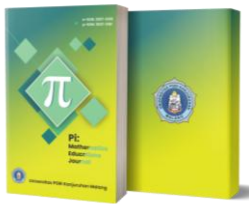
Pi: Mathematics Education Journal
e-ISSN: 2597-6915 p-ISSN: 2597-5161
Vol. 9, No. 1, 2026 | Pp. 85 – 96



Preservice Elementary Mathematics Teachers' Noticing Task Design in Video Analysis

Wiputra Cendana[a,1*], Kimura Patar Tamba[a], Sean Patrick Kang[b], Khoe Yao Tung[a]
[a]Faculty of Education, Universitas Pelita Harapan, Tangerang, Banten, Indonesia
[b]College of Social Sciences, National Sun Yat-sen University, Kaohsiung City, Taiwan
[1]wiputra.cendana@uph.edu
[*]Corresponding Author

ARTICLE HISTORY
Received:
January 15, 2026

Revised:
April 23, 2026

Published:
April 30, 2026

Keywords:
Noticing
Video Task Analysis
Task Design

ABSTRACT
Pre-service elementary mathematics teachers can learn about task design through noticing. For this reason, it is very important to understand and analyze the noticing ability of pre-service elementary mathematics teachers. This study is a qualitative descriptive study that aims to analyze the results of pre-service elementary mathematics teachers' noticing of task design using video. The participants in this study were 35 pre-service elementary mathematics teachers in one of the private universities in Tangerang. Pre-service elementary mathematics teachers' noticing data were collected from the results of video task analysis on task design. Data analysis was carried out using theoretical coding method on the results of the video task analysis. Pre-service elementary mathematics teachers' noticing of task design is not comprehensive. Pre-service elementary mathematics teachers tend to only focus on one or two aspects of task design. The focus of pre-service elementary mathematics teachers' noticing is the mathematical activity involved aspect. The results of this study also show that pre-service elementary mathematics teachers' noticing quality is at the artificial level.

How to Cite: Cendana, W., Tamba, K. P., Kang, S. P., & Tung, K. Y. (2026). Preservice elementary mathematics teachers' noticing task design in video analysis. *Pi: Mathematics Education Journal, 9*(1), 85-96. https://doi.org/10.21067/pmej.v9i1.13748

1. Introduction

Task design is essential in mathematics learning. The teacher as a living curriculum has an important role to plan and construct the assignments for an effective learning process [1]. The task is the starting point of mathematical activity [2]. When dealing with tasks, students will perform mathematical activities such as reasoning, solving problems, making representations, and making connections. Through the task, students encounter various concepts, ideas, and mathematical strategies [33].

Conceptually, the task is an instructional activity tailored by the teacher for students to learn through different kinds of form such as word problems, projects, or other contextualized learning activities [2]-[6]. The task can also be defined as an activity in a pedagogical environment through which students construct mathematical understanding [2]-

[4][6]. In other words, learning mathematics occurs when students work on activities and problems to solve [2].

The ability to design appropriate and good tasks is something that pre-service elementary mathematics teachers must develop. Thus, task design is an essential research topic in mathematics education considering its important role in students' growth on their mathematical skills [2]-[4][7]. Particularly, task design is intertwined with teachers' orientations on their task selection and modification based on the availability of teaching resources for learning activities [8]. The quality of task design should be carefully tailored towards the learning goals with contextual real-life problem transfer and rich of mathematical concepts to be applied from the lesson [9].

One way in fostering ability of pre-service elementary mathematics teachers regarding task design is by noticing [10][11]. With noticing, pre-service elementary mathematics teachers will observe, imitate, and analyze the existing form of task design. Noticing is the ability to observe to attend to important teaching features, consider what is observed in a meaningful way, and decide how to respond [12]-[16]. Noticing consists of "what" and "how" aspects [17]. The "what" aspect refers to the question "what is observed?" in other words, the "what" aspect shows the noticing focus of pre-service elementary mathematics teachers. While the "how" aspect refers to the question "how are the observations made?" The "how" aspect also reveals the quality of the observations made.

Various studies on noticing have been carried out. These studies have analyzed noticing in terms of a particular context and focus. For example, several studies analyze noticing students thinking, higher order thinking inquiry, and project-based design learning [17-21]. Several studies utilize recorded real-time teaching process by experienced teachers for pre-service teachers to develop their noticing analysis skill on essential pedagogical aspects such as students' interactions in the class during the instructional delivery [22]-[24]. Pre-service teachers should also be involved in higher-order thinking task for designing a TPACK-integrated project to practice problem-based questions on real-life scenarios [25-28]. Other research analyzes pre-service elementary mathematics teachers' noticing in a broader context, such as ambitious pedagogy [29]. Ambitious pedagogy means the focus of attention on student activities in learning [29]. Another noticing focus and context are Mathematically Significant Pedagogical Opportunities to Build on Student Thinking (MOSTs). MOSTs include (a) student mathematical thinking, (b) significant mathematics, and (c) pedagogical opportunity [30].

Given that previous studies primarily focus on noticing in broader contexts (e.g., student thinking, ambitious pedagogy, and MOSTs), noticing analysis specifically regarding task design is a crucial area that has received limited attention, thus establishing a clear research gap. Though task design is an important component of learning. Pre-service teachers' noticing analysis on task design is crucially important as in the real teaching experience, they are required to think of the contextual aspects from the given mathematical problem according to the students' cognitive level that caters the mathematical skill demand from the learning goals [9]. Furthermore, the ways of task design presentation upon its selection that aligns with the rich of mathematical concepts and real-world transfer depends on teachers' perceptions of task design for a meaningful learning activity [8]. Therefore, this study aims to analyze the noticing of prospective elementary school mathematics teachers regarding task design.

2. Methods

This research used descriptive qualitative method. This method is used because it aims to describe the pre-service elementary mathematics teachers' noticing. There were 35 pre-service elementary school mathematics teachers who participated in this research in

Tangerang. Participants were selected purposively. Participants are pre-service elementary school mathematics teachers who are enrolled in PSAL (Planning, Strategy, Assessment, and Learning) Elementary School Mathematics courses. The data collection is through video task analysis where pre-service elementary mathematics teachers observe and analyze video recordings of learning. The video recording is taken from www.insidemathematics.org. There are three video clips provided with a total duration of 120 minutes. Previous research suggests using video in analyzing noticing [23][29][31]-[42]. After watching the video, participants wrote down their noticing results with guiding regarding the observations, interpretations, and decisions taken on the interpretation results if as a teacher.

Data analysis was conducted using a systematic procedure based on the theoretical coding technique applied to the results of participants' noticing, which was chosen to rigorously ground the data interpretation within an established theoretical framework [43]. This procedure involved operationalizing the analytical framework in two stages. First, the focus of noticing was categorized using a five-dimensional analytical framework [44] into (a) contextual features, (b) forms of presentation; (c) answer forms required; (d) mathematical activity involved; and (e) level of cognitive demand. Second, the quality of noticing was assessed using a framework from [35], which groups observations into four distinct levels scored on a Likert scale: 1-artificial, 2-descriptive, 3-validation, and 4-analytical validation. To ensure reliability and systematic application of the categories, validation was performed by randomly selecting ten noticing documents for independent re-coding and comparison with the initial results. Consistent coding was used for the analysis phase, while discrepancies were thoroughly re-checked to ensure data integrity. The coding framework used can be seen in Table 1.

Table 1. Framework for Noticing Task Design

What teachers notice	How teachers notice
Contextual features The focus of this noticing is on the contextual features of the task. For example, is the task in the form of a task or question or problem that is not applicable, a task or question that is contextual, authentic *Form of presentation* The focus of this noticing is on the form of representation used or requested in the task (task, question, or problem). The form of representation includes symbols, text, visuals, or a combination of symbols, text, or visuals *Answer forms required* The focus of this noticing is on the form of the answer requested in the task (task, question, or problem). Answer forms such as closed answers (close-ended tasks), open answers (open-ended tasks), or multiple response tasks. *Mathematical activity involved* The focus of this noticing is on the form of mathematical activities carried out in completing the task, such as representation, modeling, calculation, operation, or interpretation activities.	*4-Analytical Validation* Validation means that the results of noticing contain comments that explicitly tell the form, task characteristics, and learning, and provide positive affirmation (evidence) for the description plus analysis and evidence explaining why the practice is good. As well as suggestions for improvement regarding task design. *3- Validation* Validation means that the results of noticing contain comments that tell explicitly about the form, task characteristics, and learning, and also provide positive affirmation (evidence) for the description. 2- Descriptive noticing Descriptive noticing means that the results of noticing tell explicitly about the form, task characteristics, and learning. *1-Artificial Noticing*

Level of cognitive demand
The focus of this noticing is on the cognitive level needed or used in completing a task (task, problem, or problem). The cognitive level includes memorization, procedure without connection, procedure with connection, or doing math.

The results of noticing only reveal things related to explicit form, task characteristics, and learning but not explicitly and specifically on events regarding explicit forms, task characteristics, and learning.

3. Result and Discussion

The results of this study reveal the characteristics of pre-service elementary mathematics teachers' noticing focus, and the quality of noticing. These results are obtained through the coding process and have been validated. Examples of coding results are shown in Table 2. Pre-service elementary mathematics teachers' observations in the videos in Table 2 are categorized as "contextual features" because pre-service elementary mathematics teachers reveal the contextual characteristics of the task. The contextual characteristic of the task that is expressed is the task design in the form of questions with props. The quality of the noticing can be categorized as "descriptive noticing" because the comments are explicitly told about the form, task characteristics, and learning.

Table 2. Example of Codes of Noticing

Video Task Analysis Results	Noticing focus	Noticing quality
The teacher [in the video] uses a task design with a worksheet of questions given to students. In the worksheet there is a table containing questions and students will be able to answer these questions using props in the form of colored snap cubes, with a maximum of fifteen blocks of each color.	Contextual features	Descriptive noticing

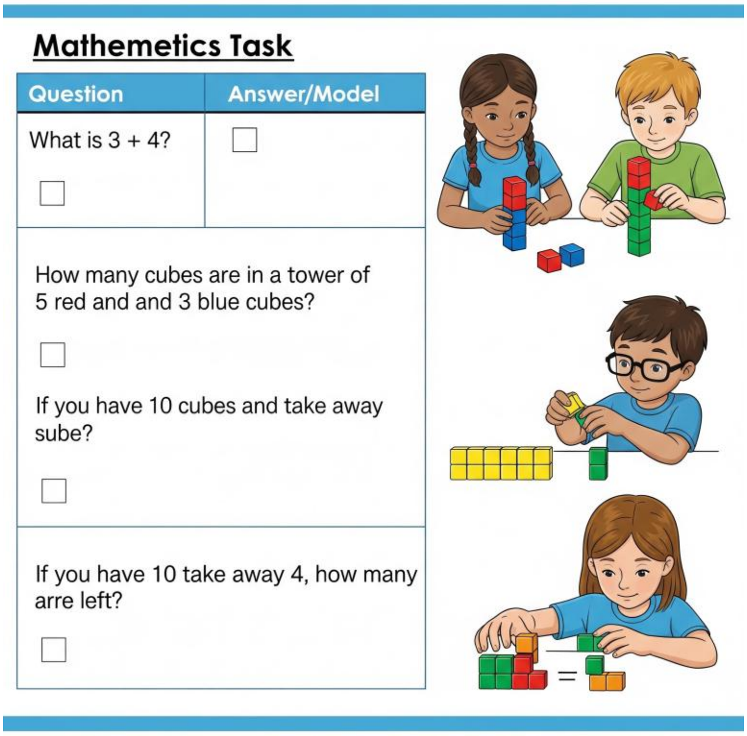


Figure 1. Visual Illustration of The Task Design

The characteristics of pre-service elementary mathematics teachers' noticing focus (the "what" component) are shown in Table 3. The frequency is displayed based on the aspect of noticing focus. From Table 3, only 14 (40.00%) pre-service elementary mathematics teachers observed the "contextual features" of the task design in the learning videos they watched. That is, only 40% pay attention to matters relating to the contextual features of the task. For example, is the task in the form of a task or question or problem that is not applicable, a task or question that is contextual, and authentic. Table 3 shows that only 14 (40%) pre-service elementary mathematics teachers observed the "contextual features" aspect of the task design. Pre-service elementary mathematics teachers do not observe the form of the task, for example, whether the task is in the form of a task or question or problem that is not applicable or a task or question that is contextual, authentic, or fictitious. There were 18 people (51.4%) pre-service elementary mathematics teachers who observed the "form of presentation" aspect. Observations regarding the "form of presentation" include the form of representation used or requested in the task (task, problem, or problem), for example, symbols, text, visuals, or a combination of symbols, text, or visuals. Noticing focus on "answer forms required" was observed by 16 people (45.7%) of pre-service elementary mathematics teachers (Table 3). This shows that only 45.7% observed the form of answers requested in the task (tasks, questions, or problems).

Table 3 shows that the lowest noticing focus is the "level of cognitive demand". Only 11 (31.4%) pre-service elementary mathematics teachers observed the "level of cognitive demand" of the task design. This means that the "level of cognitive demand" is not significant for pre-service elementary mathematics teachers. In contrast, the majority (68.6%) of pre-service elementary mathematics teachers did not observe the cognitive level required or used in completing tasks (activity, questions, or problems).

From all aspects of task design, prospective elementary school mathematics teachers put greater attention and observation on the "mathematical activity involved". The frequency of teachers observing this aspect is higher than others.

Table 3. Percentage of Focus of Noticing

Focus of Noticing	Freq	Percentage
Contextual features	14	40.0%
Form of presentation	18	51.4%
Answer forms required	16	45.7%
Mathematical activity involved	27	77.1%
Level of cognitive demand	11	31.4%

The results of the comprehensive level analysis of noticing focus on task design are shown in Table 4. It can be seen that only 3 (8.57%) participants observed the five aspects of task design. This result means that most of the pre-service elementary mathematics teachers are not comprehensive in observing task design in learning. Most pre-service elementary mathematics teachers only observe two aspects of task design in learning.

Table 4. Comprehensive Level of Noticing

Comprehensive Level	Freq	Percentage
No aspects	0	0%
One aspect	5	14.29%
Two aspects	18	51.43%
Three aspects	6	17.14%
Four aspects	3	8.57%
Five aspects	3	8.57%
Total	35	100%

Table 5 shows descriptive statistics of the quality of pre-service elementary mathematics teachers' noticing regarding task design. This result shows the quality of each noticing focus. It can be seen that the minimum score for noticing quality is 0. This means that there are pre-service elementary mathematics teachers who do not observe the focus of the noticing. For example, the minimum value of the "contextual features" aspect is 0, this means that there are pre-service elementary mathematics teachers who do not observe this aspect of task design. This data is following the results that have been presented in Table 3. Likewise, the maximum value of noticing quality shows how pre-service elementary mathematics teachers observe each focus of noticing. For example, the maximum value for noticing focus on "mathematical activity involved" is 4. This value indicates that there are pre-service elementary mathematics teachers who can observe "mathematical activity involved" in the analytical validation of the task design. Analytical validation means that pre-service elementary mathematics teachers write down their observations explicitly regarding the "mathematical activity involved". The results of these observations are accompanied by providing positive affirmations (evidence) and analysis explaining why "mathematical activity involved" is good and suggestions for improvement.

Table 5. Noticing Quality Descriptive Statistics

Noticing focus	Min	Max	Mean
Contextual features	0	4	0.97
Form of presentation	0	4	0.91
Answer forms required	0	4	0.89
Mathematical activity involved	0	4	1.80
Level of cognitive demand	0	4	0.57
Total	0	4	1.02

Table 5 also shows that the average quality of pre-service elementary mathematics teachers' noticing regarding task design is 1.02. This value means that the average quality of pre-service elementary mathematics teachers' noticing is still at the "descriptive noticing" level. The results of their observations are still only talking explicitly about the form, task characteristics, and learning. If we look at the five aspects of noticing focus, only the "mathematical activity involved" aspect exceeds the "artificial noticing" level. This means that pre-service elementary mathematics teachers have not been able to reveal explicitly and specifically about the form, task characteristics, and learning. Observations made by pre-service elementary mathematics teachers are still very general and not explicit about task design.

If viewed in more detail (Table 6), in the aspect of "form of presentation", "answer forms required", and "level of cognitive demand" the quality of pre-service elementary mathematics teachers' noticing is mostly at the "artificial" level. This result means that in these three aspects most of the pre-service elementary mathematics teachers have noticing quality at the "artificial" level. The quality of observations of pre-service elementary mathematics teachers is still only a general and not explicit mention of this aspect.

In the aspect of "contextual features" and "mathematical activity involved" the quality of pre-service elementary mathematics teachers' noticing is slightly better. The frequency of pre-service elementary mathematics teachers who have noticing quality at the "analytic" level is the same or greater than the other levels. These results indicate that the quality of pre-service elementary mathematics teachers' noticing also depends on what aspects are the focus of their observations.

Table 6. Frequency Based on Noticing Quality

Aspect	Noticing quality				
	Not observing	**Artificial**	**Descriptive**	**Validation**	**Analytic**
Contextual features	60.0%	11.4%	11.4%	5.7%	11.4%
Form of presentation	48.6%	25.7%	17.1%	2.9%	5.7%
Answer forms required	54.3%	20.0%	11.4%	11.4%	2.9%
Mathematical activity involved	22.9%	22.9%	20.0%	22.9%	11.4%
Level of cognitive demand	68.6%	17.1%	5.7%	5.7%	2.9%

There are two main findings from the results of the research above. The first is about the characteristics of pre-service elementary mathematics teachers' noticing focus regarding task design. In general, pre-service elementary mathematics teachers are not comprehensive in noticing the task design. Pre-service elementary mathematics teachers tend to only focus on one or two aspects of task design. The aspect most observed by pre-service elementary mathematics teachers is the "mathematical activity involved". This means that pre-service elementary mathematics teachers are more focused and believe that the most important thing in task design is the form of mathematical activities carried out in completing the task, such as representation, modeling, calculation, operation, or interpretation activities. This shows that pre-service elementary mathematics teachers' noticing focus on task design is still partial.

One of the factors that make this possible is the confidence of the pre-service elementary mathematics teachers [6]. Research on noticing also shows the same thing. The focus on noticing an aspect of learning is influenced by the perspective of that aspect [22]. The pre-service teachers' beliefs, knowledge, and philosophical standpoint in learning mathematics influence what aspects of task design are important and how they are implemented [45][46]. Furthermore, pre-service teachers tend to have blinders on the tasks' richness of mathematical concepts in real-life transfer contexts that instead focusing on designing busy learning activity which impede the true purpose of task design to be superficial [9]. Therefore, noticing skill is critical in pre-service teachers' task design which impacts the students' mathematical learning outcome over time.

Another factor that influences the noticing focus of task design is the use of video. The use of video can reduce the breadth and comprehensiveness of the noticing focus. Although various studies reveal that video is very helpful for pre-service elementary mathematics teachers' noticing, other studies reveal the limitations of using video. Noticing focus is less comprehensive when watching video than direct observation [34][35][37][41][47]–[50].

The second finding is regarding the quality of pre-service elementary mathematics teachers' noticing of task design. The results show the average of pre-service elementary mathematics teachers' noticing quality is still at the artificial level in this study. A probable factor of such outcome might be the lack of comprehensive (detailed) aspects observed by pre-service elementary mathematics teachers regarding task design. Previous studies discovered the higher quality of noticing if it was done in a detailed and engaging manner [17][22][24][51]. The extent of this finding might cover the broader spectrum of teachers' task design preparation such as their beliefs on what mathematics learning should be like, mathematical knowledge, mathematics anxiety in relation to pedagogical competence, and teachers' mathematical literacy skills in decision making while solving the problems

[45][52]–[54]. The instructors should be aware of these factors that will impede the pre-service teachers' ability to reason on the richness of mathematical concepts with its cognitive demand and meaningful real-life transfer [55]. Also, the pre-service teachers' experience in constructing mathematical problems or a project can shape their interpretation skill for the required assessment criteria in task design [56]. Again, the banal noticing skill of pre-service teachers imposes hidden mathematical learning superficiality danger for students' mathematical literacy growth.

According to the aforementioned results, this research contributes in several ways. First, this research contributes in terms of pre-service elementary mathematics teachers' noticing. Noticing skills is essential to be developed since the teachers' learning journey in their teacher's college education [17][29][50]. Second, this study strengthens the research results of [22] which uses video recordings of learning (implementation of task design) by other teachers who are not known by the participants. Third, the findings amplify the needs for teachers' college for emphasizing the opportunities for pre-service teachers to inquire while designing a TPACK-integrated project-based learning [25]– [28]. The implication is that prospective elementary school mathematics teachers can have authentic noticing experiences from authentic video recordings done by teachers in real context.

This aligns with [48] who argued that pre-service elementary mathematics teachers have tendency to praise instead of giving critical analysis through questions or feedbacks when observing a mock teaching carried out by their friends. Henceforth, this supports the previous findings to show other teachers' teaching videos to provide unbiased and authentic quality of noticing experience.

However, the use of other people's videos can also be one of the limitations of this study. While it allows for more authentic noticing, context factors also play a role. Different contexts may influence pre-service elementary mathematics teachers in analyzing the video provided. Especially, this is strongly connected in the current needs for teacher education in teaching task design that is TPACK oriented and project-based for supporting students' critical mathematical thinking [26][27][56]. Subsequent research needs to be carried out taking this context into account [22].

4. Conclusion

The results of this study answered two research questions. First, regarding the characteristics of the focus of noticing. The focusing characteristic of pre-service elementary mathematics teachers' noticing regarding task design is that it tends to focus on the mathematical activity involved. In addition, the focus on task design by pre-service elementary mathematics teachers' noticing was not comprehensive. Not comprehensive means that it does not cover all aspects of the task design. Second, the noticing quality from most of the pre-service elementary mathematics teachers' were still at the artificial level.

These findings thereby have some implications for teacher education. Given that pre-service teachers' noticing is still partial, teacher education programs should prioritize developing a more comprehensive noticing skill set for task design. Instructors should explicitly guide pre-service teachers to look beyond just the surface level (e.g., focusing only on mathematical activity) to consider all five dimensions of task design, especially the level of cognitive demand. Furthermore, incorporating authentic noticing experiences, potentially through video analysis of unfamiliar teaching contexts, can help provide unbiased perspectives. Curricula should emphasize opportunities for pre-service teachers to engage in design-based inquiries, aligning task design with TPACK-integrated project-based learning to help synchronizing between their beliefs and effective pedagogical competence.

Future research should address the aforementioned limitations, particularly by exploring how different teaching contexts influence pre-service teachers' noticing during video analysis. Subsequent studies should also investigate the long-term impact of focused intervention programs (e.g. for those emphasizing TPACK-oriented and project-based task design, on improving the breadth and quality of pre-service teachers' professional noticing in mathematics education).

References

[1] S. P. Kang and S. L. Wibowo, "Teacher's role in interactively teaching English online for middle school students," in *Proc. 13th AISOFOLL: Keeping up with the New Trends in Language Teaching*, Jakarta, Indonesia, 2023, vol. 9, pp. 364–376.

[2] Watson and M. Ohtani, Eds., *Task Design in Mathematics Education*. Cham: Springer, 2015.

[3] Leung, "Exploring techno-pedagogic task design in the mathematics classroom," *ZDM–Math. Educ.*, vol. 8, pp. 3–16, 2017.

[4] Margolinas, "Task design in mathematics education," in *Proc. ICMI Study 22*, 2013.

[5] Clarke, B. Grevholm, and R. Millman, *Tasks in Primary Mathematics Teacher Education: Purpose, Use and Exemplars*. New York: Springer, 2009.

[6] P. Sullivan, D. Clarke, and B. Clarke, *Teaching with Tasks for Effective Mathematics Learning*. New York: Springer, 2013.

[7] S. M. Günster and H. G. Weigand, "Designing digital technology tasks for the development of functional thinking," *ZDM–Math. Educ.*, vol. 52, no. 7, pp. 1259–1274, 2020, doi: 10.1007/s11858-020-01179-1.

[8] Riard and B. Kaur, "A 'stimulus-based interview' approach to illuminate teachers' orientations and resources related to task selection and modification," *Math. Educ. Res. J.*, vol. 34, no. 3, pp. 599–630, 2022, doi: 10.1007/s13394-022-00417-x.

[9] S. Sevinc and R. Lesh, "Preservice mathematics teachers' conceptions of mathematically rich and contextually realistic problems," *J. Math. Teacher Educ.*, vol. 25, pp. 1–29, 2021, doi: 10.1007/s10857-021-09512-5.

[10] B. H. Choy, "Snapshots of mathematics teacher noticing during task design," *Math. Educ. Res. J.*, vol. 28, 2016, doi: 10.1007/s13394-016-0173-3.

[11] B. H. Choy and J. Dindyal, "Productive teacher noticing and affordances of typical problems," *ZDM–Math. Educ.*, vol. 53, no. 1, pp. 195–213, 2021, doi: 10.1007/s11858-020-01203-4.

[12] V. R. Jacobs, L. L. C. Lamb, and R. A. Philipp, "Professional noticing of children's mathematical thinking," *J. Res. Math. Educ.*, vol. 41, no. 2, pp. 169–202, 2010, doi: 10.5951/jresematheduc.41.2.0169.

[13] B. Sherin and J. R. Star, "Reflections on the study of teacher noticing," in *Mathematics Teacher Noticing*. New York: Routledge, 2011, pp. 66–78.

[14] K. Stürmer, K. D. Könings, and T. Seidel, "Declarative knowledge and professional vision in teacher education," *Br. J. Educ. Psychol.*, vol. 83, no. 3, pp. 467–483, 2013, doi: 10.1111/j.2044-8279.2012.02075.x.

[15] J. W. Stigler and K. F. Miller, *Expertise and Expert Performance in Teaching*, 2nd ed. Cambridge: Cambridge University Press, 2018.

[16] J. Mason, *Researching Your Own Practice: The Discipline of Noticing*. New York: Routledge, 2002.

[17] A. van Es, "A framework for learning to notice student thinking," in *Mathematics Teacher Noticing*. New York: Routledge, 2011, pp. 134–151.

[18] P. Guner and D. Akyuz, "Noticing student mathematical thinking within the context of lesson study," *J. Teacher Educ.*, vol. 71, no. 5, pp. 568–583, 2020, doi: 10.1177/0022487119892964.

[19] P. Ivars, C. Fernández, and S. Ciscar, "A learning trajectory as a scaffold for pre-service teachers' noticing," *Int. J. Sci. Math. Educ.*, 2019, doi: 10.1007/s10763-019-09973-4.
[20] R. LaRochelle et al., "Secondary practising teachers' professional noticing," *Math. Teacher Educ. Develop.*, vol. 21, no. 1, pp. 4–27, 2019.
[21] M. Y. Lee, "The development of elementary pre-service teachers' professional noticing," *Asia-Pacific J. Teacher Educ.*, vol. 47, no. 4, pp. 383–398, 2019, doi: 10.1080/1359866X.2019.1607253.
[22] K. P. Tamba and W. Cendana, "Preservice elementary teachers' noticing formative assessment," *J. Pendidik. Indones.*, vol. 11, no. 1, pp. 43–50, 2022, doi: 10.23887/jpi-undiksha.v11i1.33678.
[23] S. Zuo, L. Liu, and C. Qi, "Using video to develop pre-service teachers' noticing," *Eurasia J. Math. Sci. Technol. Educ.*, vol. 20, no. 5, 2024, doi: 10.29333/ejmste/14466.
[24] Y. F. Estu et al., "Model inovasi pembelajaran mahasiswa berkebutuhan khusus berbasis video," *Pi: Math. Educ. J.*, vol. 4, no. 1, pp. 10–19, 2021, doi: 10.21067/pmej.v4i1.5138.
[25] M. Zayyadi et al., "Karakterisasi pengajuan pertanyaan mahasiswa calon guru," *Pi: Math. Educ. J.*, vol. 6, no. 1, pp. 10–16, 2023, doi: 10.21067/pmej.v6i1.8010.
[26] W. N. E. Kusuma and K. F. Zamzam, "Pengembangan media pembelajaran papan pintar aljabar berbasis project-based learning," *Pi: Math. Educ. J.*, vol. 7, no. 1, pp. 40–48, 2024, doi: 10.21067/pmej.v7i1.9841.
[27] I. Rahma et al., "Keterampilan berpikir kritis dan kreatif calon guru," *Pi: Math. Educ. J.*, vol. 8, no. 1, pp. 1–11, 2024, doi: 10.21067/pmej.v8i1.10769.
[28] M. Lia and M. Zayyadi, "Students' questioning skills on systems of linear equations," *Pi: Math. Educ. J.*, vol. 7, no. 2, pp. 93–99, 2024, doi: 10.21067/pmej.v7i2.10355.
[29] A. van Es et al., "Learning to notice mathematics instruction," *Cognition and Instruction*, vol. 35, no. 3, pp. 165–187, 2017, doi: 10.1080/07370008.2017.1317125.
[30] K. Leatham et al., "Conceptualizing mathematically significant pedagogical opportunities," *J. Res. Math. Educ.*, vol. 46, pp. 88–124, 2015, doi: 10.5951/jresematheduc.46.1.0088.
[31] Cyrille and S. Chaliès, "Video viewing in teacher education," *Educ. Res. Rev.*, vol. 16, pp. 41–67, 2015, doi: 10.1016/j.edurev.2015.06.001.
[32] Gotwals et al., "Using video to examine formative assessment practices," *Int. J. Sci. Math. Educ.*, vol. 13, pp. 405–423, 2015, doi: 10.1007/s10763-015-9623-8.
[33] J. König et al., "Teachers' general pedagogical knowledge," *Teaching and Teacher Education*, vol. 38, pp. 76–88, 2014, doi: 10.1016/j.tate.2013.11.004.
[34] K. W. Kosko et al., "Preservice teachers' professional noticing," *J. Teacher Educ.*, vol. 72, no. 3, pp. 284–297, 2021, doi: 10.1177/0022487120939544.
[35] K. Lebak, "Analyzing online video club discussions," *Educ. Inf. Technol.*, vol. 23, no. 5, pp. 1789–1804, 2018, doi: 10.1007/s10639-018-9689-3.
[36] S. A. Roller, "What they notice in video," *J. Math. Teacher Educ.*, vol. 19, no. 5, pp. 477–498, 2016, doi: 10.1007/s10857-015-9307-x.
[37] R. Santagata and C. Yeh, "Learning to teach mathematics," *J. Math. Teacher Educ.*, vol. 17, no. 6, pp. 491–514, 2014, doi: 10.1007/s10857-013-9263-2.
[38] J. R. Star and S. K. Strickland, "Learning to observe," *J. Math. Teacher Educ.*, vol. 11, no. 2, pp. 107–125, 2008, doi: 10.1007/s10857-007-9063-7.
[39] T. R. Tripp and P. J. Rich, "The influence of video analysis," *Teaching and Teacher Education*, vol. 28, no. 5, pp. 728–739, 2012, doi: 10.1016/j.tate.2012.01.011.
[40] F. Ulusoy and E. Çakıroğlu, "Using video cases," *Eurasia J. Math. Sci. Technol. Educ.*, vol. 14, no. 11, 2018, doi: 10.29333/ejmste/92020.

[41] J. Walkoe, "Exploring teacher noticing," *J. Math. Teacher Educ.*, vol. 18, no. 6, pp. 523–550, 2015, doi: 10.1007/s10857-014-9289-0.
[42] K. Warshauer et al., "Developing prospective teachers' noticing," *J. Math. Teacher Educ.*, vol. 24, no. 1, pp. 89–121, 2021, doi: 10.1007/s10857-019-09451-2.
[43] L. Cohen, L. Manion, and K. Morrison, *Research Methods in Education*, 7th ed. London: Routledge, 2011.
[44] V. Berisha and R. Bytyqi, "Types of mathematical tasks," *Int. J. Eval. Res. Educ.*, vol. 9, 2020, doi: 10.11591/ijere.v9i3.20617.
[45] M. Muhtarom et al., "Pre-service teacher's beliefs," *Al-Jabar: J. Pendidik. Mat.*, vol. 10, no. 1, pp. 101–110, 2019, doi: 10.24042/ajpm.v10i1.3617.
[46] M. Swan, "Task-based professional development," *J. Math. Teacher Educ.*, vol. 10, no. 4, pp. 217–237, 2007, doi: 10.1007/s10857-007-9038-8.
[47] L. Beattie et al., "Measuring teacher noticing," in *Teacher Noticing*. Cham: Springer, 2017, pp. 321–338.
[48] Ellis et al., "Social interactions of beginning teachers," *Contemp. Issues Technol. Teacher Educ.*, vol. 15, no. 3, pp. 404–421, 2015.
[49] M. T. Magiera and V. S. Zambak, "Teacher noticing in STEM," *Int. J. STEM Educ.*, vol. 8, 2021, doi: 10.1186/s40594-020-00263-y.
[50] E. A. van Es and M. G. Sherin, "Learning to notice," *Teaching and Teacher Education*, vol. 24, no. 2, pp. 244–276, 2008, doi: 10.1016/j.tate.2006.11.005.
[51] S. L. Stockero et al., "Learning to notice student thinking," *Teaching and Teacher Education*, vol. 63, pp. 384–395, 2017, doi: 10.1016/j.tate.2017.01.006.
[52] M. Prabawati, "Analisis literasi matematik," *Mosharafa: J. Pendidik. Mat.*, vol. 7, pp. 113–120, 2018, doi: 10.31980/mosharafa.v7i1.347.
[53] W. Murtafiah et al., "Decision-making process," *J. Pendidik. Mat.*, vol. 15, pp. 145–160, 2021, doi: 10.22342/jpm.15.2.13908.145-160.
[54] P. Rahayu et al., "Mathematics anxiety," *Al-Jabar: J. Pendidik. Mat.*, vol. 10, no. 1, pp. 111–124, 2019, doi: 10.24042/ajpm.v10i1.4165.
[55] Abdara, "Analisis kemampuan calon guru matematika," *Kreano*, vol. 8, no. 1, 2017, doi: 10.15294/kreano.v8i1.7120.
[56] Nasution et al., "Pre-service teachers' perception on the implementation of project-based learning," *Infinity J.*, vol. 10, no. 1, pp. 109-120, 2021, doi: 10.22460/infinity.v10i1.p109-120.