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Mapping the Difficulties of Junior High School Mathematics Teachers in Sukabumi Regency for OSN Coaching

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ABSTRACT

Coaching students for the National Science Olympiad (OSN) in Mathematics demands teacher competencies that differ from regular classroom teaching. However, studies mapping the difficulties of olympiad coaches in Indonesia remain limited. This study aimed to map the difficulties junior high school mathematics teachers in Sukabumi Regency face in coaching for the OSN. A cross-sectional survey used a 32-item, five-point Likert questionnaire across eight initial constructs and was analyzed using Exploratory Factor Analysis (Principal Axis Factoring, Direct Oblimin rotation). The data were suitable for factoring (KMO = 0.770; Bartlett's χ^2 = 1,199.955; df = 276; $p < 0.001$). After eight problematic items were removed, 24 items formed three factors: specialized pedagogy, differentiation, and coaching planning (11 items); mathematical competence, problem design, and self-development (6 items); and talent identification and progress monitoring (7 items). School support items did not form a stable structure. The 24-item instrument demonstrated excellent internal consistency, yielding a global Cronbach's alpha of 0.970 and factor-specific Composite Reliability (CR) values well above the 0.70 threshold. Exploratory Factor Analysis (EFA) extracted three distinct dimensions explaining 72.678% of the total variance: Factor 1 (specialized pedagogy, differentiation, and coaching planning; CR = 0.9652) accounted for 58.526%; Factor 2 (mathematical competence, problem preparation, and self-development; CR = 0.9186) for 8.759%; and Factor 3 (talent identification and student development monitoring; CR = 0.9471) for 5.393%. Factor 1 emerged as the most dominant dimension, representing the greatest perceived difficulty among the participating teachers.

Keywords: Exploratory Factor Analysis; OSN; Teacher Difficulties

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INTRODUCTION

The National Science Olympiad (OSN) Mathematics is a tiered science competition, from the district/city to the national level, that provides a forum for junior high school students to develop their academic potential in mathematics. The training materials go far beyond the ordinary school curriculum, so OSN coaching is better understood as an advanced enrichment program. In talent development, mentoring plays a key role in student achievement from the beginning (Olszewski-Kubilius, 2024).

Therefore, olympiad coaching is different from mathematics learning in regular classes. Coaching teachers often lack sufficient theoretical knowledge; they need to master strategies for solving non-routine problems, recognize the characteristics of competition questions, provide appropriate challenges, and regularly monitor students' learning progress. Reports on coaching programs in Indonesia show that Olympiad coaching requires activities oriented to Olympiad questions, teacher training, and strengthening mathematical thinking skills (Harahap et al., 2025; Umbara et al., 2025). Training to recognize and compile competition questions has also been provided to junior high school teachers in Bogor Regency (Mahatma et al., 2020).

At the international level, research on mathematics competition teachers is emerging. Lin et al. (2025) surveyed 289 mathematics competition teachers in China. They found that competitive teaching professionalism, teaching efficacy, engagement, teaching practices, and teachers' adaptability relate to student development in an online learning environment. Lv et al. (2024), through interviews with 33 teachers who teach Olympiad mathematics in China, revealed work pressures related to student characteristics, difficult material demands, and the school environment.

Another challenge arises when teachers have to structure or modify problems. Li et al. (2022) showed that teachers' instructional beliefs and practices shape their mathematics teaching through problem posing. A meta-analysis of 26 intervention studies found that interventions to improve problem-posing competence had a positive effect with moderate effect sizes (Zhang et al., 2024). Montes et al. (2024) showed that problem transformation mobilizes teacher-specific mathematical and pedagogical knowledge, which is relevant for coaching teachers who have to turn routine problems into challenging ones.

Coaching success also depends on teachers' ability to recognize students' potential and differentiate services. Ayık et al. (2025) surveyed 441 primary school teachers in Turkey. They found that teachers' broader views on talent were related to more diverse student nominations and more inclusive differentiation practices. At the same time, gifted child education training predicted teacher proficiency in nomination and differentiation. Hinch et al. (2024) examined differentiation practices for gifted students among 470 teachers in Ireland, and Cheung et al. (2022) reported that professional development programs for 2,031 teachers in Hong Kong improved teachers' knowledge of gifted children's education and the use of special learning strategies.

From a systems perspective, the talent development approach views high ability as potential developed through assessment, curriculum and learning, and psychosocial development (Subotnik et al., 2023). This approach requires programs designed in stages and sustainably, not rapid preparation ahead of the competition (Olszewski-Kubilius, 2024). Working conditions and school support also matter: Lv et al. (2024) highlight the role of the school environment in teacher experience, and Weber and Mofield (2023) emphasize the need for professional learning that strengthens talented students' pedagogical

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content knowledge. Therefore, measuring teacher difficulty should not stop at technical ability; teachers also need to overcome external barriers such as time constraints, teaching materials, collaboration, school support, and opportunities to participate in training.

Based on the author's initial literature search from 2021 to 2026, publications on the development of the mathematics olympiad in Indonesia are mostly training or community service reports (Harahap et al., 2025; Mahatma et al., 2020; Umbara et al., 2025). Lin et al. (2025) conducted their research in the context of online learning in China, while Lv et al. (2024) used a qualitative design and were also set in China. To the authors' knowledge, no research has integrated Olympiad competence, question preparation, student potential identification, differentiation, program management, assessment, and institutional support into a single survey instrument to map the difficulties of OSN Mathematics coaches.

This study aims to map the factors related to the difficulties of junior high school mathematics teachers in Sukabumi Regency in developing OSN Mathematics. The problem is: What factors underlie the difficulties of junior high school mathematics teachers in Sukabumi Regency in developing OSN Mathematics? The novelty of the research lies in the focus and integration of constructs. The research does not redevelop the competency scale of teachers in existing mathematics competitions; instead, it develops a new instrument that integrates eight theoretically interrelated factor groups. In this article, teacher difficulty is defined as the difficulty teachers perceive and measured through questionnaire scores; higher scores indicate greater perceived difficulty. The research output is a set of difficulty dimensions that can be used to determine priorities for teacher professional development, for example through workshops, mentoring, and a forum for the coaching teacher community such as MGMP.

METHOD

Research Design and Setting

This study uses a quantitative, cross-sectional survey design to identify and map the underlying dimensions of teachers' difficulties in fostering students' learning in OSN Mathematics. This design is not intended to prove a cause-and-effect relationship. Therefore, the results are interpreted as dimensions or factors underlying teachers' perceptions of difficulties, not as causal factors.

The data collection was carried out in a series of Community Service (PkM) workshops organized by the Universitas Pendidikan Indonesia (UPI) Mathematics Study Program team in collaboration with the Mathematics MGMP Junior High School of Sukabumi Regency. The workshops took place over four sessions on September 16, 23, 30, and October 7, 2026.

Participants, Instruments, and Procedures

This study included junior high school mathematics teachers in Sukabumi Regency who were involved in, or had experience coaching, students for OSN Mathematics. A total of 45 respondents participated in the workshop and filled out the questionnaire. After screening, 4 incomplete questionnaires were excluded, leaving a final valid sample of 41 respondents.

Data were collected through an online closed-ended questionnaire (Google Forms) using a five-level Likert scale: Strongly Agree (5), Agree (4), Neutral (3), Disagree (2), and Strongly Disagree (1). The instrument consisted of 32 statements, with four items representing each of the eight initial conceptual

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constructs (items x1–x4 for construct 1, x5–x8 for construct 2, up to x29–x32 for construct 8). All items were formulated as difficulty statements so that higher scores indicate greater perceived difficulty.

Content validation was conducted through expert judgment involving three university lecturers specializing in mathematics education and olympiad training. These experts have extensive professional backgrounds as national-level Mathematics Olympiad (OSN) instructors, coaches, judges, and former competition medalists. The experts evaluated the instrument for item suitability to the construct, relevance, clarity, readability, term accuracy, and potential meaning overlap. To quantify their agreement, the Content Validity Index (CVI) was computed, yielding an Item-level CVI (I-CVI) of 1.00 across all items and a Scale-level Content Validity Index (S-CVI/Ave) of 1.00, indicating perfect content validity alignment among the expert panel. The qualitative insights and structural recommendations provided by the experts were fully implemented to refine and finalize the instrument's phrasing before deployment. The initial conceptual framework is detailed in Table 1.

Table 1. Constructs and Conceptual Basis of Instruments

No.	Construct	Conceptual foundation	Rationale of the indicator
1	Mathematics competence and Olympiad problem-solving	MKT; special knowledge for teaching mathematics; professionalism of competition teaching	Teachers understand non-routine material, solution strategies, and competition question patterns.
2	Preparation and evaluation of the Olympiad questions	Problem posing; mathematical-pedagogical knowledge	Teachers can select, modify, compile, and assess question quality.
3	Identify students' potential/talents	Gifted/talent development; teacher nomination	Teachers can recognize indicators of mathematical potential and distinguish general achievement from specific potential.
4	Differentiation and coaching strategies	Differentiated instruction; PCK for gifted learners	Teachers can adjust challenges, pace, strategies, and feedback.
5	Coaching program planning	Talent development; sustainable coaching programs	Teachers can prepare realistic stages, targets, schedules, materials, and evaluations.
6	Assessment and monitoring of progress	Assessment for learning; feedback; monitoring	Teachers can diagnose weaknesses, monitor progress, and use assessment results.
7	Resources, time, collaboration, and school support	Professional learning; teachers' working conditions; collaborative professional development	Teachers gain time, learning resources, networking, school support, and learning opportunities.
8	Self-efficacy and professional development	Teacher self-efficacy; professional learning	Teachers' confidence in their ability to nurture students and competency development needs.

Data Analysis

The data were first examined to ensure there were no duplicate responses, complete answers on all items, reasonable answer patterns, and scale-appropriate response codes. We checked the data's feasibility for factor analysis using Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity. An MSA value of 0.60 or higher is considered adequate, and analysis is resumed if the Bartlett test yields $p < 0.05$.

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The analysis was conducted in SPSS using Spearman's correlation matrix. Because the Likert data are ordinal, this was noted as a limitation. Principal Axis Factoring was used for factor extraction because the focus was on latent constructs rather than variable reduction. Oblique rotation (Direct Oblimin with Kaiser normalization) was used because the difficulty dimensions were estimated to be interrelated (Watkins, 2018).

Factors were retained based on Kaiser's criterion (initial eigenvalues > 1.0) and visual inspection of the scree plot. To determine component retention, we retained only eigenvalues preceding the primary break in the scree plot, following a widely accepted heuristic, as they capture most of the meaningful variance. (Jackson, 1991). To ensure discriminant validity and structural integrity during the Exploratory Factor Analysis (EFA), item retention was governed by strict cross-loading containment rules. Cross-loading occurs when an indicator shows substantial structural affinity to multiple dimensions, threatening the construct's theoretical purity. According to psychometric standards (Hair et al., 2010), discriminant validity is compromised if an item fails to differentiate clearly between distinct factors. Therefore, a cross-loading criterion was established where an item was flagged for deletion if the absolute difference between its primary factor loading and any secondary cross-loading fell below a threshold of 0.20. This criterion ensures that each retained indicator measures only its designated latent dimension, without semantic or conceptual overlap.

RESULTS

The data feasibility test showed that the correlation matrix was highly suitable for factoring. As shown in Table 2, the KMO value of 0.770 was well above the 0.60 threshold, and Bartlett's Test of Sphericity was highly significant ($p < 0.001$).

Table 2. Results of the KMO and Bartlett Tests on the Final Solution (24 Items)

Statistics	Value
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.770
Bartlett's Test of Sphericity: approx. Chi-Square	1,199.955
Bartlett's Test of Sphericity: df	276
Bartlett's Test of Sphericity: Sig.	< 0.001

The analysis was carried out in stages until a simple structure was reached. Eight of the original 32 items were removed. The step-by-step reduction is detailed as follows:

1. Initial Validity Test: A total of 5 items (x_{25}, x_{26}, x_{27}, x_{28}, and x_{30}) were found to be invalid. Notably, this subset includes all 4 items belonging to Construct 7 (*school support and resources*). Even after refining the phrasing of these items, they remained invalid and were consequently excluded from further analysis.
2. Exploratory Factor Analysis (EFA): The remaining items were then subjected to EFA. During this stage, unstable cross-loadings between factors were observed. A clean, stable factor structure was achieved only after eliminating 3 additional items, namely x_3, x_6, and x_8.

Consequently, removing these 8 items (5 from the initial validity test and 3 from the EFA) leaves 24 items for the final empirical structure, all of which are valid, reliable, and factorially stable.

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Table 3. Items Removed in Factor Analysis

Initial construct	Deleted items & reason	Quantity
1. Mathematics competence and Olympic problem-solving	x_3 (cross-loading unstable)	1
2. Preparation and evaluation of the Olympiad questions	x_6, x_8 (cross-loading unstable)	2
7. School resources, time, collaboration, and support	x_{25}, x_{26}, x_{27}, x_{28} (not valid)	4
8. Self-efficacy and professional development	x_{30} (not valid)	1
Total		**8**

The 24-item instrument demonstrated excellent internal consistency, yielding a global Cronbach's alpha of 0.970 and factor-specific Composite Reliability (CR) values well above the 0.70 threshold. Exploratory Factor Analysis (EFA) extracted three distinct dimensions explaining 72.678% of the total variance (see Table 4): Factor 1 (specialized pedagogy, differentiation, and coaching planning; CR = 0.9652) accounted for 58.526%; Factor 2 (mathematical competence, problem preparation, and self-development; CR = 0.9186) for 8.759%; and Factor 3 (talent identification and student development monitoring; CR = 0.9471) for 5.393%. Factor 1 emerged as the most dominant dimension, representing the greatest perceived difficulty among the participating teachers.

Factors were retained based on Kaiser's criterion (initial eigenvalues > 1.0) and visual inspection of the scree plot. The scree plot (Figure 1) showed a sharp decline (elbow point) immediately after the third component, supporting the three-factor solution. Cumulatively, these three extracted factors accounted for 72.678% of the total variance (Table 4). To establish a clean and robust factor structure, item retention was governed by strict psychometric rules: indicators were eliminated if their primary factor loading fell below 0.40, or if they exhibited cross-loading behaviors where the absolute difference between the primary loading and any secondary cross-loading was less than 0.20.

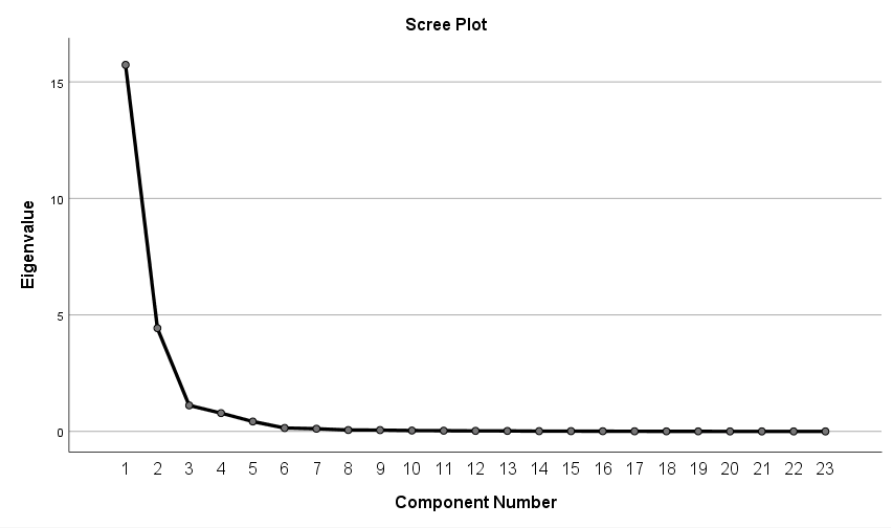

Figure 1. Scree plot for eigenvalues

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Table 4. Eigenvalues and Variance Explained for Three Factors

Component	Initial Eigenvalue	% of Variance Explained	Cumulative % of Variance
1	14.046	58.526	58.526
2	2.102	8.759	67,285
3	1.294	5.393	72.678

Factor extraction and rotation converged in 6 iterations, yielding three distinct factors (Table 5 & Table 6).

Table 5. Principal Axis Factoring Yield Pattern Matrix with Direct Oblimin Rotation

Item/Variable	Factor 1 (Cognitive/Primary)	Factor 2 (Affective/Supportive)	Factor 3 (Behavioral/Specific)	h^2
x16	0.921			0.906
x21	0.914			0.858
x32	0.851		0.304	0.675
x19	0.841			0.723
x17	0.833			0.799
x18	0.808			0.782
x22	0.790			0.748
x14	0.790		-0.304	0.721
x13	0.776			0.798
x15	0.673			0.584
x4	0.547	0.301		0.640
x24	0.398		-0.392	0.735
x7		0.836		0.759
x5		0.798		0.630
x1		0.765		0.758
x29		0.733		0.684
x2		0.707		0.619
x31		0.666		0.613
x10			-0.794	0.849
x11			-0.700	0.879
x12			-0.618	0.686
x9		0.397	-0.588	0.765
x23		0.352	-0.431	0.664
x20			-0.378	0.566

Note: *Extraction Method: Principal Axis Factoring. Rotation Method: Oblimin with Kaiser Normalization. Loadings < 0.30 are omitted. The negative loadings appearing uniformly across Factor 3 are a statistical artifact representing a sign reflection during the mathematical rotation block; they do not alter the directional meaning, substance, or practical interpretation of the parameters.*

Table 6. Factor Correlation Matrix (Oblique Rotation)

Factors	1	2	3
1. Factor 1	1.000	0.564	-0.451
2. Factor 2	0.564	1.000	-0.420
3. Factor 3	-0.451	-0.420	1.000

Note: Extraction Method: Principal Axis Factoring. Rotation Method: Oblimin with Normalization Emperor.

The initial overall scale showed a high Cronbach's alpha ($\alpha = 0.970$). To investigate potential item redundancy and account for the multidimensional structure identified via EFA, reliability was further evaluated using McDonald's omega (ω) for each extracted factor (Tavakol & Dennick, 2011). The results showed excellent internal consistency across all dimensions: Factor 1 ($\omega = 0.965$), Factor 2

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($\omega = 0.919$), and Factor 3 ($\omega = 0.947$). While values above 0.90 may indicate item redundancy (Tavakol & Dennick, 2011), they also reflect a highly cohesive set of items for each factor. Future refinement could shorten the scale to improve efficiency.

Table 7. Descriptive Statistics for Factors and Retained Items (N = 41)

Factor / Item Code	Description	Mean	SD
Factor 3	**Talent identification and student development monitoring**	**3.16**	**0.97**
x23	Monitoring student capability development systematically over time	3.46	1.07
x12	Recognizing characteristics of students with special math talents	3.29	1.10
x11	Using assessments to determine students for OSN coaching	3.22	1.19
x24	Determining whether students are ready for higher-level selection	3.15	1.11
x10	Distinguishing high math grades from true competition potential	3.15	1.13
x9	Recognizing high math potential despite average academic grades	3.00	1.10
x20	Prioritizing topics to teach when coaching time is limited	2.88	1.10
Factor 1	**Specific pedagogy, differentiation, and coaching planning**	**2.87**	**0.97**
x22	Using test/tryout results to determine follow-up coaching	3.20	1.12
x19	Designing consistent and sustainable coaching schedules/programs	3.02	1.08
x32	Allocating time to develop coaching competence continuously	3.00	1.20
x21	Designing diagnostic assessments to identify student weaknesses	2.93	1.10
x14	Choosing coaching strategies tailored to student strengths/weaknesses	2.90	1.09
x16	Giving specific feedback to help students fix problem-solving strategies	2.90	1.16
x18	Setting realistic student development targets for each stage	2.83	1.14
x15	Managing coaching tempo so students at different levels optimize	2.76	1.16
x17	Sequencing coaching phases from basic to advanced OSN levels	2.73	1.16
x13	Providing different levels of question difficulty within a group	2.68	1.25
x4	Assisting students in finding alternative problem-solving paths	2.59	0.95
Factor 2	**Mathematical competence, problem preparation, and self-development**	**2.86**	**0.95**
x31	Finding the right learning resources or training to improve skills	3.20	1.23
x1	Mastering mathematical concepts required to coach OSN students	2.90	1.04
x7	Modifying existing problems into high-quality new math problems	2.90	1.07
x29	Confidence in ability to coach students to higher OSN levels	2.85	1.11
x5	Designing high-level reasoning problems that match OSN standards	2.66	1.17
x2	Solving non-routine problems that match OSN level and characteristics	2.63	1.13

Based on the descriptive statistics in Table 7, participants perceive Factor 2 (mathematical competence, problem preparation, and self-development) as the most challenging dimension, with the lowest overall mean score (mean = 2.86, SD = 0.95). While Factor 1 also presents comparable administrative and pedagogical challenges (mean = 2.87, SD = 0.97), item-level analysis shows that the core difficulties center on high-level mathematical execution and problem-solving pedagogy. Specifically, the items with the lowest mean scores across the entire instrument are item x4 (mean= 2.59, "Assisting students in finding alternative problem-solving paths"), item x2 (mean=2.63, "Solving non-routine problems that match OSN level and characteristics"), and item x5 (mean=2.66, "Designing high-level reasoning problems that match OSN standards").

These findings provide a concrete, data-driven priority for the Subject-Matter School Teacher Forum (MGMP). Rather than focusing on general pedagogical scheduling or talent identification—which scored higher—MGMP must prioritize professional development programs that directly enhance teachers' subject-matter mastery. Specifically, MGMP should implement targeted workshops focusing

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on non-routine mathematical problem-solving techniques and the collaborative design of Olympiad-standard higher-order thinking skills (HOTS) tasks.

DISCUSSION

The reduction from eight initial constructs to three empirical factors may suggest that teachers conceptualize difficulties not by theoretical boundaries, but by operational tasks: execution of differentiated instruction, question mastery, and talent identification. This result needs confirmation with a large sample.

Factor 1 aligns with gifted education studies focusing on differentiation practices (Hinch et al., 2024) and professional development efficacy (Cheung et al., 2022). Integrating planning and assessment items into this factor mirrors comprehensive talent frameworks in which curriculum, pacing, and feedback form a single pedagogical node (Subotnik et al., 2023; Weber & Mofield, 2023).

Factor 2 merges mathematical content knowledge with problem posing and self-efficacy. This heavily supports the notion that Mathematical Knowledge for Teaching (MKT) is intrinsically tied to a teacher's procedural and pedagogical confidence (Pansell, 2023; Scheiner et al., 2024). Transforming and modifying complex routine problems requires distinct technical capabilities that heavily impact teaching efficacy (Lin et al., 2025; Montes et al., 2024).

Factor 3 highlights that identifying talent is perceived as a distinct operational domain. Differentiating regular high achievers from students with creative non-routine potential remains a primary friction point (Ayık et al., 2025; Olszewski-Kubilius, 2024). Excluding Construct 7 (school support) does not rule out external barriers. However, it signals an unstable correlation matrix in this cross-sectional sample, suggesting diverse institutional conditions that future qualitative research should explore (Lv et al., 2024).

Table 8 situates these findings within the contemporary mathematics competition literature.

Table 8. Summary of Previous Research on Which the Research is Based

Researcher (year)	Focus	Methods/participants
Mahatma et al. (2020)	Junior High School Mathematics Question Making Training	Community service; Bogor Regency Junior High School teacher
Li et al. (2022)	Teachers' beliefs and practices in teaching through problem posing	Study of teachers' beliefs and instructional practices
Cheung et al. (2022)	Professional development of gifted child education teachers	Quasi-experimental; 2,031 teachers in Hong Kong
Pansell (2023)	Mathematical Knowledge for Teaching	Theoretical studies
Scheiner et al. (2024)	MKT and mathematics didactic knowledge	Comparative conceptual studies
Subotnik et al. (2023)	Talent development framework in schools	Study of the conceptual framework
Weber & Mofield (2023)	Professional learning and PCK for talented student teachers	Conceptual studies
Hinch et al. (2024)	Differentiation practices for gifted students	Survey of 470 teachers in Ireland
Lv et al. (2024)	The work pressure of teachers who teach Olympiad mathematics	Interview of 33 teachers in China
Montes et al. (2024)	Teacher-specific knowledge through problem transformation	Study of mathematics teacher knowledge

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Olszewski-Kubilius (2024)	Implementation of the talent development framework	Review
Zhang et al. (2024)	Problem Solving	Meta-analysis of 26 intervention studies
Ayık et al. (2025)	Conception of talent, nomination, and differentiation	Survey of 441 primary school teachers in Turkey
Lin et al. (2025)	Teacher adaptability, mathematics competitions and student development	Survey of 289 teachers in China
Harahap et al. (2025)	Mathematics Olympiad coaching for high school students and teachers	Online training programs
Umbara et al. (2025)	Strengthening mathematical thinking for the Olympiads	Online training of 530 participants; coaching of 19 students

CONCLUSION

Exploratory factor analysis successfully reduced 32 items from eight conceptual frameworks to 24 items across three distinct factors explaining teacher difficulties in OSN coaching in Sukabumi Regency: specialized pedagogy and coaching planning (Factor 1); mathematical competence and problem preparation (Factor 2); and talent identification paired with student monitoring (Factor 3).

A closer look at the descriptive data shows that Factor 2 is the most challenging dimension for teachers, with the lowest overall mean score (mean = 2.86, SD = 0.95). While Factor 1 presents a nearly identical administrative and pedagogical challenge (mean = 2.87, SD = 0.97), item-level tracking pinpoints where teachers struggle most. The steepest hurdles strictly center on high-level mathematical execution and adaptive problem-solving pedagogy. This is clearly reflected in the lowest-scoring items across the entire study: guiding students through alternative problem-solving paths (item x4, mean=2.59), tackling non-routine Olympiad problems firsthand (item x2, mean=2.63), and crafting advanced reasoning tasks that meet OSN standards (item x5, mean=2.66).

These insights give the Subject-Matter School Teacher Forum (MGMP) a clear, data-driven roadmap for three concrete Professional Development (PD) initiatives tailored to each factor. For Factor 1 (Pedagogy & Planning): MGMP should conduct a collaborative syllabus-mapping masterclass where teachers collectively design and align long-term, scaffolded Olympiad training pathways. For Factor 2 (Math Competence & Problem Prep): MGMP must establish peer-led collaborative labs focusing on subject-matter mastery, where teachers regularly cross-examine, dissect, and solve non-routine mathematical Olympiad problems together. For Factor 3 (Talent Identification & Monitoring): MGMP should host training sessions on advanced assessment design, equipping teachers with standardized cognitive rubrics to ensure objective and systematic student tracking over time.

Several limitations should be noted when interpreting these findings. First, the small sample size (N = 41) from a single region (Sukabumi Regency) limits the generalizability of the factor structure. Second, the reliance on self-reports introduces potential subjective bias regarding teacher difficulties. Third, collecting data within a specific workshop context may have altered respondents' usual professional mindsets. Finally, while the high uniformity reflects strong, cohesive domains, it also suggests the 24-item scale could be shortened. Future studies should optimize the instrument by removing redundant items to reduce participant fatigue and improve survey efficiency without compromising psychometric validity. Moving forward, future research should utilize Confirmatory Factor Analysis (CFA) to validate this three-factor structure across broader geographic cohorts, while employing experimental or longitudinal designs to evaluate how effectively the proposed teacher interventions actually mitigate these identified difficulty thresholds.

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DECLARATIONS

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Conflict of Interest: The authors declare no competing financial interest.

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