Understanding student engagement: an examination of the moderation effect of professional teachers' competence

Ika Maryani[1], Nursyiva Irsalinda[2], Patria Handung Jaya[1], Hanum Hanifa Sukma[1], Arumugam Raman[3]

[1]Department of Elementary Teacher Education, Faculty of Teacher Training and Education, Universitas Ahmad Dahlan, Yogyakarta, Indonesia
[2]Department of Mathematics, Faculty of Applied Sciences and Technology, Universitas Ahmad Dahlan, Yogyakarta, Indonesia
[3]School of Education and Modern Languages, College of Arts and Sciences, Universiti Utara Malaysia, Kedah Darul Aman, Malaysia

Article Info

ABSTRACT

Due to low levels of student engagement during the COVID-19 pandemic, elementary school students suffered significant learning losses, which served as the driving force behind this research. Teachers should be the key to solving problems. This research aims to measure how much influence the competence of professional elementary school teachers has on student engagement in Indonesia. This research uses a quantitative approach with a correlational design and survey method. Data collection was carried out through teacher professional competency and student involvement questionnaires, with data sources coming from elementary school teachers and students in the western, eastern, and central regions of Indonesia. Samples were taken using the cluster random sampling technique. Quantitative data analysis was used with descriptive statistical stages, correlation analysis, regression analysis, and comparative analysis. The results of the hypothesis test also show that professional competence in the aspect of understanding content and understanding the curriculum has a significant influence on student engagement, while in the aspect of understanding student character, it does not have a significant influence. These results make an important contribution to teachers' ongoing professional development. Aspects of content development and curriculum development are recommended as priorities for self-development.

Corresponding Author:

Ika Maryani
Department of Elementary Teacher Education, Faculty of Teacher Training and Education
Universitas Ahmad Dahlan
Ki Ageng Pemanahan St. 19 Sorosutan, Yogyakarta, Indonesia
Email: ika.maryani@pgsd.uad.ac.id

1.   INTRODUCTION

The significant learning loss and student involvement in learning after the COVID-19 pandemic are the driving forces behind this research. Elementary schools experienced the highest number of learning loss cases after the school closure policy was followed by limited face-to-face policies [1], [2]. Elementary school students who have concrete learning characteristics must experience conditions where learning is not with direct teacher assistance. They cannot be directly involved in learning, and they do not interact with classmates. This is what causes students to lose their learning experience. World Bank research released data on a loss of study time of 0.9 and 1.2 years and a decrease in reading ability of 25-35 points from PISA. Learning loss has resulted in 70% of elementary school students in Indonesia having reading proficiency

scores that are below the minimum proficiency level [3]. As a result, it will accumulate at the next level and hinder the achievement of learning objectives.

The problem of student engagement is related to many other variables, namely a supportive learning environment, autonomy and student choices, the learning approach, effective teacher-student relations, feedback, and assessment, as well as peer collaboration and interaction [4]. Teachers can encourage student engagement through a variety of strategies. Professional teachers, also referred to as having professional competence, are capable of carrying out all of these activities. Professional competence refers to the knowledge, skills, and abilities possessed and utilized by instructors in their professional practice [5]. It includes content knowledge, pedagogical knowledge, classroom management skills, assessment and evaluation skills [6], and the ability to establish and maintain a positive and inclusive learning environment. Professional teachers are proficient in designing and delivering effective instruction, employing a variety of teaching strategies and technologies to satisfy the needs of diverse learners. In addition, they have excellent classroom administration skills. Teachers' professional competence also includes the ability to assess student learning, provide feedback, and adapt their instruction to meet the needs of students [7]. They are skilled at utilizing a variety of assessment tools and techniques to evaluate student progress and at providing constructive feedback that encourages student growth and development.

Many studies have been conducted on teacher professional competence and student engagement. The results of a preliminary study of publications in the last 5 years produced several findings, namely the technology in teacher-provided learning, online courses, and online learning applications [8]. Furthermore, lessons in nature boost subsequent classroom engagement. Other studies suggest that there is no uniform association between higher behavioral engagement and student-peer interactions, but interactions with other students and teachers predict increased engagement.

Student engagement in learning refers to the level of involvement, interest, and active participation in academic work and educational experiences that students demonstrate. Students who are invested in their learning, motivated to achieve their objectives, and willing to participate in class activities and discussions are considered engaged. They also have a positive outlook on learning, actively seek out opportunities to learn more, and are willing to take risks and be challenged. Students can demonstrate engagement in a variety of ways, including active listening, asking questions, engaging in experiments, participating in discussions, completing assignments and projects on time, collaborating with classmates, requesting feedback, solving a learning problem, and taking responsibility for their learning process [9]. Engaged students are more likely to retain information, perform better on assessments, and develop a deeper understanding of the subject matter, which increases their likelihood of academic success. Student engagement is how involved or interested students appear to be in their learning and how connected they appear to be with their classes, their institutions, and each other. There are several correlations between student engagement and learning outcomes, such as critical thinking and grades [10]. Engagement is an essential internal modality for students, which is crucial for facilitating successful learning.

The measurement of student engagement in this study is based on the student engagement instrument (SEI). The SEI was created to measure the two higher-inference categories of student engagement affective and cognitive through student self-report [11]. The SEI concentrates on affective and cognitive engagement because data supporting inferences on student levels of academic and behavioral engagement are readily available in the data systems of the majority of schools. The measurement of affective engagement and cognitive engagement in this research is conducted using six subscales and 35 questions. The professional competence of elementary school teachers in Indonesia is still not as high as expected. Currently, 54.23% of elementary school teachers in Indonesia are not certified [12]. This is very contradictory to the expectation that teacher professionalism supports student engagement and learning success. Research objective: i) what is the professional competence of elementary school teachers in Indonesia? ii) how is student engagement in elementary schools in Indonesia? and iii) what is the influence of teacher professional competence on student engagement in Indonesia?

2. METHOD
2.1. Research method
This research is correlative, with a quantitative approach and survey method. A correlative research study is a type of research that relates one or more variables to another variable [13]. In this research, the researchers relate teachers' professional competence variables with student engagement variables.

2.2. Population and sample
The population in this study was all elementary school teachers in Indonesia from the eastern, central, and western parts of the country. Respondents involved in this research are elementary school teachers, who

will be selected by cluster random sampling so that they represent each region or province. A cluster random sample is a two-step process in which the entire population is divided into clusters or groups [14].

2.3. Variables

The independent variable in this study is the teachers' competence (X_1, X_2, and X_3), while the dependent variable is the level of student engagement (Y). There are three aspects of teacher competence whose contribution to one aspect of student engagement will be measured. Details regarding this variable can be seen in Table 1.

Table 1. Variables and indicators

Variable	Teachers' competence
X_1	The understanding of the learning content and its method
X_2	Students' character and learning strategies
X_3	The curriculum and its implementation
Y	Student engagement

2.4. Data collection and instrument

Data collection involved all alumni networks and students of the teaching profession program in positions in all regions through the teacher professional competence questionnaire and the student engagement questionnaire. Before the instruments were distributed to the respondents, the researcher first tested the instruments through validity and reliability tests. The validity test uses the product-moment correlation, while the reliability test uses the Cronbach's alpha [15]. The validity test results show that the significance value for the questions in the questionnaire is below 0.05. In addition, a comparison between the R_{count} and R_{table} values shows consistent results across all questions, with the R_{count} being greater than the R_{table} value (with N=30 and a significance level of 5%, namely 0.361, or valid). The reliability test used a sample size of N=30 with a significance level of 5%. The results show that the question items have a significant Cronbach's alpha value (for example, more than 0.7), so it can be stated that the instrument has an adequate level of reliability.

2.5. Research design

This study uses a comparative design to prove the relationship between the variables of teacher professional competence (X1) and student engagement (Y). The determination test is used to know the magnitude of the influence of variable X on variable Y. The equation used in the research design is as (1).

$$Y = a + b_1X_1 + b_2X_2 + \ldots. + b_nX_n \qquad (1)$$

Where Y is the dependent variable and X is the independent variable; a is the constant (intercept), and b is the regression coefficient for each independent variable.

2.6. Data analysis

To analyze and compare the impact of teacher professional competence on student engagement, we need to proceed with the following research steps: data collection, defining variables, data analysis, interpretation, and conclusion. Data collection is intended to gather information on teacher professional competence and student engagement. Surveys, observations, or existing datasets can accomplish this. A defined variable identifies key variables for analysis. Factors such as years of experience, educational qualifications, professional development activities, and teaching strategies can measure teacher professional competence in this case. Attendance rates, participation levels, academic performance, and student feedback can measure student engagement.

The data analysis techniques use several stages. The first is descriptive statistics, which calculates measures such as means, standard deviations, and frequencies to summarize the data for each variable. The next step is correlation analysis. We used correlation coefficients to examine the relationship between teacher professional competence and student engagement. This can help determine if there is a statistical association between the two variables. We perform the regression analysis to determine the impact of teacher professional competence on student engagement while controlling for other relevant factors. This can provide insights into the specific contribution of professional competence to student engagement outcomes. The last steps are comparative analysis, interpretation, and conclusion.

It compares the levels of student engagement across different teacher professional competence categories or groups. This will be done using independent sample t-tests. The interpretation step aims to

analyze the results of the data analysis and interpret the findings. Determine if there is a significant relationship between teacher professional competence and student engagement. Assess the magnitude of the relationship and consider any limitations or alternative explanations. Finally, we summarize the findings and draw conclusions based on the analysis. Discuss the implications for educational practice, policy, and future research.

3.   RESULTS AND DISCUSSION

Firstly, 349 teachers successfully returned questionnaires, and they observed the engagement of 219 students. However, after data reduction by taking 1 teacher and 5 students, the final data succeeded in obtaining 205 pairs of data. The following section then describes the data analysis and discussion of each research question.

3.1. Research question 1: what is the professional competence of elementary school teachers in Indonesia?

Descriptively, research shows that the professional competence of elementary school teachers in Indonesia is included in the moderate category. In the aspects of curriculum knowledge, knowledge about student characteristics, and content knowledge, more than 65% of teachers are in the medium category. Meanwhile, the rest are divided into high and low categories, as seen in Figure 1.
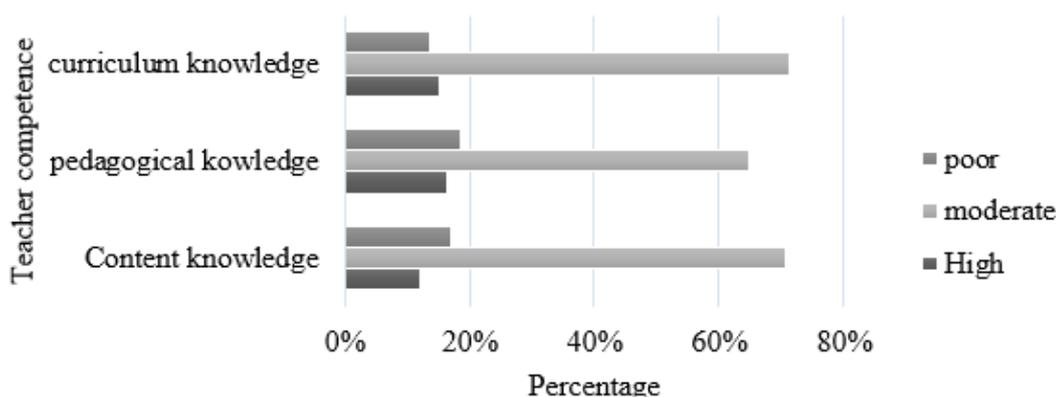

Figure 1. Professional competence categories of elementary school teachers based on technological pedagogical content knowledge (TPACK) indicators

The tendency for teachers with a moderate level of curriculum knowledge is to participate in professional development opportunities occasionally [16]. They can upgrade their subject matter skills through several possibilities, namely attending workshops, seminars, and conferences to stay up-to-date with the latest research and developments in the subject area. They can also read books, research papers, and academic journals related to the subject. They also utilize online resources, such as educational websites and open courseware, to deepen their knowledge. On several occasions, they were advised to seek opportunities to collaborate with experts in the field.

In the pedagogic aspect, teachers utilize a variety of teaching methods and engage students to some extent. They manage the classroom well but may occasionally face challenges [17]. Some students may exhibit disruptive or challenging behavior in class, making it difficult to maintain a productive learning environment. In this condition, the teacher can implement a clear and consistent set of class rules and expectations. It can be done by using positive behavioral reinforcement techniques, such as rewards and praise, to encourage appropriate behavior. For persistent behavior problems, they consider involving a school counselor or support staff.

Teachers also communicate clearly but may struggle to convey complex ideas [18]. They frequently use various assessment methods and provide feedback, but it may not always be efficient. In the student engagement and motivation aspect, teachers with moderate TPACK tend to engage and motivate students to some degree [5]. This condition is certainly less than satisfactory. They should effectively engage and motivate students, foster a love for learning, use innovative and effective teaching strategies, create a positive and well-managed classroom environment [19], communicate effectively with students, parents, and colleagues, and consistently assess student progress.

The results of this research can be used as a consideration for pre-service teacher-producing institutions to focus on developing TPACK. Teacher quality is an important factor that influences the quality of teaching and student learning outcomes [20]. One of the efforts recommended for accelerating teacher TPACK recently is the lesson study approach. This approach is used to accelerate the implementation of the Merdeka Curriculum in Indonesia. We found that lesson study has been promoted as a promising approach to encourage improvements in teaching and student learning systems.

In one study, it was found that teachers' motivational beliefs play an important role in the effective application of technology in learning [21]. Teachers with high motivational beliefs tend to try their best to design the best lesson study and integrate technology into it. Motivation is a key component of teachers' professional competence in encouraging students' independent learning (SRL) [22]. This study suggests that future research should focus on investigating general professional knowledge of preservice teachers (PSTs) and identifying the level of pedagogical content knowledge (PCK) proficiency required for digital media PCK development. This study recommends that seminars on digital media integration should be held at the final stage of teacher education or after introductory courses that cover other aspects of PCK [23].

3.2. Research question 2: how is student engagement in elementary schools in Indonesia?

The student engagement shows the dominance of the moderate level. Complete data can be seen in Figure 2. Recent observations showed that students with a high level of student engagement will participate in learning activities, have a positive affective state, and be able to overcome obstacles [24]. Engaged students generally have positive influences on their peers, as their enthusiasm for learning can be contagious [25]. They foster a collaborative and supportive classroom environment that encourages active participation and a deeper understanding of the subject matter [26]. On the other hand, students with low student engagement will be passive, unwilling to work hard [27], bored, quick to give up and display negative emotions such as wrath, blame, and denial [28]. To promote student engagement, teachers can create an engaging and motivating learning environment that stimulates students' curiosity and enthusiasm for learning [29]. The emergence of student involvement in behavioral and cognitive aspects shows the positive effects of teacher facilitation [30]. The academic accomplishment of students is significantly influenced by their active involvement. These factors are strongly influenced by motivational traits, particularly their academic self-concept [31].
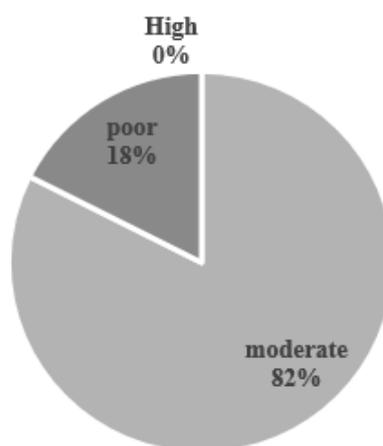

Figure 2. Student engagement of elementary school di Indonesia

The primary factor influencing both well-being and transformative learning was found to be affective engagement. The relationship between behavioral engagement and the development of self-efficacy and self-esteem was examined. Teachers, schools, and parents must have strong collaboration to provide more opportunities for students to maximize their involvement at the university [32]. Previous research conducted on online learning shows that the cognitive engagement of students develops two important lifelong skills, namely digital literacy and independent learning [33]. This aspect of involvement is strongly supported by the teacher's competence in accompanying online learning [34]. Students with a higher self-concept tend to show patterns of moderate to high engagement. However, it is important to note that the other three techniques, namely feedback, scaffolding, and active learning strategies, may have a greater impact on

enhancing teachers' self-concept [35]. Compared with students with low engagement, students with higher engagement patterns systematically gain end-of-year achievement. These findings illustrate the power of person-centered analysis to explain the complexity of student engagement. This implies the need for differentiation beyond disengaged and engaged students and brings recognition that engagement can be carried out through various forms of interaction provided by the teacher during the learning process [31]. Elementary school students are more emotionally involved than middle school students [36].

3.3. Research question 3: what is the influence of teacher professional competence on student engagement in Indonesia?

In this research, particularly, we want to determine whether these independent variables have a significant influence on the dependent variable Y. To test this hypothesis, we perform a multiple linear regression analysis using a statistical model. The results of this regression will help us understand the extent to which the independent variables contribute to variations in the dependent variable Y. The results of the linear regression analysis that has been carried out are shown in Tables 2 and 3.

Table 2. Results of linear regression analysis (variables entered/removed)

Model[a]	Variables entered	Variables removed	Method
1	Curriculum understanding, students' character understanding, content understanding[b]		Enter

*a: dependent variable: Y1 and b: all requested variables entered.

Table 3. Results of linear regression analysis (model summary)

Model	R	R square	Adjusted R square	Std. error of the estimate
1	.638[a]	.407	.398	3.63251

*a: predictors: (constant), curriculum understanding, students' character understanding, content understanding

The following is some information obtained from the model summary in Table 3: i) R-squared (R^2): this is one of the important metrics in the model summary table. R-squared measures the extent to which variability in the dependent variable (Y) can be explained by the independent variables (X_1, X_2, and X_3) present in the model. The R-squared value ranges from 0 to 1, and the higher the value, the better your model is at explaining variations in the data. For example, if the R-squared is 0.407, this means that 40.7% of the variation in Y can be explained by the independent variable; ii) adjusted R-squared (R^2 adjusted): this is a variation of R-squared adjusted for the number of independent variables in the model. This offers more details about the model's performance without causing it to suffer unnecessarily from the addition of pointless independent variables. The higher the adjusted R-squared value, the better the resulting model. In the research conducted, the adjusted R-squared was obtained at 0.398. The next analysis is by looking at the results of the F-test in the result of analysis of variance (ANOVA) analysis in Table 4 and the result of t-test analysis in Table 5.

Table 4. The result of the ANOVA analysis

ANOVA[a] model		Sum of squares	df	Mean square	F	Sig.
1	Regression	1822.531	3	607.510	46.040	.000[b]
	Residual	2652.222	201	13.195		
	Total	4474.753	204			

*a: dependent variable: Y1 and b: predictors: (constant), curriculum understanding, students' character understanding, content understanding

Table 5. The result of t-test analysis

Coefficients[a] model		Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Std. error	Beta		
1	(Constant)	46.789	1.739		26.905	.000
	Curriculum understanding	.425	.174	.237	2.439	.016
	Students' character understanding	.002	.094	.002	.016	.987
	Content understanding	.572	.135	.431	4.226	.000

*a: dependent variable: Y1

A high F-statistic value with a low level of significance indicates that the overall model is significant. In Table 4, it can be seen that the resulting model has a very low significance level, namely

0.000, where this value is less than 0.05, which indicates that at least one of the independent variables X_1, X_2, and X_3 has a significant influence on the dependent variable Y. Results the interpretation shows that the independent variables X_1, X_2, and X_3 together have a significant influence on the dependent variable Y.

Furthermore, the results of the analysis on the t-test can be seen in Table 5. If the p-value is low and the t-statistic is high, then the independent variable can be considered significant in explaining variations in the dependent variable. Conversely, if the p-value is high, the variable may not have a significant effect on the model. In the coefficient column, it can be seen that of the three dependent variables, there are only two that have a significant effect on Y, namely variables and, which produce a significance value of less than 0.05, namely 0.016 and 0.000. Meanwhile, the variable produces a significance value of 0.987, which indicates that this variable has no significant effect on variable Y.

Table 5 also produces the coefficients of the multiple linear regression model that is formed, from this table, it can be seen that the resulting multiple analysis model is as (2).

$$Y = 46.789 + 0.425\,X_1 + 0.002\,X_2 + 0.572\,X_3 \tag{2}$$

Intercept (46.789): this is the Y value when all independent variables X_1, X_2, and X_3 are zero. This means that the estimated minimum student engagement value is when all factors are considered absent or zero. Coefficient X_1 (0.425): this shows how much increase in Y is expected when X_1 increase by one unit, ignoring other variables. If X_1 is the understanding of the learning content and how to teach it and Y is the level of student involvement, so this coefficient indicates how much increase in the level of student involvement is expected when the understanding of learning content and the way teachers teach it increases one unit. Coefficient X_2 (0.002): this shows how much of an increase in Y is expected when This coefficient is smaller than X_1, so a one-unit increase in X_2 only has a very small impact on Y. This result can also be seen from the t-test results that X_2 is not a very significant factor in explaining variations in Y. Coefficient X_3 (0.572): this shows how much of an increase in Y is expected when this coefficient is larger than the others, indicating that X_3 has a significant influence in explaining variations in Y. This could mean that X_3 is the most important factor in this research model.

The level of student involvement with technology is likely to be impacted by the presence of a reliable network infrastructure and the ease of accessing educational resources. When teachers are highly competent and effective in their roles, they create an environment that encourages students to actively participate and remain engaged in the learning process [37]. Competent teachers are skilled in various teaching methods and strategies (pedagogical knowledge). They can choose the most suitable one based on their students' needs so that learning becomes more interesting and accessible [38]. In the content knowledge aspect, teachers who have a deep understanding of their subject matter can present information interestingly and comprehensively, making it easier for students to connect with the material [39]. In the technological knowledge aspect, competent teachers use technology as a tool to improve learning. They can combine multimedia, online resources, and interactive platforms, which often appeal to today's technology-savvy students [40].

Students are more likely to be engaged when they have knowledgeable, enthusiastic, and caring teachers who create a positive and stimulating learning environment. Teachers with high TPACK have full awareness to develop themselves through continuous professional development [39], [40]. The acquisition of pedagogical knowledge is crucial for the training of aspiring teachers, as it enables them to effectively manage the process of learning. They continually seek opportunities to improve their teaching skills and stay up-to-date with the latest educational research and trends.

4. CONCLUSION

Our findings provide conclusive evidence that professional competence in the aspects of understanding content and understanding the curriculum has a significant influence on student engagement. In the aspect of understanding students' character, does not have a significant influence. These results make an important contribution to teachers' ongoing professional development. Aspects of content development and curriculum development are recommended as self-development priorities. However, the aspect of understanding student character should not be ignored. Future research could explore the impact of teacher professional development interventions through self-development that still prioritizes students' basic needs.

REFERENCES

[1]   A. Iskandar, Nofirman, E. Fatmawati, B. M. A. S. A. Bangkara, and A. Damayanto, "Understanding Learning Loss After 2 Years of Distance Learning Responding to School Closure Policy during Covid-19," *Int. J. Mech. Eng.*, vol. 7, no. 2, pp. 3647–3655, 2022.

[2]   S. Taimur, H. Sattar, and E. Dowd, "Exploring Teachers' Perception on Successes and Challenges Associated with Digital Teaching Practice During COVID-19 Pandemic School Closures," *Pedagog. Res.*, vol. 6, no. 4, p. em0105, 2021, doi: 10.29333/pr/11253.

[3]   N. Yarrow, E. Masood, and R. Afkar, *Estimates of COVID-19 Impacts on Learning and Earning in Indonesia*. World Bank, Washington, DC, 2020. doi: 10.1596/34378.

[4]   T. K. F. Chiu, "Applying the self-determination theory (SDT) to explain student engagement in online learning during the COVID-19 pandemic," *J. Res. Technol. Educ.*, vol. 54, no. sup1, pp. S14–S30, Jan. 2022, doi: 10.1080/15391523.2021.1891998.

[5]   J. Sulaiman and S. N. Ismail, "Teacher competence and 21st century skills in transformation schools 2025 (TS25)," *Univers. J. Educ. Res.*, vol. 8, no. 8, pp. 3536–3544, 2020, doi: 10.13189/ujer.2020.080829.

[6]   C. Wilson, L. M. Woolfson, and K. Durkin, "School environment and mastery experience as predictors of teachers' self-efficacy beliefs towards inclusive teaching," *Int. J. Incl. Educ.*, vol. 24, no. 2, pp. 218–234, 2020.

[7]   L. L. Hadar, O. Ergas, B. Alpert, and T. Ariav, "Rethinking teacher education in a VUCA world: student teachers' social-emotional competencies during the Covid-19 crisis," *Eur. J. Teach. Educ.*, vol. 43, no. 4, pp. 573–586, Aug. 2020, doi: 10.1080/02619768.2020.1807513.

[8]   D. Orhan Göksün and G. Gürsoy, "Comparing success and engagement in gamified learning experiences via Kahoot and Quizizz," *Comput. Educ.*, vol. 135, pp. 15–29, 2019, doi: https://doi.org/10.1016/j.compedu.2019.02.015.

[9]   I. Maryani, S. Tutur Martaningsih, and C. Putra Bhakti, "Module Based on Pedagogical Content Knowledge to Increase the Engagement and Skills of the Future Teachers in Designing a Lesson Plan," *J. Educ. Learn.*, vol. 11, no. 1, pp. 91–102, Feb. 2017, doi: 10.11591/EDULEARN.V11I1.5758.

[10]   K. E. Cameron and L. A. Bizo, "Use of the game-based learning platform KAHOOT! to facilitate learner engagement in animal science students," *Res. Learn. Technol.*, vol. 27, 2019, doi: 10.25304/RLT.V27.2225.

[11]   K. C. O'Donnell, A. L. Reschly, and J. J. Appleton, "Assessment of Engagement and Disaffection With the Student Engagement Instrument," *J. Psychoeduc. Assess.*, p. 07342829231199314, Aug. 2023, doi: 10.1177/07342829231199314.

[12]   D. H. Jayani, "The number of certified teachers has not yet reached 50% (in Indonesian: *Jumlah Guru yang Tersertifikasi Belum Sampai 50%*)," *Katadata Media Network*, 2019. https://databoks.katadata.co.id/datapublish/2019/12/12/guru-sertifikasi-belum-sampai-50 (accessed May 18, 2023).

[13]   J. Bloomfield and M. J. Fisher, "Quantitative research design," *J. Australas. Rehabil. Nurses Assoc.*, vol. 22, no. 2, pp. 27–30, Aug. 2019, doi: 10.33235/jarna.22.2.27-30.

[14]   A. E. Berndt, "Sampling Methods," *J. Hum. Lact.*, vol. 36, no. 2, pp. 224–226, Mar. 2020, doi: 10.1177/0890334420906850.

[15]   J. Barbera, N. Naibert, R. Komperda, and T. C. Pentecost, "Clarity on Cronbach's Alpha Use," *J. Chem. Educ.*, vol. 98, no. 2, pp. 257–258, Feb. 2021, doi: 10.1021/acs.jchemed.0c00183.

[16]   R. Sancar, D. Atal, and D. Deryakulu, "A new framework for teachers' professional development," *Teach. Teach. Educ.*, vol. 101, p. 103305, 2021, doi: https://doi.org/10.1016/j.tate.2021.103305.

[17]   R. Lazarides, H. M. G. Watt, and P. W. Richardson, "Teachers' classroom management self-efficacy, perceived classroom management and teaching contexts from beginning until mid-career," *Learn. Instr.*, vol. 69, p. 101346, 2020, doi: https://doi.org/10.1016/j.learninstruc.2020.101346.

[18]   D. R. Byrd and M. Alexander, "Investigating special education teachers' knowledge and skills: Preparing general teacher preparation for professional development," *J. Pedagog. Res.*, vol. 4, no. 2, pp. 72–82, 2020, doi: 10.33902/JPR.2020059790.

[19]   Narayan Prasad Adhikari, "Pedagogical Approaches for an Effective Classroom Management," *Interdiscip. Res. Educ.*, vol. 6, no. 1, pp. 45–56, 2021, doi: 10.3126/ire.v6i1.43421.

[20]   X. Yang and G. Kaiser, "The impact of mathematics teachers' professional competence on instructional quality and students' mathematics learning outcomes," *Curr. Opin. Behav. Sci.*, vol. 48, p. 101225, 2022, doi: https://doi.org/10.1016/j.cobeha.2022.101225.

[21]   I. Backfisch, A. Lachner, C. Hische, F. Loose, and K. Scheiter, "Professional knowledge or motivation? Investigating the role of teachers' expertise on the quality of technology-enhanced lesson plans," *Learn. Instr.*, vol. 66, p. 101300, 2020, doi: https://doi.org/10.1016/j.learninstruc.2019.101300.

[22]   J. Jud, C. N. Hirt, A. Rosenthal, and Y. Karlen, "Teachers' motivation: Exploring the success expectancies, values and costs of the promotion of self-regulated learning," *Teach. Teach. Educ.*, vol. 127, p. 104093, 2023, doi: https://doi.org/10.1016/j.tate.2023.104093.

[23]   T. Schubatzky, J.-P. Burde, R. Große-Heilmann, C. Haagen-Schützenhöfer, J. Riese, and D. Weiler, "Predicting the development of digital media PCK/TPACK: The role of PCK, motivation to use digital media, interest in and previous experience with digital media," *Comput. Educ.*, vol. 206, p. 104900, 2023, doi: https://doi.org/10.1016/j.compedu.2023.104900.

[24]   T. K. F. Chiu, "Digital support for student engagement in blended learning based on self-determination theory," *Comput. Human Behav.*, vol. 124, p. 106909, 2021, doi: https://doi.org/10.1016/j.chb.2021.106909.

[25]   A. Mystkowska-Wiertelak, "Teachers' accounts of learners' engagement and disaffection in the language classroom," *Lang. Learn. J.*, vol. 50, no. 3, pp. 393–405, May 2022, doi: 10.1080/09571736.2020.1800067.

[26]   M. Ramzan, Z. K. Javaid, A. Kareem, and S. Mobeen, "Amplifying Classroom Enjoyment and Cultivating Positive Learning Attitudes among ESL Learners," *Pakistan J. Humanit. Soc. Sci.*, vol. 11, no. 2, pp. 2298–2308, 2023, doi: 10.52131/pjhss.2023.1102.0522.

[27]   M. Cevikbas and G. Kaiser, "Student Engagement in a Flipped Secondary Mathematics Classroom," *Int. J. Sci. Math. Educ.*, vol. 20, no. 7, pp. 1455–1480, 2022, doi: 10.1007/s10763-021-10213-x.

[28]   R. Al-Jarf, "Distance learning and undergraduate Saudi students agency during the COVID-19 pandemic," *Bull. Transilv. Univ. Braşov, Ser. IV Philol. & Cult. Stud.*, vol. 13, no. 2, pp. 37–54, 2020.

[29]   F. Batubara, T. Derin, N. S. Putri, and R. S. Yudar, "Five Factors Influencing the Students' Motivation to Learn English as a Foreign Language: A Closer Look into Montessori Classroom Environment," *REiLA J. Res. Innov. Lang.*, vol. 2, no. 2, pp. 76–

84, 2020, doi: 10.31849/reila.v2i2.3165.

[30] B. Xu, N.-S. Chen, and G. Chen, "Effects of teacher role on student engagement in WeChat-Based online discussion learning," *Comput. Educ.*, vol. 157, p. 103956, 2020, doi: https://doi.org/10.1016/j.compedu.2020.103956.

[31] K. Schnitzler, D. Holzberger, and T. Seidel, "All better than being disengaged: Student engagement patterns and their relations to academic self-concept and achievement," *Eur. J. Psychol. Educ.*, vol. 36, no. 3, pp. 627–652, 2021, doi: 10.1007/s10212-020-00500-6.

[32] A. P. Delfino, "Student engagement and academic performance of students of Partido State University," *Asian J. Univ. Educ.*, vol. 15, no. 1, pp. 22–41, 2019, doi: 10.24191/ajue.v15i3.05.

[33] S. Z. Salas-Pilco, Y. Yang, and Z. Zhang, "Student engagement in online learning in Latin American higher education during the COVID-19 pandemic: A systematic review," *Br. J. Educ. Technol.*, vol. 53, no. 3, pp. 593–619, May 2022, doi: https://doi.org/10.1111/bjet.13190.

[34] T. K. F. Chiu, "Student engagement in K-12 online learning amid COVID-19: A qualitative approach from a self-determination theory perspective," *Interact. Learn. Environ.*, vol. 31, no. 6, pp. 3326–3339, Aug. 2023, doi: 10.1080/10494820.2021.1926289.

[35] F. Han, "The relations between teaching strategies, students' engagement in learning, and teachers' self-concept," *Sustain.*, vol. 13, no. 9, 2021, doi: 10.3390/su13095020.

[36] T. Havik and E. Westergård, "Do Teachers Matter? Students' Perceptions of Classroom Interactions and Student Engagement," *Scand. J. Educ. Res.*, vol. 64, no. 4, pp. 488–507, Jun. 2020, doi: 10.1080/00313831.2019.1577754.

[37] E. Sinakou, V. Donche, J. B. De Pauw, and P. Van Petegem, "Designing powerful learning environments in education for sustainable development: A conceptual framework," *Sustain.*, vol. 11, no. 21, 2019, doi: 10.3390/su11215994.

[38] L. I. González-pérez and M. S. Ramírez-montoya, "Components of Education 4.0 in 21st Century Skills Frameworks: Systematic Review," *Sustain.*, vol. 14, no. 3, pp. 1–31, 2022, doi: 10.3390/su14031493.

[39] M. Muhaimin *et al.*, "A sequential explanatory investigation of TPACK: Indonesian science teachers' survey and perspective," *J. Technol. Sci. Educ.*, vol. 9, no. 3, pp. 269–281, 2019, doi: 10.3926/jotse.662.

[40] Z. Yu, L. Yu, Q. Xu, W. Xu, and P. Wu, "Effects of mobile learning technologies and social media tools on student engagement and learning outcomes of English learning," *Technol. Pedagog. Educ.*, vol. 31, no. 3, pp. 381–398, May 2022, doi: 10.1080/1475939X.2022.2045215.

BIOGRAPHIES OF AUTHORS

Ika Maryani ☉ ⚒ SC ◉ is an Assistant Professor at the Department of Elementary Teacher Education, Universitas Ahmad Dahlan (UAD). In 2022, she obtained her doctoral degree in educational studies focusing on science education. Her research interests lie in teacher education, science education, higher education, and learning innovation. Her works have been published in books, articles, and proceedings at national and national levels. She can be contacted at email: ika.maryani@pgsd.uad.ac.id.

Nursyiva Irsalinda ☉ ⚒ SC ◉ is a Ph.D. candidate specializing in mathematics at Universiti Malaysia Terengganu. She has been a dedicated faculty member of the Department of Mathematics at Universitas Ahmad Dahlan, Indonesia since 2015. Her expertise lies in applied mathematics, and she has achieved significant recognition for her numerous research publications in both national and international journals. She can be contacted at email: nursyiva.irsalinda@math.uad.ac.id.

Patria Handung Jaya ☉ ⚒ SC ◉ is a Ph.D. candidate in linguistics. Since 2022, he has been a part of the Department of Elementary Teacher Education of Universitas Ahmad Dahlan as a lecturer. He completed his master's degree in the Linguistics Study Program, at Universitas Gadjah Mada in 2016. He is also interested in conducting research in the fields of TEYL, TEFL, and Applied Linguistics. He can be contacted at email: patria.jaya@pgsd.uad.ac.id.

Hanum Hanifa Sukma 🆔 📇 SC ⊙ has been a member of the teaching staff at the Department of Elementary Teacher Education, Universitas Ahmad Dahlan since 2015. She has been involved in basic education research, focusing on improving teacher competence and student learning experiences, as well as teaching Indonesian in elementary school. She graduated with her master's degree in basic education from Universitas Pendidikan Indonesia. She can be contacted at email: hanum.sukma@pgsd.uad.ac.id.

Arumugam Raman 🆔 📇 SC ⊙ is a faculty member in the School of Education, College of Arts and Sciences at Universiti Utara Malaysia. His research interests include Educational Technology, Instructional Technology, Computers in Education, Educational Research Methodology, Technology and ICT, Statistics for Educational Research, and Partial Least Squares Structural Equation Modeling (PLS-SEM). He had engaged in many research projects and had received five grants including university, national (FRGS, RAGS), and college (Leads). He can be contacted at email: arumugam@uum.edu.my.