawati et al., 2018).

Implementing STEM to analyze students' problem-solving skills in learning to train the realm of scientific practice and engineering practice associated with project-based learning problems. The pre-experimental method with the one-group pretest-posttest design was applied to 27 students in class X. This shows an increase in students' problem-solving abilities by applying the problem integration model and project-based learning in STEM-based learning (Apriyani et al., 2019). Furthermore, applying problem-based learning models compared to conventional learning models increases the problem-solving abilities of class XI Science students of SHS 2 Labuapi. By using a non-equivalent control group quasi-experimental design. Data analysis techniques used the Anacova test for hypothesis testing and N-Gain to see an increase in students' problem-solving abilities. Shows that students' problem-solving abilities using problem-based learning models do not experience a higher increase compared to conventional learning (Kurniawan & Sofyan, 2020).

Critical thinking skills based on indicators of interpretation, analysis, evaluation, and inference in solving mathematical problems. The subjects of this study were school principals, math teachers, and class IX students of Public Middle Schools for the 2020/2021 academic year. Demonstrating high initial math skills is a basic need for

students to develop critical thinking skills based on interpretation indicators. In this indicator, students need special attention from the teacher. Every student of every level always can encounter difficulties in solving some problems without collaborating with others. In this case, the teacher must guide students to improve their critical thinking skills (Sutama et al., 2022).

Increasing students' problem-solving capacity after using the andro-web module-based comic media in ideal gas subjects, using the design nieve en model of development. The average validation score of the andro-web-based comic module by the validator is 81.7% in the excellent category. Score validation by the user validator obtained a score of 93.3% with a correct category. In addition, the increase in students' physics problem-solving abilities obtained a score of 47.3% on the n-gain test in the medium category (Annisa et al., 2020). Furthermore, using a mixed method design embedded experimental model on problem-solving abilities and science process skills based on outdoor learning in junior high schools. Shows that the science process skills developed at each stage consist of making observations, formulating hypotheses, experimenting, creating data, classifying and analyzing data, formulating conclusions, communicating and applying concepts, and making predictions obtained with an average value of 75.33 in the excellent category. Meanwhile, the problem-solving ability of students based on outdoor learning also increased by 0.58 in the medium category. Teachers can use the application of outdoor learning as an alternative, which is quite effective in developing science process skills and problem-solving abilities (Wahyuni et al., 2017).

The B-Geo Module is developed using a brain-based teaching (BBTA) approach integrated with GeoGebra Software (B-Geo Module), which is expected to help students' problem-solving abilities on the topic of Differentiation. BBA is a strategy that uses brain-based learning techniques. Multimedia such as GeoGebra can be a tool for BBTA to facilitate additional Mathematics teachers in secondary schools to help students solve problems and enhance their learning on the topic of Differentiation (Mohd Yatim et al., 2022). Furthermore, students' critical thinking skills and problem-solving in learning and innovation skills in genetics and DNA technology units through a science technology society (STS) approach. The STS approach in the Yuenyong framework is based on five stages. This includes (1) identification of social problems, (2) identification of potential solutions, (3) need for knowledge, (4) decision-making, and (5) socialization stage. The study revealed that the Genetics and DNA technology units in the STS approach promote students' critical thinking and problem-solving skills. Not only is it shown that solutions emerge from problems leading to solutions through critical thinking and problem-solving, but it can also be mentioned that students develop their critical thinking and problem-solving skills as they study the STS of Genetically Modified Organisms (GMOs) problems (Yuenyong & Wongsila, 2019).

The effectiveness of the GSL model in increasing collaborative problem-solving skills and the confidence of prospective elementary school teachers in learning basic natural sciences for the 2018 school year using the one-group pretest and posttest design in 119 elementary schools. Shows a significant increase in collaborative problem-solving skills and self-confidence at = 5%, with the average posttest score and n-gain in the high category for the four groups. Thus, the GSL model effectively increases collaborative problem-solving skills and the self-confidence of prospective elementary school teachers (Fuad et al., 2019). Furthermore, interactive multimedia-based learning, which contains problem-solving, has factors that influence student learning outcomes. Tests of

science process skills in formal descriptions and reasoning tests in the form of descriptions are used as instruments. This shows that the problem-solving abilities of students who learn to use interactive multimedia-based problem-solving are better than students who learn through conventional methods (Manurung & Panggabean, 2020).

In order to improve memory and ability to solve problems in undergraduate physics. For eight weeks, students in the two lecture sections of an introductory university-level physics course completed homework assignments three times a week, each containing interlaced (i.e., alternating topics) or conventionally arranged (i.e., one topic practiced at a time) problems. Students recalled more relevant information on the two tests of surprise criteria that contained new and more challenging problems. They more frequently came up with the correct solution after engaging in interleaved practices (with an observed median increase of 50% on test 1 and 125% on test 2). Despite benefiting more from interleaved practice, students tend to find the technique more difficult and incorrectly believe they learn less from it (Samani & Pan, 2021).

Furthermore, on the effectiveness of activity-based science learning practices on acquiring problem-solving skills in pre-school children aged 5-6 years. The Personal Information form and Problem-Solving Ability Scale are data collection tools for children aged 4-7. A pre-test-post-test control group design was used. The research researchers' activity-based science teaching practices in the experimental group were prepared in 12 weeks (24 integrated activities). In the control group, there was only a specific implementation related to problem-solving skills other than the Turkish Ministry of National Education's Pre-school Curriculum. In data analysis, Mann-Whitney U and Wilcoxon Signed-Rank tests were performed (Aksüt & Bahar, 2020).

Application of the Problem-Based Learning model to describe the ability of elementary school students to solve science problems. The sampling technique used is random sampling. Based on the results of this study, the average pretest and posttest scores were respectively 35.54 and 73, with an N-Gain of 0.59 in the "medium" category. This explains that applying the Problem-Based Learning (PBL) model can improve elementary school students' problem-solving abilities (Rahmani & Mahyana, 2022).

The PBL learning model on students' ability to solve science problems using a quasi-experimental method with a non-equivalent experimental design. The posttest results showed that the class using the problem-based learning model through a contextual approach had a higher average score when compared to the class using the conventional method, namely 84.54 and 50.45. The results of the hypothesis test obtained $t_{count} > t_{table}$, namely 11.747 > 1.681, so Ha is accepted, and H0 is rejected (Sulastri & Pertiwi, 2020). Furthermore, to describe students' problem-solving abilities in optical wave material using a quantitative descriptive method, with one group pretest and posttest design. Shows that 15 students experienced an increase in scores. This explains that students' problem-solving abilities have increased (Nurita et al., 2017).

Philippine higher education institutions responding to the problem-solving success scale in their Mathematics in the Modern World course, namely, Non-Routine Problem Solving and Tracing Traits and Numbers Patterns (NRPSNNPT), Mathematical Language and Symbols (MLS), and Data Management (DM) were analyzed using Descriptive Statistics, Pearson-r and Standardized Multiple Regression. Among the four sources of problem-solving efficacy, only social persuasion significantly predicts mathematics achievement, particularly in NRPS-NNPT, MLS, and DM (Dagdag et al., 2021). Furthermore, a one-shot case study using quantitative methods aims to

determine the relationship between metacognitive skills and motivation in problem-solving abilities that focus on chemical equilibrium. Shows that (1) students' metacognitive skills and motivation are positively correlated with a coefficient of +0.450 on chemistry problem-solving abilities. Balance: (2) student motivation variables (self-efficacy, active learning strategies, science/chemistry learning scores, performance goals, achievement goals, and stimulation of the learning environment) have a positive correlation with metacognitive skills with a correlation coefficient of +0.580, +0.537, +0.363, +0.241, +0.516, and +0.271, respectively. Based on these results, it is necessary to implement learning that develops students' metacognitive skills and motivation by the teacher (Muna et al., 2017).

Based on the problem-solving ability meter according to PISA 2012. Using a descriptive method to describe student problem-solving. Only 27.5% of students could answer the problem-solving test questions. 50.25% of students can explore and understand problems. 20% of students can present, formulate problems, and plan and implement solutions. Thus, it can be concluded that students' problem-solving abilities in science are still low (30.83%). This reveals that the cause of the low problem-solving abilities of students is the learning process that has yet to facilitate students' developing problem-solving abilities (Koswara et al., 2019).

Furthermore, by using correlational survey research designed to determine the relationship between problem-solving skills and the size of working memory and the attention span of science students with low ability levels in all High Schools (SSI) that hold Physics, Chemistry and Biology subjects in the study areas for the academic year 2017/2018. The study's results revealed that the low percentage variation in students' problem-solving skills in science could be associated with working memory and attention span measures. There is no significant relationship between the size of working memory, attention span, and the combination of working memory and students' attention span (Ellah et al., 2019).

Exploring the impact of problem-solving learning on science learning in terms of scientific knowledge, reasoning based on scientific concepts, and problem-solving skills. Using a quasi-experiment with a factorial learning approach design (problem-solving and traditional learning). This explains that the problem-solving group significantly outperforms the traditional hands-on learning group for immediate effect and retention, regardless of scientific knowledge, scientific concept-dependent reasoning, and problem-solving abilities (Cheng et al., 2017). Furthermore, to analyze students' problem-solving abilities in science learning and the ability to plan to learn using descriptive-quantitative methods for S1 students of Distance Higher Education located in Serang, majoring in Elementary School Teacher Education. Thirty-nine students from the two groups took Science Learning courses in Elementary School Semester I of 2017. This research shows that the Elementary School Teacher Education In-service Training Program is capable (score 66) of solving science learning problems and planning science learning (Widiasih et al., 2018).

CONCLUSION

Based on the literature review of the articles collected, it can be concluded that to meet the necessities of life in various situations in facing the global era, literacy skills are a fundamental thing that all students must own. The role of scientific literacy instruments is needed to measure students' science problem-solving abilities. Because scientific literacy is an individual's ability to identify, explain and conclude scientific evidence by

using problem-solving skills based on how to understand, plan, solve and re-examine. This can be seen from the many theories and learning methods that support the results obtained from the forty-four journals reviewed, with the criteria of the articles used being those published in 2017-2022.

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