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Assessing Presentation Skills in STEAM Project-Based Learning: A Longitudinal Analysis Using Rasch Modeling

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Abstract: Assessing Presentation Skills in STEAM Project-Based Learning: A Longitudinal Analysis Using Rasch Modeling. Project presentation is a crucial element in PjBL learning, as it allows students to demonstrate their understanding of the material studied and the ability to convey project ideas and results effectively. **Objectives:** This study aims to analyse students' presentation performance in teaching using the Project-based Learning approach. **Methods:** The type of research used is a quasi-experimental design with a time series approach. Respondents involved in this study were 22 prospective elementary school teacher students. The groups assessed were randomly selected using a lottery system. The instrument used to assess group presentation skills consists of 11 items, and each item uses a 5-point Likert rating scale. Presentation performance data was analysed using the Logit Value of Item (LVI) technique combined with the Wright map. **Findings:** Group presentation performance experienced variations in improvement over time, with some skills showing an increasing trend and others showing a decreasing trend. **Conclusion:** The implication of this study, in terms of presentation performance, is that although there is variation in the improvement of student presentation skills over time, analysis using Rasch modelling can provide greater insight into the factors that influence presentation quality and help identify areas that require improvement in Project-based Learning teaching.

Keywords: logit value of item, presentation skills, rasch model, STEAM, wright map.

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INTRODUCTION

Education in the 21st century demands the application of innovative and interdisciplinary approaches to prepare the next generation to face global challenges. One approach that is increasingly being applied is STEAM (Science, Technology, Engineering, Arts, and Mathematics), which emphasizes the integration of various disciplines to develop critical thinking skills, creativity, and complex problem solving (Perez Jr. et al., 2025; Prahani et al., 2025). In Indonesia, prospective elementary school teachers strategically implement STEAM learning at the basic education level. Therefore, developing STEAM learning in prospective elementary school teachers' study programs is an important step to produce educators who can integrate various disciplines in the learning process (Delia Voicu et al., 2023; He et al., 2022).

One of the effective learning models in implementing the STEAM approach is Project-Based Learning (PjBL). This model encourages

students to work collaboratively to complete projects relevant to the learning topic and present the project results to peers (Rahim et al., 2024; Winarni et al., 2024). In addition to building academic knowledge, this approach develops non-cognitive skills, such as communication, cooperation and presentation skills (Petchamé et al., 2024; Yusri et al., 2024). Presentation skills are very important for prospective teachers, as they are the basis for delivering material in the classroom in a clear, engaging and interactive manner.

However, educational practices in various prospective elementary school teachers' study programs in Indonesia still face challenges in strengthening effective presentation skills. Students often find it difficult to organise and deliver good presentations in terms of structure, content, and delivery style. This skill is very important to support successful teaching in the future. Although project-based learning provides space for presentation practice, evaluation of the development of these skills has not been done systematically.

Previous research has discussed efforts to improve presentation skills, either through video-based assignments (Galindo et al., 2020), the use of feedback from lecturers and peers (Al Jahromi, 2020), or through the use of multimedia technology and virtual environments (Namin et al., 2021). The results of these studies show that such interventions can have a positive impact in the short term on improving students' presentation skills.

However, most existing studies have focused on short-term interventions, and few have examined presentation skill development longitudinally. Studies such as Algouzi et al. (2023) and Mahdi (2022) show immediate skill improvement, but do not explain how these skills develop sustainably over a longer period. In addition, most studies use conventional assessment approaches such as pre-post-test and simple scoring rubrics that are less accurate in measuring latent or indirectly observable abilities.

One important gap in the literature is the absence of rigorous psychometric approaches, such as Rasch Modelling, in evaluating presentation skills in project-based learning contexts, particularly in STEAM fields. In fact, Rasch Modelling allows for more objective, reliable and valid measurement, considering the task's difficulty, rater consistency, and the development of individual and group student abilities.

In addition, peer assessment, which is part of PjBL, also often poses challenges related to the subjectivity of assessment. The application of Rasch Modelling in this context is expected to improve the objectivity and consistency of evaluation by calibrating the rater effect and the difficulty level of the task items.

This study uses Rasch Modelling longitudinally to analyse the presentation skills of prospective elementary school teachers in STEAM Learning Development courses that apply the Project-Based Learning approach. Specifically, this study aimed to:

1. Evaluate the development of students' presentation skills at several assessment points during the learning process;
2. Identify factors that influence the quality of student presentations.

To achieve these objectives, three research questions were raised in this study, namely:

1. What is the Item Quality in the student presentation performance assessment instrument?
2. What is the tendency of students' presentation performance?
3. How is student presentation performance based on Rasch modelling in a longitudinal design?

Combining a longitudinal design and Rasch analysis approach, this study is expected to

significantly contribute to developing educational theory and practice, particularly strengthening student presentation skills through project-based learning in higher education.

METHOD

Participants

This study involved 22 students from the prospective elementary school teacher Study Program at one of the private universities in Indonesia taking the STEAM Learning Development course. The population in this study were all prospective elementary school teacher students enrolled in the odd semester of the 2024/2025 academic year. The sampling technique used was purposive sampling, with the following inclusion criteria: (1) active students in semester 5, (2) have taken basic education courses, and (3) attended Pjbl-STEAM classes in full during the research period. The exclusion criteria were students who did not participate in at least one group presentation session. The final sample consisted of 22 students who met all these criteria.

Research Design and Procedures

Research Design. This study used a quasi-experimental design with a time series approach. This design was chosen because it allows researchers to continuously observe changes in student presentation skills at several points without the need for a control group (Andargie et al., 2025). This approach is effective for evaluating the longitudinal impact of an intervention in a real-world context. The advantage of this design is its ability to monitor change trends and identify patterns of individual and group development over time. A limitation is the possibility of outside influences that cannot be fully controlled, as there is no comparison with other groups.

Research Steps. The study was conducted for four consecutive weeks, with one weekly meeting. The procedures were: (1) Week 1, Introduction to PjBL and project group formation. Students started to design their STEAM project. (2) Week 2-5, Each group presented their project progress. (3) Assessment is conducted every week after the presentation session, using prepared instruments. (4) Assessment is conducted by peers (peer assessment) using Google Forms. Additional assessment by the lecturer was conducted as triangulation data, but was not used in the Rasch analysis.

Instrument

The instrument is a non-test instrument, a self-developed group presentation skills assessment questionnaire based on the literature on oral communication and academic presentans. The instrument consists of 11 statement items, arranged based on 4 main indicators of presentation skills, namely (see Table 1):

Table 1. Presentation skills research instrument indicators

	Indicators	Sample Statement Item	N
1.	Structure and Clarity of Presentation	"The presentation was clearly structured and easily understood by the audience."	3 items
2.	Communication Techniques and Material Understanding	"Students were able to answer questions appropriately and confidently."	4 items
3.	Collaboration and Group Participation	"All group members are actively involved in the presentation."	2 items
4.	Time Management and Visual Media	"The presentation was delivered within the allotted time without rushing."	2 items

Each item uses a 5-point Likert rating scale, from 1 (Strongly Disagree) to 5 (Strongly Agree). The quality of the research instruments is reported in the discussion section.

Data Analysis

Data were analysed using the Rasch Modelling approach with the help of the latest version of Winsteps software. The choice of Rasch was based on its ability to: (1) objectively measure latent traits, (2) map the relationship between participants' ability levels and item difficulty on the same logit scale, and (3) identify misfitting items or participants. Data Analysis Steps:

1. Data were coded from Google Forms into Excel format and entered into Winsteps.
2. Each response was converted to logit values using the Logit Value of Item (LVI) to identify the easiest and most difficult items.
3. The LVI results were used to see the distribution of items based on relative difficulty.
4. A Wright Map (Item-Person Map) was created to illustrate the distribution of participants based on their presentation ability over time.
5. A week-to-week comparison of participants' progress was analysed based on the shifting positions on the Wright Map.

With this approach, the researcher could observe the longitudinal development of students' presentation skills accurately and based on standardised data.

■ RESULT AND DISCUSSION

Item Quality of Presentation Performance

The quality assessment items used are shown in Table 1. Item quality analysis using the Rasch Model (see Table 1) shows that all items in the student presentation performance assessment instrument are in the appropriate category. The assessment of item quality is based

Table 1. Quality assessment items

Item Code	Statement	Infit		Outfit		Pt. Mea. Corr
		MnSq	ZStd	MnSq	ZStd	
S1	Presentations are clear, structured, and easily understood by the audience.	0.96	-0.10	0.92	-0.22	0.65
S2	Students used effective communication techniques, such as eye contact, intonation, and body language.	1.11	0.55	1.16	0.74	0.60
S3	Explanations about the project are delivered smoothly and without confusion.	1.01	0.11	1.04	0.23	0.61
S4	Presentations are supported by effective use of visual media (e.g., slides, videos).	1.28	1.23	1.22	0.91	0.62
S5	Students were able to answer questions appropriately and confidently.	0.73	-1.18	0.72	-1.12	0.77
S6	Students show deep understanding when discussing their projects.	0.51	-2.47	**0.45**	**-2.61**	0.80
S7	Students can explain concepts not covered during the presentation well.	0.89	-0.42	1.01	0.12	0.73
S8	All group members are actively involved in the presentation.	1.23	0.99	1.26	1.02	0.64
S9	Group members contribute equally to the presentation and discussion.	1.06	0.32	0.81	-0.70	0.69

S10	Presentations are delivered within the allotted time without rushing or being short on time.	0.96	-0.11	0.91	-0.28	0.71
S11	Students manage the presentation time well so that all important points can be delivered.	1.32	1.32	1.23	0.91	0.63

on the Outfit MnSq value (expected between 0.5 and 1.5), Zstd (-2.0 to 2.0), and Pt. Measure Corr. (0.40-0.80) (Sukarelawan et al., 2024; Sumintono & Widhiarso, 2014). All items had Outfit MnSq values between 0.45 and 1.26, indicating that no items provided noise to the estimation of participants' abilities.

However, one item, S6, had a Zstd value of -2.61, slightly outside the suggested lower limit. A Zstd value that is too low indicates that the item is either too easy or very consistently answered, thus providing less discriminatory information. Despite this, the Pt. Measure Corr. value of item S6 remained within the range of 0.40-0.80, indicating that the item still contributed to the measurement of students' presentation skills. Therefore, item S6 was not eliminated, but needs to be re-evaluated in the context of long-term application.

The trend of student presentation performance

The trend of group presentation performance over time is shown in Figure 1. The logit results of the four presentation sessions showed fluctuations in the trend of student

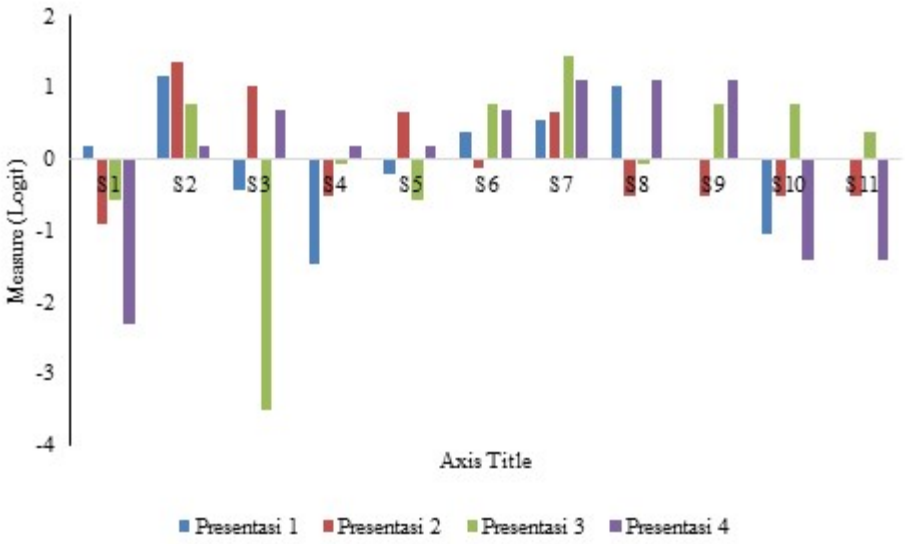

Figure 1. The trend of group presentation performance over time

performance. A decrease in the logit value indicates increased skills, and vice versa. Based on the analysis in Figure 1, skills with increasing trends occurred in items S1 (presentation structure), S2 (non-verbal communication), S6 (material understanding), and S11 (time management). Skills with a decreasing trend occur in items S4 (use of media), S7 (elaboration of additional concepts), S8-S10 (collaboration and timeliness). while Skills with an unstable trend occur in items S3 and S5 (fluency and response to questions).

This difference in trends can be caused by each skill's complexity level, previous presentation experience, and psychological factors such as self-confidence and individual readiness (Jasuli et al., 2024; Lev Ari & Sebanz, 2020). For example, technical aspects such as media use (S4) tend to be mastered earlier, while spontaneous communication, such as answering questions (S5, S7), takes more time and practice to develop (Drossman et al., 2021).

However, it is important to note that this study has not systematically controlled for several variables that may affect students' presentation performance, such as previous public speaking experience, confidence level, or psychological preparedness. Although these factors have been mentioned as possible causes, they were not directly measured or included in the research design. In addition, the presentations in this study were conducted in a classroom setting, which, while providing a structured environment for observation and feedback, does not necessarily fully represent the social and cognitive demands of a real-world presentation context. As such, the ecological validity of the findings is limited. Finally, the findings in this study are from a group of prospective elementary school teachers at a private university in Indonesia. Therefore, generalization of the results to other populations needs to be done with caution. Differences in curriculum, institutional culture, or demographic characteristics of students may yield different results in other contexts.

Wright Map of Changes in Student Presentation Performance

Changes in student presentation performance based on peer assessment are shown in Figure 2.

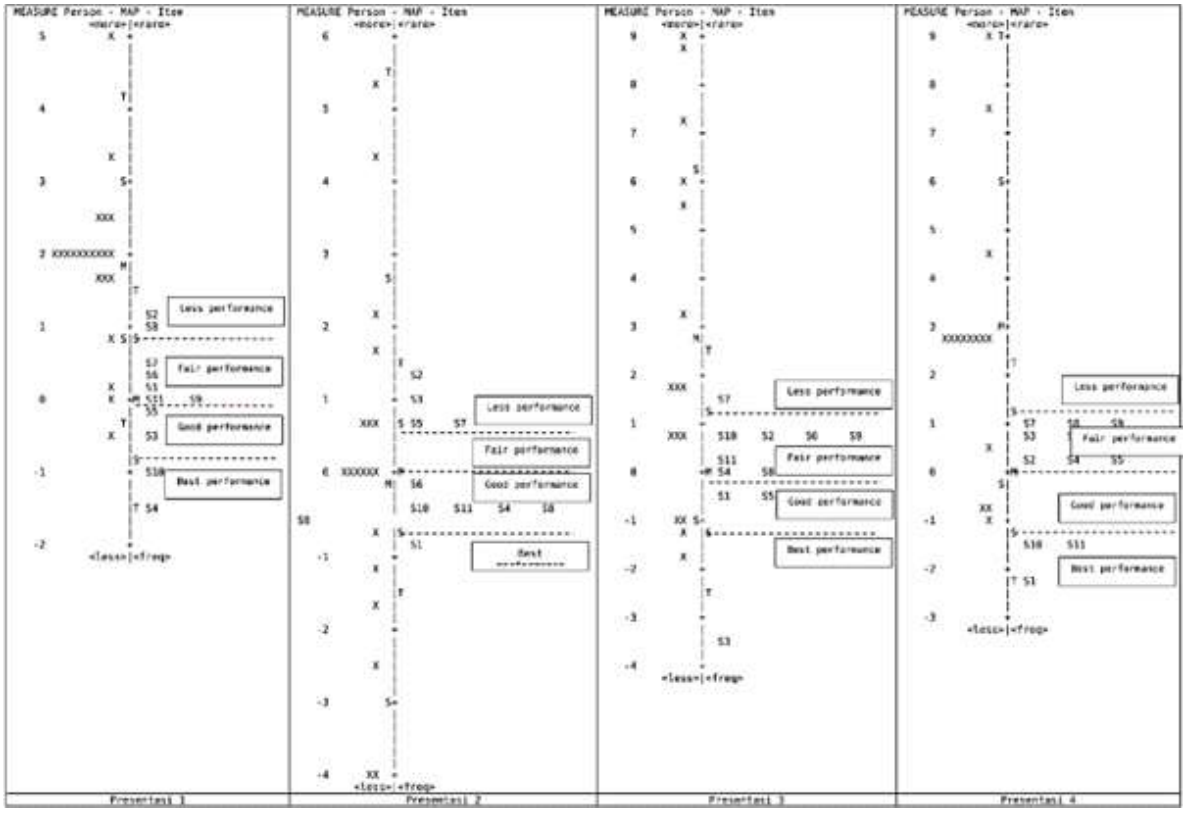

Figure 2. Changes in student presentation performance based on peer assessment

First presentation. The research findings showed that in the first presentation, two items showed the best performance, namely S4, "The presentation was supported by effective use of visual media (such as slides, videos)," and S10, "The presentation was delivered within the allotted time without rushing or being short of time." These two items reflect strengths in the technical aspects of the presentation, which is an excellent potential for the group. Effective use of visual media demonstrates students' ability to utilize technology to clarify and enrich material delivery (Ahmad & Abd Halim, 2024). Meanwhile, the ability to manage time well without rushing or being short of time illustrates the group's readiness and good management in organizing and delivering presentations according to the specified time limit.

However, there are challenges in two other items, namely S2: "Students use effective communication techniques, such as eye contact, intonation, and body language," and S8: "All group members are actively involved in the presentation." Effective communication skills, including eye contact, intonation, and body language, are important presentation elements that can influence audience understanding. The lack of attention to these aspects indicates room for improvement in enhancing audience interaction and engagement. In addition, item S8, indicating the lack of active involvement of all group members, is also a challenge, as equal participation from each member is essential in team-based projects. This could reflect an uneven distribution of tasks or a lack of coordination in presentation preparation.

Second presentation. In the second presentation, the presenting group showed significant progress in terms of the structure and delivery of the material, which was reflected in the best performance on item S1, namely, "The presentation was clearly delivered, structured, and easily understood by the audience." This success in crafting a more structured and clear presentation is potentially very good, as conveying information effectively is crucial in ensuring the audience can understand the material well (Meredith, 2021; Rala & Paula Gaspar, 2023). However, despite improvements in the delivery aspect, challenges remain in several other skills that need to be improved.

The biggest challenges are seen in items S2, S3, S5, and S7, which reflect the need for improvement in non-verbal communication, fluency of explanation, and the ability to answer questions and explain concepts not covered during the presentation. Effective communication skills, such as eye contact, intonation, and body language, as well as the ability to answer questions confidently, need to be strengthened to improve the quality of interaction with the audience (Drossman et al., 2021; Jasuli et al., 2024; Lev Ari & Sebanz, 2020). In addition, the ability to explain concepts that have not been carefully planned also needs to be trained so that students are better prepared to face unexpected situations. Therefore, although there has been an improvement, the presenting group still needs to pay more attention to these aspects to improve the overall quality of the presentation.

Third Presentation. In the third presentation session, the group improved material delivery, as seen from the best performance on item S3: "The project explanation was delivered smoothly and was not confusing." This achievement is very promising because a smooth and easy-to-understand delivery is key for the audience to follow and understand the essence of the project presented. This ability indicates progress in verbal communication skills and a more systematic delivery structure, which in turn supports the overall success of the presentation (Talpur et al., 2024; Teng et al., 2024).

However, challenges arose in item S7: "Students can explain concepts that were not discussed during the presentation well." This finding indicated that although students had been able to explain the project well, they still

experienced difficulties when it came to discussing additional concepts or unexpected matters during the presentation. This challenge points to the importance of making more thorough preparations for all aspects of the project, including possible additional questions or discussions that could arise during the presentation. Therefore, although there was a clear improvement in fluency, there is still room to improve the skill of explaining other concepts better and more confidently.

Presentation Four. In presentation four, the presenting group showed significant progress, reflected by the best performance on three items, namely S1: "The presentation was delivered clearly, structured, and easily understood by the audience," S10 "The presentation was delivered within the allotted time without rushing or being short of time," and S11 "Students managed the presentation time well so that all important points could be delivered." Achievement on these three items shows great potential in terms of effective delivery of material, good time management, and the ability to keep the presentation structured and easy to understand. The ability to manage presentation time well, without rushing or being short on time, also reflects a thorough level of preparation (Leong, 2015; Shinozaki & Aoki, 2023). So that all materials can be delivered optimally.

No items underperformed in the fourth presentation, which means that the presenting group maintained a good standard of presentation quality in various other aspects. However, some items were still in the good and fair performance categories, indicating that despite significant progress, there is still room to improve the quality of the presentation in certain aspects. This is an opportunity to further hone communication and presentation skills so that performance in the next meeting can be more optimal and more consistent in maintaining the high standards achieved.

This finding aligns with previous literature, which states that project-based learning (PjBL) can improve soft skills such as communication and collaboration, but requires consistent instructional support (Petchamé et al., 2024; Talpur et al., 2024). These results also support Tsang's study that presentation skills do not improve linearly but require formative feedback and repeated reflection spaces (Tsang, 2020).

In terms of methodology, using the Rasch Model provides advantages over conventional assessment as it allows for individualized analysis, item reliability, and objective ability detection (Sumintono & Widhiarso, 2014).

Practical Implications

The findings in this study provide some significant practical implications for the development of project-based STEAM learning, particularly in the context of prospective elementary school teacher study programs. First, the results show that non-verbal communication skills, such as eye contact, intonation, and body language, still challenge students. Therefore, lecturers must design explicit training that focuses on mastering these communication techniques, for example, through presentation simulations or recorded video reflections. Secondly, students' ability to answer spontaneous questions and explain concepts beyond the presentation material still needs improvement. This indicates the need to integrate question and answer exercises in the learning process, so students are accustomed to responding spontaneously and confidently in real situations.

In addition, lecturers need to facilitate presentation reflection not only at the group level, but also at the individual level. This individual reflection will encourage the active involvement of all group members and prevent domination by one or two people in the presentation process. Strengthening the role of lecturers as facilitators who provide personalised feedback can also accelerate the development of students' presentation skills. Furthermore, structured and objective rubric-based peer assessment proved

effective in increasing students' awareness of the quality of their own and others' presentations. Therefore, this strategy can be integrated more widely in project learning practices, accompanied by assessment literacy training to enable students to evaluate fairly and constructively.

Overall, the results of this study can be used as a reference in designing learning approaches that focus on content mastery and the development of academic communication skills that are crucial for prospective teachers. By implementing appropriate learning strategies that are oriented towards real practice, lecturers and educational institutions can be more effective in preparing prospective elementary school teacher students to become educators who are communicative, reflective, and ready to face the challenges of 21st-century learning.

CONCLUSION

The conclusion of this study shows that the presentation performance of prospective elementary school teacher students in the STEAM Learning Development course using the Project-based Learning approach varies over time. Based on Rasch's modelling analysis, some presentation skills showed an increasing trend, such as the ability to deliver material in a structured manner and good time management. In contrast, other skills, such as non-verbal communication and group member involvement, decreased. Although there were significant improvements in some aspects, challenges regarding effective communication and preparation to explain additional concepts still need to be improved to enhance the overall quality of presentations.

The limitation of this study lies in the relatively small number of respondents, 22 students, which may affect the generalizability of the findings. In addition, this study only focused on aspects of presentation performance and did not include external factors that might affect the results, such as group dynamics or environmental factors. Therefore, future research is recommended to involve a larger number of respondents and consider external factors that may be influential. Further research is also recommended to develop a more holistic evaluation method that can include other non-cognitive aspects relevant to STEAM teaching and deepen the analysis related to individual differences in improving presentation performance.

REFERENCES

Ahmad, M., & Abd Halim, N. D. (2024). Audio-visual learning in secondary school: a review of advantages and challenges in education. *Innovative Teaching and Learning Journal*, *8*(1), 15–23. https://doi.org/10.11113/itlj.v8.153

Al Jahromi, D. (2020). Can teacher and peer formative feedback enhance l2 university students' oral presentation skills? In *Changing Language Assessment* (pp. 95–131). Springer International Publishing. https://doi.org/10.1007/978-3-030-42269-1_5

Algouzi, S., Alzubi, A. A. F., & Nazim, M. (2023). Strengthening english language undergraduates' presentation skills: A blackboard-mediated intervention program. *PLOS ONE*, *18*(8), e0289936. https://doi.org/10.1371/journal.pone.0289936

Andargie, A., Amogne, D., & Tefera, E. (2025). Effects of project-based learning on EFL learners' writing performance. *PLOS ONE*, *20*(1), e0317518. https://doi.org/10.1371/journal.pone.0317518

Delia Voicu, C., Ampartzaki, M., Yilmaz Dogan, Z., & Kalogiannakis, M. (2023). STEAM implementation in preschool and primary school education: experiences from six countries. In *Early Childhood Education - Innovative Pedagogical Approaches in the Post-modern Era*. IntechOpen. https:/

/doi.org/10.5772/intechopen.107886

Drossman, D. A., Chang, L., Deutsch, J. K., Ford, A. C., Halpert, A., Kroenke, K., Nurko, S., Ruddy, J., Snyder, J., & Sperber, A. (2021). A review of the evidence and recommendations on communication skills and the patient–provider relationship: a rome foundation working team report. *Gastroenterology*, *161*(5), 1670-1688.e7. https://doi.org/10.1053/j.gastro.2021.07.037

Galindo, C., Gregori, P., & Martínez, V. (2020). Using videos to improve oral presentation skills in distance learning engineering master's degrees. *International Journal of Mathematical Education in Science and Technology*, *51*(1), 103–114. https://doi.org/10.1080/0020739X.2019.1662118

He, J., Simon, S., & Chiang, F.-K. (2022). A comparative study of pre-service teachers' perceptions on STEAM education in UK and China. *STEM Education*, *2*(4), 318–344. https://doi.org/10.3934/steme.2022020

Jasuli, J., Hartatik, S. F., & Astuti, E. S. (2024). The impact of nonverbal communication on effective public speaking in english. *Journey: Journal of English Language and Pedagogy*, *7*(2), 226–232. https://doi.org/10.33503/journey.v7i2.4346

Leong, E. C. (2015). How to prepare for an oral presentation. In E. C. Leong, C. L.-H. Heah, & K. K. W. Ong (Eds.), *Guide to Research Projects for Engineering Students* (pp. 228–233). CRC Press. https://doi.org/10.1201/b18756-29

Lev Ari, S., & Sebanz, N. (2020). Interacting with multiple partners improves communication skills. *Cognitive Science*, *44*(4). https://doi.org/10.1111/cogs.12836

Mahdi, D. A. (2022). Improving speaking and presentation skills through interactive multimedia environment for non-native speakers of english. *Sage Open*, *12*(1), 1–12. https://doi.org/10.1177/21582440221079811

Meredith, D. (2021). Understand your audiences. In *Explaining Research* (pp. 15–29). Oxford University Press. https://doi.org/10.1093/oso/9780197571316.003.0002

Namin, A., Ketron, S. C., Kaltcheva, V. D., & Winsor, R. D. (2021). Improving student presentation skills using asynchronous video-based projects. *Journal of Management Education*, *45*(6), 987–1010. https://doi.org/10.1177/1052562920978805

Perez Jr., J. C. S., Salic-Hairulla, M. A., Magsayo, J. R., Nabua, E. B., & Malayao Jr., S. O. (2025). Developing an inquiry-based STEAM teaching packet in ecoliteracy for pre-service teachers. *Journal of Education and Learning (EduLearn)*, *19*(2), 764–774. https://doi.org/10.11591/edulearn.v19i2.21664

Petchamé, J., Iriondo, I., Torné, O., & Solanellas, F. (2024). Student perceptions of project-based learning when studying 'information systems' in an ict engineering program: taking advantage of active learning. *Education Sciences*, *14*(11), 1148. https://doi.org/10.3390/educsci14111148

Prahani, B. K., Nisa', K., Suliyanah, S., & Deta, U. A. (2025). Evaluation of ChatGPT research in STEAM education. *International Journal of Evaluation and Research in Education (IJERE)*, *14*(1), 598. https://doi.org/10.11591/ijere.v14i1.30423

Rahim, B., Ambiyar, A., Waskito, W., Fortuna, A., Prasetya, F., Andriani, C., Andriani, W., Sulaimon, J., Abbasinia, S., Luthfi, A., & Salman, A. (2024). Effectiveness of project-based learning in metal welding technology course with steam approach in vocational education. *TEM Journal*,

1481–1492. https://doi.org/10.18421/TEM132-62

Rala, S., & Paula Gaspar, A. (2023). Emotion in the communication process and the power of understanding the message. https://doi.org/10.54941/ahfe1003527

Shinozaki, F., & Aoki, H. (2023). Does interactivity in an english presentation affect its preparation process? *Vision: Journal for Language and Foreign Language Learning*, *12*(1), 33–46. https://doi.org/10.21580/vjv12i217294

Sukarelawan, M. I., Ramadhan, M. F., Oktova, R., Jumadi, J., Puspitasari, A. D., Indratno, T. K., & Nuryana, Z. (2024). Psychometric properties of Indonesian physics motivation questionnaire using Rasch model. *International Journal of Evaluation and Research in Education (IJERE)*, *13*(6), 4279. https://doi.org/10.11591/ijere.v13i6.29285

Sumintono, B., & Widhiarso, W. (2014). *Aplikasi model rasch untuk penelitian ilmu-ilmu sosial*. Trim Komunikata Publishing House.

Talpur, M. A., Channar, H. B., Siyal, R. P., JOKHIO, P. B., Junejo, Z., & Siyal, M. I. (2024). Impact of lecture method on preparing oral presentations among undergraduate nursing students at two nursing colleges of shaheed benazirabad district, sindh. *Journal of Health and Rehabilitation Research*, *4*(3). https://doi.org/10.61919/jhrr.v4i3.1249

Teng, L., Tang, Y. M., Wu, R. P. H., Tsui, G. C. P., Tsang, Y. P., & Tang, C. Y. (2024). Exploring the efficacy of collaborative learning in a remote robotics laboratory: a comparative analysis of performance and pedagogical approaches. *Smart Learning Environments*, *11*(1), 15. https://doi.org/10.1186/s40561-024-00305-w

Tsang, A. (2020). Enhancing learners' awareness of oral presentation (delivery) skills in the context of self-regulated learning. *Active Learning in Higher Education*, *21*(1), 39–50. https://doi.org/10.1177/1469787417731214

Winarni, E. W., Purwandari, E. P., & Raharjo, F. O. (2024). The effect of integrating STEAM and virtual reality using PjBL on scientific literacy in elementary schools. *Education and Information Technologies*, *29*(18), 24991–25011. https://doi.org/10.1007/s10639-024-12853-2

Yusri, R., Yusof, A. M., & Sharina, A. (2024). A systematic literature review of project-based learning: research trends, methods, elements, and frameworks. *International Journal of Evaluation and Research in Education (IJERE)*, *13*(5), 3345. https://doi.org/10.11591/ijere.v13i5.27875