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Developing Scientific Writing Skills Instrument Using An Inquiry-Based Approach to Local Wisdom Dilemma Stories for Senior High School Students

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Abstract: This study aims to develop a valid and reliable instrument for assessing scientific writing skills using an inquiry-based approach to local wisdom dilemma stories. A Design and Development method, based on the Ellis & Levy model, was adopted. The method consisted of six steps: (a) issues; (b) goal setting; (c) model design and development; (d) model testing; (e) model evaluation of the test findings; and (f) application model. Two hundred seventy-three high school students from three Indonesian schools were recruited as the pilot sample. Purposive sampling was used to select the participants. Five experts evaluated the instrument's validity. The Aiken formula for content validity proof yielded a respectable score of 0.86. According to the measurement model reliability evaluation, the instrument is in the dependable category, which comprises Composite Reliability with a value of 0.89. Confirmatory factor analysis revealed the Root Mean Square Error of Approximation value to be 0.043 < 0.08 and the Goodness of Fit Index to be 0.98 > 0, 90 or the declared model by the data obtained in the field and can be used in a wide range of measurements. The findings of this study have important implications for educational assessment and instructional design. Developing a valid and reliable instrument to measure scientific writing skills through an inquiry-based approach using local wisdom dilemma stories provides educators with a culturally relevant and pedagogically sound tool. This instrument can support more accurate evaluations of students' writing competencies and foster critical thinking and contextual understanding in scientific writing instruction at the high school level.

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Introduction

Writing skills are very important because they are used as an indirect form of communication carried out by someone to express ideas, ideas, concepts, and thoughts in the form of written language that can be read and understood by others (Astawa et al., 2017; Fu et al., 2019). Khosronejad et al. (2021) state that writing skills require students to be more thorough and sensitive to the surrounding environment when presenting reports, and students must write using good language and punctuation. In language learning, writing skills need to be one of the specific goals as a basic ability to think and communicate in everyday life and a basic ability to learn other sciences. Oviyanti (2017) states that it is necessary to build children's communication ability because communication skills are the most needed skills in learning. In communicating with other people, a tool is needed, namely language. This view is reinforced by Herring (2005), who that language is a means of communication by a person

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in association with others. The use of language becomes effective since an individual can communicate with others. Therefore, several skills in learning in the 21st century need to be empowered in scientific writing.

Students need scientific writing skills to be more skilled in constructing an argument, checking the credibility of sources, making decisions and solving problems responding to complex challenges (Braasch & Bråten, 2017; Liu et al., 2014). Scientific thinking makes it possible to exploit potential in seeing problems, solving problems, creating, and realizing oneself. Implementing learning writing skills facilitates students to think critically according to the characteristics of subjects and learning materials and can think critically. That supports the achievement of the core competencies of learning Indonesian in the free learning curriculum. Students must learn it at the school level.

Scientific writing is a critical thinking activity carried out by someone by the facts or materials presented; students must be honest with the information obtained so that students can explain well. Thus learning in the 21st century needs to place writing skills as an important student need in learning designed to improve writing skills. Writing skills can grow when individuals have ideas/thoughts in the learning process (Kellogg, 1999). The model must be combined with the selection of specific themes to be more focused on the learning objectives to overcome the inquiry's weakness. That will prevent students from straying from the learning objectives and accumulating irrelevant or unimportant information during the inquiry process.

The Independent Learning Curriculum implemented in Indonesia places importance on scientific writing skills possessed by students. Students must have attitudes, skills, and productive, creative, and innovative skills. Students with good scientific writing skills will be able to think based on ideas and have thoughts in expressing reasons in concluding and solving problems (Anazifa & Djukri, 2017; Widana, 2018). Scientific writing skills need to be the main goal in language learning so that every student can become a critical thinker who can be seen from his skills to interpret, analyze, evaluate, conclude, explain what he thinks and make decisions, apply the power of scientific thinking to himself, and improve the ability to think critically about the opinions he makes. Stupple et al. (2017) stated that scientific writing skills are an important focus in school education for good academic achievement. Indonesian language learning is directed to develop language skills that make students lifelong independent, creative, and able to solve problems by using language skills.

The results of the field survey show that students' low motivation to write scientifically becomes an obstacle in scientific writing. Students still need help constructing scientific work by paying attention to content, systematics, and language, not using proper grammar according to Indonesian spelling, assembling sentences, developing sentences, and writing scientific reports. The difficulties experienced by educators are that educators find it difficult to develop students' courage to write scientifically, and educators need to find the right model for learning to write scientifically.

Students' writing skills still need attention to be improved in learning using the inquiry model (Ali & Ulker, 2020; Cetin & Eymur, 2017; Erenler & Cetin, 2019; Hamsina, 2020; Palupi et al., 2020). The inquiry learning model can facilitate students to be more independent in building their understanding, meaningful and can contribute to improving critical thinking skills (Jatmiko et al., 2018; Lin et al., 2021; Maknun, 2020; Verawati et al., 2020). Building a classroom environment that focuses on learning through inquiry is important for effective classroom management (Garza & Arreguín-Anderson, 2018). In the classroom, language needs to be framed in a real context, making it possible to express and develop ideas that have meaning for students outside the classroom (Ahmed, 2017; Boot et

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al., 2017; Buxton et al., 2019; Gillies et al., 2015). However, the inquiry model also has weaknesses, including (1) if students are not used to it, it will be difficult to plan; (2) difficulties in controlling activities and learning success; (3) difficulty in time management; and (4) difficulties if the learning objectives are only in mastering the material. Difficulties in implementing the inquiry also arise if the number of students is too many. Therefore, it is crucial to include the model in selecting specific topics to be more focused on the learning objectives to overcome the inquiry's weakness and prevent students from deviating from the learning objectives and gathering unnecessary or unimportant information. The theme referred to in this study is related to the topic of scientific writing learning materials that contain the value of local wisdom.

The theme of local wisdom in people's social, cultural, and religious lives is integrated into the inquiry model in learning scientific writing material. The inquiry model based on local wisdom dilemmas stories is used to overcome the weaknesses of the inquiry model. So that students stay consistent with themes about local wisdom dilemmas stories in learning scientific writing materials in formulating problems and collecting data. Learning based on local wisdom dilemmas stories is recommended in language learning to improve critical thinking skills (Martínez & Mejía, 2020; Smith et al., 2020). This study believes cultivating local wisdom dilemmas stories will be successful if supported by the surrounding socio-cultural environment (Adhikari et al., 2017; Scott-Weich & Yaden, 2017). In the context of the socio-cultural environment around students, the home, school and community environments have a very important role in supporting efforts to socialize and inculcate and even preserve the values of these local wisdom dilemmas stories. Schools need to build programs that educate, especially those with local wisdom dilemmas stories. These activities can be demonstrated inside or outside of learning as extracurricular activities. Learning based on local wisdom dilemmas stories supports skill improvement in Ilan scientific writing because it facilitates students to carry out each inquiry stage to help increase students' understanding of social and cultural values in society.

Curriculum documents in high school place the competence of scientific writing skills as one of the main achievements. However, it still needs a valid and reliable instrument model for measuring students' scientific writing skills. So the assessment instrument needs to be integrated with a supportive approach to be more effective in measuring scientific writing skills. This study aims to develop a valid scientific writing skill instrument that can measure variables both in content and construction. The development of scientific writing skill instruments is important as an evaluation tool and measuring curriculum achievement in high school in language learning.

Previous research on the development of scientific writing instruments, among others, by Supriyadi (2021) developed an evaluation instrument for scientific writing learning with a constructivist approach. Furthermore, Baram-Tsabari & Lewenstein (2013) developed an instrument to assess the written skills of scientists in science public communication. This study introduces a novel instrument model for measuring scientific writing skills through an inquiry-based approach using local wisdom dilemma stories. The indicators align with the national curriculum and are enriched by expert input, offering a new reference for culturally grounded learning assessments.

Research Method

The Ellis & Levy model is used in this study as part of the Design and Development (D&D) process, which includes the steps of (1) issue, (2) goal setting, (3) model design and development, and (4) model testing, and (5) model evaluation results

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testing, and (6) application models. This approach systematically studies the design, development, and evaluation processes to build an empirical foundation for creating new instructional products, tools, and models (Klein, 2014; Spector et al., 2014). The product produced in this study is an instrument model of scientific writing skills with an inquiry-based approach to local wisdom dilemmas stories. Field studies and needs analysis carry out problem analysis. The result of this study is goal setting, namely the development of scientific writing skills with an inquiry-based approach to local wisdom dilemmas stories for high school students. The planning and development stages refer to the theory of definitions and indicators of scientific writing skills and the integration of an inquiry-based approach to local wisdom dilemmas stories to synthesize indicators. The instrument grid was then developed based on the indicator formulation. According to Mulyono et al. (2023), the prototype instrument was developed based on

$$V = \frac{\Sigma s}{[n(c-1)]} \quad (1)$$

Information:
s = r – lo
lo = the lowest number of validity assessment
c = the highest validity score
r = the score given by assessor

Construct validity test with Confirmatory Factor Analysis (CFA) using Linear Structural Model (Lisrel). The sample used is students from 3 high schools in Indonesia, as many as 273 people. The sampling technique used in this study is purposive sampling. Data collection techniques through tests. It is used to determine the extent to which the empirical data in the field supports the theoretical construct that has been defined, whether the construct has been met or whether the data in the field does not support the theoretical construct. When evaluating an instrument's appropriateness for use with field data, the following criteria are applied: p, value = 0.05, then interprets the acquisition of goodness of fit indices (GFI) value, then adjusted goodness of fit index (AGFI) value and root mean square value error of approximation (RMSEA)(Mulyono et al., 2023). The measurement model reliability assessment includes Composite Reliability (CR) and Average Variance Extracted (AVE). CR and AVE are found by equations (2) and (3).

$$AVE = \frac{\Sigma LF^2}{\Sigma LF^2 + \Sigma(1-LF^2)} \quad (2)$$

$$CR = \frac{(\Sigma LF)^2}{[(\Sigma LF)^2 + \Sigma(1-LF^2)]} \quad (3)$$

Information:
LF = loading factor

Results and Discussion

Planning stage

A model or prototype is designed and developed at this stage. A literature review and synthesis of the results are conducted to support the development model at this stage. The prototype 1 model's basic design phase is complete, and model testing is still ongoing. As a foundation for creating an initial design model or prototype, this phase's literature review explores the idea of scientific writing as an instructional influence of a learning and assessment technique.

Research insights into the ideas, processes, phases and methodologies employed in development research are gained after evaluating scientific writing techniques. Through this activity, an empirical study of the application and assessment of scientific writing skills can

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be obtained for high school students writing scientific papers. A review of relevant research results shows that the assessment of scientific writing skills is very supportive of learning to write in high school. These students' abilities can be determined by applying the scientific writing skills assessment model.

The literature study results and preliminary activities then analyzed the problems and needs. The problem analysis shows that the previously developed test instrument has yet to measure scientific writing skills. In addition, the assessment model of the scientific writing skill test instrument that was previously developed is still at the level of concept knowledge. Therefore, the assessment tool previously designed has yet to be able to measure and improve scientific writing skills.

A problem-analysis process was carried out to find research models that might hone students' scientific writing abilities in learning materials for scientific writing. This study's needs analysis revealed that: (1) it is important to train educators to create instruments that can measure scientific writing abilities, and (2) the assessment model created can identify the learning deficits of high school students.

Development stage

The result of this development is in the form of a test instrument product to measure scientific writing skills in scientific writing material for high school students. In the early stages of development is to develop a prototype and validated it. This activity aims to produce products in the form of instruments that can be applied properly and effectively. The prototype consists of assessment instruments, guidelines, and how to interpret the assessment results. Prototype planning is carried out through design activities, including planning objectives, instruments, and implementation guidelines. The initial design of the assessment prototype was then reviewed by involving experts in the field of scientific writing and the field of educational evaluation.

Instruments of scientific writing skills are formulated based on the synthesis of definitions and indicators from experts. Researchers have synthesized indicators of scientific writing skills based on the current national curriculum's formulation and in conjunction with the expert formulation. That is done because it adapts to the syntax of the model and the material for writing scientific papers. The synthesis produced indices of scientific writing abilities, which are operationally defined and shown in Table 1.

Table 1. Operational Definition of Scientific Writing Skills

No	Indicator	Operational definition
1	Writing background	The ability of students to analyze data/discourses and find gaps/problems, then write them down as the basis for preparing scientific papers
2	Writing a problem statement	Student's ability to analyze problems and formulate them into appropriate problem formulations deserves to be studied
3	Writing goals	The ability of students to write down the focus of the objectives in scientific works in a concise, concise, and appropriate manner
4	Writing citations and reference sources	Students' ability to write foot citations and bibliography ethically appropriate
5	Writing the scientific method	applicable rules
6	Write results	Student's ability to write down the steps in the scientific method in a systematic and structured manner
7	Writing arguments	The ability of students to write down research data according to the problem formulation in a systematic and

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No	Indicator	Operational definition
		easy-to-understand way
8	Writing conclusions and suggestions	Student's ability to write their arguments related to data based on their critical analysis skills

The prototype instrument was developed based on formulated indicators and validated through content validity using the Aiken formula with five expert validators. Expert input emphasized the need for clear characteristics, defined objectives, alignment with assessment principles, and comprehensive, user-friendly guidelines. After revisions, the instrument was re-evaluated and deemed appropriate. Based on a 1–5 scale and a significance level of 0.05, the Aiken value reached 0.84, exceeding the 0.80 threshold, indicating the instrument's content is valid.

Product Trial Results

Product trials were conducted to construct validity measures. The results of the construct validity test using Confirmatory Factor Analysis (CFA) using the Linear Structural Model (Lisrel) are presented in Figure 1.

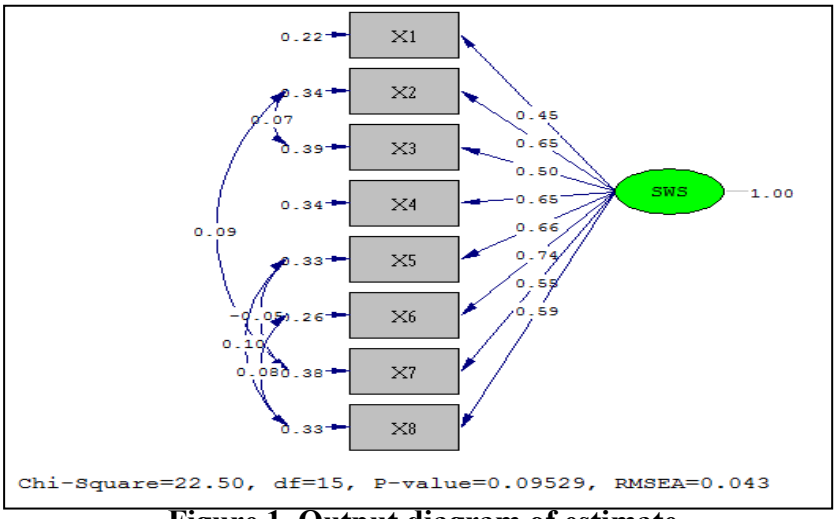

Figure 1. Output diagram of estimate

Figure 1 shows the model fit. The interpretation of the analysis results in detail is presented in Table 2.

Table 2. Model Fit Test Result

Indicator	Score Benchmark	Score Acquisition	Model Fit
Chi-Square/df	≤ 2.00	1.50	Good
Probability (p-value)	≥ 0.08	0.95	Good
Goodness of Fit Index (GFI)	≥ 0.90	0.98	Good
Root Mean Square Error of Approximation (RMSEA)	≤ 0.05	0.04	Good
Comparative Fit Index (CFI)	≥ 0.90	1.00	Good
Relative Fit Index (RFI)	≥ 0.90	0.98	Good
Incremental Fit Index (IFI)	≥ 0.90	1.00	Good
Adjusted Goodness of Fit Index (AGFI)	≥ 0.90	0.95	Good
Parsimony Goodness of Fit Index (PGFI)	≥ 0.05	0.41	Good

According to Jöreskog & Sörbom (1989), a model is considered adequate if it meets at least three model fit indices, such as Chi-Square, RMSEA, P-Value, and GFI. The empirical data support the model's theoretical constructs, with all indices falling within acceptable ranges,

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indicating good model fit. The t-test results further confirm that all parameter estimates are significant, with t-values exceeding the critical threshold of 1.65.

Construct validity is supported by loading factor values above 0.5, and convergent validity is met as AVE exceeds the 0.5 threshold. That confirms that the indicators are valid in representing the model. Reliability testing, including Composite Reliability (CR) and Average Variance Extracted (AVE), also confirms the instrument's consistency and accuracy in measuring the intended latent constructs.

Table 3. Reliability Analysis Results

	Score	Information
CR	0.90	Reliable
AVE	0.52	Reliable

Table 3 shows that the reliability test results meet the required standards, with CR = 0.7 and AVE = 0.5, indicating that the instrument is dependable. AVE reflects the latent variable's ability to represent the data accurately, with 0.5 as the minimum acceptable value (Sürücü & Maslakci, 2020). These results confirm strong convergent validity, meaning the indicators reliably measure the intended construct and the instrument remains consistent across different respondents.

Discussion

A model for evaluating the writing abilities of high school students' scientific paper writing materials is the study's final output. According to Cantos et al. (2015), the evaluation should be able to motivate students to reach their full potential by reflecting their general aptitude, knowledge, attitudes, and abilities (Kriswantoro et al., 2021). The created assessment tool must fulfil the requirements for being a reliable gauge of students' skills and competences (Amelia & Kriswantoro, 2017; Kriswantoro et al., 2021).

The qualitative analysis, validation, testing, and measurement phases of this scientific writing skill assessment model have all been completed at the time of application. As previously stated, two types of model testing are done: expert testing and empirical testing using actual trials. The produced model has the required elements of scientific writing abilities, according to the findings of the expert evaluation of the original design assessment model. According to Connell et al. 2018; Högberg et al. 2019; and Moyano-Fuentes et al. (2019), an instrument is deemed to be legitimate if the expert thinks it can measure the objects to be tested. The eight components of the development model will also be considered legitimate and acceptable in light of expert advice and recommendations. The experts' notes revised these comments and recommendations. After being fixed, the model may be used for the following phase, which involves empirical testing using trials, with an Aiken index of 0.86, making it possible to prove. This study's Scientific Writing Assessment Model labelled these findings as Revision I. Trials in three high schools. According to the analysis's findings, a loading factor value was created for each of the eight elements. RMSEA and the Goodness of Fit Index (GFI) are the criteria that were employed (Kartowagiran et al., 2020). Since the values acquired generally fall within the necessary intervals, the model obtained is fit, which means that the instrument construct is sound and suitable for usage in terms of the spread of this measurement model.

Internal validation (the verification of components and procedures) and external validation are given priority when discussing validation (validation of the impact of using the model). Validation incorporates expert evaluation, the procedure through which the expert judges the components, structure, and potential applications. Based on defined criteria, the review procedure and evaluation inputs are created. On input data and recommendations from

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experts, further model changes are built. This validation process may be considered a formative assessment (Elwy et al., 2020; Made et al., 2022; van Groen & Eggen, 2020). The Delphi approach is employed since it is more akin to a validation procedure that includes experts critiquing and evaluating the created model's constituent parts and overall structure (Kriswantoro et al., 2021). More particularly, two features of the Delphi method were quite useful in our investigation. First, the assessment qualification contributed to this approach's success. The evaluation panel is knowledgeable in several different fields. The internal validation procedure heavily relies on experts. The first cycle, which starts with a focus group discussion (FGD), is given one week for expert reviewers to evaluate, answer multiple open-ended questions, and create the most substantial change in the model. That gives each expert a configurable time limit to score and remark. It is crucial to consider comments and ideas before making the following adjustment.

Additional research includes empirical investigations that provide a more detailed description of the building or improvement procedures. This study explains how the created model was made and how it was put together. First of all, by concentrating on several different factors, this method enables the completion of the development of a new model with the proper degree of clarity. Second, users in this example, instructors and students—can quickly learn the model's output. Last but not least, our research yields a tested model of content validity that teachers who are inseparable from context, material, and students may employ.

The objectives and content of teaching Indonesian at each level are relatively the same, expecting students to be skilled in using language for communication purposes. However, so that students feel energized with learning, educators should prepare and present materials in the curriculum and adapt them to the school level and the maturity of their students (Susilowati, 2020).

Writing is a complex skill that is not easy to master. Weideman et al. (2017) said that writing skills require mastery of linguistic and non-language elements that will become text elements. Elements of message content or language elements must be well woven to produce a script that contains coherently. Nevertheless, skilled writers can produce good manuscripts—a manuscript composed of good words, sentences, and paragraphs. The UK Government's Division of Curriculum and Assessment (2010) requires a scientific paper to have four requirements: clear, specific, supported and focused. Clear or clear means the information must be easily understood by the reader. Although the ideas presented are complex, the way they are conveyed must be easy to understand—specific, which means that the written material should not be superficial. The information presented in scientific writings should be detailed and detailed. Supported or supported by facts means scientific writings should be accompanied by accurate and accountable facts, data, examples, and statements. Focused or centred, scientific writing should focus on the initial idea. That can be done with unity and coherence between paragraphs. Stuhlsatz et al. (2020) adds that scientific writing contains information, expert opinions, and strong logical thinking. Wallwork (2016) stated that the characteristics of scientific writing include clarity (clear), readability (readability), and non-ambiguity (not confusing).

The findings of this study underscore both conceptual and practical implications for enhancing scientific writing skills. Conceptually, they highlight the importance of alignment between learning strategies and evaluation methods, emphasizing that effective assessment should reflect the instructional approach. Practically, the study demonstrates that even if a learning environment does not explicitly foster scientific writing, carefully designed instruments such as the one developed in this research can still validly and reliably assess

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students' scientific writing abilities. That supports more targeted feedback and instructional improvement.

Conclusion

The findings of this study conclude that the developed instrument model for measuring scientific writing skills is valid, reliable, and applicable for educational assessment. The confirmatory factor analysis results demonstrate strong construct validity, with a Root Mean Square Error of Approximation (RMSEA) value of 0.043 (< 0.08) and a Goodness of Fit Index (GFI) of 0.98 (> 0.90), indicating excellent model fit. Content validity assessed by expert judgment yielded a high Aiken V score of 0.86, and the instrument's Composite Reliability reached 0.89, placing it in the dependable category. These results confirm that the instrument is ready for practical application in assessing high school students' scientific writing skills through an inquiry-based approach using local wisdom dilemma stories, and it can serve as a standardized tool in educational settings.

Recommendation

As a follow-up, teachers are encouraged to apply this instrument to assess students' scientific writing skills and adapt teaching strategies accordingly while integrating local wisdom content to enhance cultural relevance. Future researchers should expand the instrument to cover broader writing topics, validate it with larger, diverse samples, and explore its impact on students' writing performance and critical thinking.

References

Adhikari, J., Scogings, C., Mathrani, A., & Sofat, I. (2017). Evolving digital divides in information literacy and learning outcomes: A BYOD journey in a secondary school. *International Journal of Information and Learning Technology*, *34*(4), 290–306. https://doi.org/10.1108/IJILT-04-2017-0022

Ahmed, S. (2017). Authentic ELT Materials in the Language Classroom : An Overview. *Journal of Applied Linguistics and Language Research*, *4*(2), 181–202.

Ali, H. F., & Ulker, V. (2020). The effect of inquiry-based approach on development of reading and writing skills of a University EFL students. *Asian EFL Journal*, *27*(2), 84–100. https://doi.org/10.2139/ssrn.3621259

Amelia, R. N., & Kriswantoro, K. (2017). Implementation of Item Response Theory for Analysis of Test Items Quality and Students' Ability in Chemistry. *JKPK (Jurnal Kimia Dan Pendidikan Kimia)*, *2*(1), 1. https://doi.org/10.20961/jkpk.v2i1.8512

Anazifa, R. D., & Djukri, D. (2017). Project-based learning and problem-based learning: Are they effective to improve student's thinking skills? *Jurnal Pendidikan IPA Indonesia*, *6*(2), 346–355.

Astawa, I. N., Mantra, I. B. N., & Widiastuti, I. A. M. S. (2017). Developing communicative English language tests for tourism vocational high school students. *International Journal of Social Sciences and Humanities*, *1*(2), 58–64. https://doi.org/10.29332/ijssh.v1n2.43

Baram-Tsabari, A., & Lewenstein, B. V. (2013). An Instrument for Assessing Scientists' Written Skills in Public Communication of Science. *Science Communication*, *35*(1), 56–85. https://doi.org/10.1177/1075547012440634

Boot, P., Zijlstra, H., & Geenen, R. (2017). The Dutch translation of the Linguistic Inquiry and Word Count (LIWC) 2007 dictionary. *Dutch Journal of Applied Linguistics*, *6*(1), 65–76. https://doi.org/10.1075/dujal.6.1.04boo

Copyright © 2025, The Author(s)

Braasch, J. L. G., & Bråten, I. (2017). The Discrepancy-Induced Source Comprehension (D-ISC) Model: Basic Assumptions and Preliminary Evidence. *Educational Psychologist*, *52*(3), 167–181. https://doi.org/10.1080/00461520.2017.1323219

Buxton, C., Harman, R., Cardozo-Gaibisso, L., Jiang, L., Bui, K., & Allexsaht-Snider, M. (2019). Understanding Science and Language Connections: New Approaches to Assessment with Bilingual Learners. *Research in Science Education*, *49*(4), 977–988. https://doi.org/10.1007/s11165-019-9846-8

Cantos, A. E., Alday, M. G., Alog, K. J., Asi, K. J., Calacal, R. H., & Britiller, M. C. (2015). Changing learning needs of student nurses: input to the nursing curriculum. *Asia Pacific Journal of Multidisciplinary Research*, *3*(3), 108–119.

Cetin, P. S., & Eymur, G. (2017). Developing Students' Scientific Writing and Presentation Skills through Argument Driven Inquiry: An Exploratory Study. *Journal of Chemical Education*, *94*(7), 837–843. https://doi.org/10.1021/acs.jchemed.6b00915

Connell, J., Carlton, J., Grundy, A., Taylor Buck, E., Keetharuth, A. D., Ricketts, T., Barkham, M., Robotham, D., Rose, D., & Brazier, J. (2018). The importance of content and face validity in instrument development: lessons learnt from service users when developing the Recovering Quality of Life measure (ReQoL). *Quality of Life Research*, *27*(7), 1893–1902. https://doi.org/10.1007/s11136-018-1847-y

Elwy, A. R., Wasan, A. D., Gillman, A. G., Johnston, K. L., Dodds, N., McFarland, C., & Greco, C. M. (2020). Using formative evaluation methods to improve clinical implementation efforts: description and an example. *Psychiatry Research*, *283*, 112532.

Erenler, S., & Cetin, P. S. (2019). Utilizing argument-driven-inquiry to develop pre-service teachers' metacognitive awareness and writing skills. *International Journal of Research in Education and Science*, *5*(2), 628–638.

Fu, Q. K., Lin, C. J., Hwang, G. J., & Zhang, L. (2019). Impacts of a mind mapping-based contextual gaming approach on EFL students' writing performance, learning perceptions and generative uses in an English course. *Computers and Education*, *137*(April), 59–77. https://doi.org/10.1016/j.compedu.2019.04.005

Garza, E., & Arreguín-Anderson, M. G. (2018). Translanguaging: Developing scientific inquiry in a dual language classroom. *Bilingual Research Journal*, *41*(2), 101–116. https://doi.org/10.1080/15235882.2018.1451790

Gillies, R. M., Nichols, K., & Khan, A. (2015). The effects of scientific representations on primary students' development of scientific discourse and conceptual understandings during cooperative contemporary inquiry-science. *Cambridge Journal of Education*, *45*(4), 427–449. https://doi.org/10.1080/0305764X.2014.988681

Hamsina, S. (2020). Increasing Students' Motivation on Learning Writing Skills Through Inquiry Approach. *ETERNAL (English, Teaching, Learning, and Research Journal)*, *6*(1), 31. https://doi.org/10.24252/eternal.v61.2020.a3

Herring, S. C. (2005). *Computer-mediated discourse*. The handbook of discourse analysis, 612-634.

Högberg, J., Hamari, J., & Wästlund, E. (2019). Gameful Experience Questionnaire (GAMEFULQUEST): an instrument for measuring the perceived gamefulness of system use. *User Modeling and User-Adapted Interaction*, *29*(3), 619–660.

Jatmiko, B., Prahani, B. K., Munasir, Supardi, Z. A. I., Wicaksono, I., Erlina, N., Pandiangan, P., Althaf, R., & Zainuddin. (2018). The comparison of oripa teaching

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model and problem based learning model effectiveness to improve critical thinking skills of pre-service physics teachers. *Journal of Baltic Science Education*, *17*(2), 300–319. https://doi.org/10.33225/jbse/18.17.300

Jöreskog, K. G., & Sörbom, D. (1989). *LISREL 7 user's reference guide*. Scientific Software. Inc., Mooresville, IN.

Kartowagiran, B., Suyanta, Hamdi, S., Jaedun, A., Ahman, Rusijono, & Laliyo, L. A. R. (2020). Development of web-based application for teacher candidate competence instruments: Preparing professional teachers in the IR 4.0 era. *European Journal of Educational Research*, *9*(4), 1749–1763. https://doi.org/10.12973/eu-jer.9.4.1749

Kellogg, R. T. (1999). *The Psychology of Writing*. Oxford University Press.

Khosronejad, M., Reimann, P., & Markauskaite, L. (2021). 'We are not going to educate people': how students negotiate engineering identities during collaborative problem solving. *European Journal of Engineering Education*, *46*(4), 557–574. https://doi.org/10.1080/03043797.2020.1821174

Klein, J. D. (2014). *Design and development research: A rose by another name*.

Kriswantoro, Kartowagiran, B., & Rohaeti, E. (2021). A critical thinking assessment model integrated with science process skills on chemistry for senior high school. *European Journal of Educational Research*, *10*(1), 285–298. https://doi.org/10.12973/EU-JER.10.1.285

Lin, X., Yang, W., Wu, L., Zhu, L., Wu, D., & Li, H. (2021). Using an Inquiry-Based Science and Engineering Program to Promote Science Knowledge, Problem-Solving Skills and Approaches to Learning in Preschool Children. *Early Education and Development*, *32*(5), 695–713. https://doi.org/10.1080/10409289.2020.1795333

Liu, O. L., Frankel, L., & Roohr, K. C. (2014). Assessing Critical Thinking in Higher Education: Current State and Directions for Next-Generation Assessment. *ETS Research Report Series*, *2014*(1), 1–23. https://doi.org/10.1002/ets2.12009

Made, N., Mertasari, S., & Yudana, I. M. (2022). *Formative Evaluation Instruments of Integrated Character Education in Thematic Learning*. *6*(2), 289–296.

Maknun, J. (2020). Implementation of Guided Inquiry Learning Model to Improve Understanding Physics Concepts and Critical Thinking Skill of Vocational High School Students. *International Education Studies*, *13*(6), 117. https://doi.org/10.5539/ies.v13n6p117

Martínez, R. A., & Mejía, A. F. (2020). Looking closely and listening carefully: A sociocultural approach to understanding the complexity of Latina/o/x students' everyday language. *Theory into Practice*, *59*(1), 53–63. https://doi.org/10.1080/00405841.2019.1665414

Moyano-Fuentes, J., Bruque-Cámara, S., & Maqueira-Marín, J. M. (2019). Development and validation of a lean supply chain management measurement instrument. *Production Planning & Control*, *30*(1), 20–32.

Mulyono, Y., Suranto, Yamtinah, S., & Sarwanto. (2023). *Development of Critical and Creative Thinking Skills Instruments Based on Environmental Socio-Scientific Issues*. *16*(3), 691–710.

Oviyanti, F. (2017). Urgensi Kecerdasan Interpersonal Bagi Guru. *Tadrib: Jurnal Pendidikan Agama Islam*, *3*(1), 75. https://doi.org/10.19109/tadrib.v3i1.1384

Palupi, B. S., Subiyantoro, S., Rukayah, & Triyanto. (2020). The effectiveness of Guided Inquiry Learning (GIL) and Problem-Based Learning (PBL) for explanatory writing skill. *International Journal of Instruction*, *13*(1), 713–730. https://doi.org/10.29333/iji.2020.13146a

Copyright © 2025, The Author(s)

Scott-Weich, B., & Yaden, D. B. (2017). Scaffolded writing and early literacy development with children who are deaf: a case study. *Early Child Development and Care*, *187*(3–4), 418–435. https://doi.org/10.1080/03004430.2016.1246446

Smith, P., Karkar, T., Varner, J., Nigam, A., & Finch, B. (2020). Making Visible Awareness in Practice: Literacy Educators in Diverse Classrooms. *Review of Education*, *8*(2), 380–415. https://doi.org/10.1002/rev3.3190

Spector, J. M., Merrill, M. D., Ellen, J., & Bishop, M. J. (2014). *Handbook of research on educational and technology*. Springer.

Stuhlsatz, M. A. M., Buck Bracey, Z. E., & Donovan, B. M. (2020). Investigating Conflation of Sex and Gender Language in Student Writing About Genetics. *Science and Education*, *29*(6), 1567–1594. https://doi.org/10.1007/s11191-020-00177-9

Stupple, E. J. N., Maratos, F. A., Elander, J., Hunt, T. E., Cheung, K. Y. F., & Aubeeluck, A. V. (2017). Development of the Critical Thinking Toolkit (CriTT): A measure of student attitudes and beliefs about critical thinking. *Thinking Skills and Creativity*, *23*, 91–100. https://doi.org/10.1016/j.tsc.2016.11.007

Supriyadi, S. (2021). Evaluation instrument development for scientific writing instruction with a constructivism approach. *Technium Soc. Sci. J*, *21*(345).

Sürücü, L., & Maslakci, A. (2020). Validity and reliability in quantitative research. *Business & Management Studies: An International Journal*, *8*(3), 2694–2726.

Susilowati, W. (2020). Meta-Analisis Pengaruh Model Inquiry Learning Terhadap Keterampilan Berfikir Kritis Pada. *Jurnal Ilmiah Pendidikan Profesi Guru*, *3*(1), 1–6.

van Groen, M. M., & Eggen, T. J. H. . (2020). Educational test approaches: The suitability of computer-based test types for assessment and evaluation in formative and summative contexts. *Journal of Applied Testing Technology*, *21*(1), 12–24.

Verawati, N. N. S. P., Hikmawati, & Prayogi, S. (2020). The effectiveness of inquiry learning models intervened by reflective processes to promote critical thinking ability in terms of cognitive style. *International Journal of Emerging Technologies in Learning*, *15*(16), 212–220. https://doi.org/10.3991/ijet.v15i16.14687

Wallwork, A. (2016). *English for writing research papers*. Springer.

Weideman, A., Du Plessis, C., & Steyn, S. (2017). Diversity, variation and fairness: Equivalence in national level language assessments. *Literator*, *38*(1). https://doi.org/10.4102/lit.v38i1.1319

Widana, I. W. (2018). Higher Order Thinking Skills Assessment towards Critical Thinking on Mathematics Lesson. *International Journal of Social Sciences and Humanities (IJSSH)*, *2*(1), 24–32. https://doi.org/10.29332/ijssh.v2n1.74

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