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From C3 to HOTS: Does Academic Achievement Relate to Pre-Service Mathematics Teachers' Decision-Making Outcomes in Geometry Task Development?

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ABSTRACT

The ability to develop Higher Order Thinking Skills (HOTS) questions is an important competency that pre-service mathematics teachers must master. However, it is not yet known whether academic achievement reflected in the Grade Point Average (GPA) is related to this ability. This study aims to analyze the relationship between students' GPA levels and their success in transforming C3-level geometry question into HOTS Problem at levels C4 (analyzing), C5 (evaluating), and C6 (creating) based on the Revised Bloom's Taxonomy. This study used a quantitative approach with a correlational design involving 70 students who had taken courses related to mathematics evaluation and learning. GPA data were categorized into three levels (low, moderate, high) based on normative references using the mean and standard deviation, while success in developing HOTS questions was categorized nominally (success/unsuccessful). Data analysis used the chi-square test with the Monte Carlo method. The results showed that there was no significant relationship between GPA categories and success in developing HOTS questions at all cognitive levels (C4: p = 0.647; C5: p = 1.000; C6: p = 1.000).

Keywords: *preservice teacher achievement, HOTS problem construction, decision-making*

ABSTRAK

Kemampuan mengembangkan soal Higher Order Thinking Skills (HOTS) merupakan kompetensi penting yang harus dikuasai oleh calon guru matematika. Namun, belum diketahui secara pasti apakah prestasi akademik yang tercermin dalam Indeks Prestasi Kumulatif (IPK) berhubungan dengan kemampuan tersebut. Penelitian ini bertujuan untuk menganalisis hubungan antara level IPK mahasiswa dengan keberhasilan dalam mentransformasikan soal geometri level C3 menjadi soal HOTS pada level C4 (menganalisis), C5 (mengevaluasi), dan C6 (mencipta) berdasarkan Taksonomi Bloom Revisi. Penelitian ini menggunakan pendekatan kuantitatif dengan desain korelasional yang melibatkan 70 mahasiswa yang telah menempuh mata kuliah yang berkaitan dengan evaluasi dan pembelajaran matematika. Data IPK dikategorikan menjadi tiga kelompok (rendah, sedang, tinggi) berdasarkan acuan norma menggunakan rata-rata dan standar deviasi, sedangkan keberhasilan mengembangkan soal HOTS dikategorikan secara nominal (berhasil/gagal). Analisis data menggunakan uji chi-square dengan metode Monte Carlo. Hasil penelitian menunjukkan bahwa tidak terdapat hubungan yang signifikan antara kategori IPK dengan keberhasilan mengembangkan soal HOTS pada semua level kognitif (C4: p = 0,647; C5: p = 1,000; C6: p = 1,000)

Kata Kunci: prestasi calon guru, konstruksi soal HOTS, pengambilan keputusan

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INTRODUCTION

Teachers are at the forefront of efforts to achieve National Education goals (Listiani & Sulistyorini, 2021) and implement the curriculum (Izzati & Febrian, 2021). Regarding teacher professionalism, four competencies must be mastered: pedagogical, professional, personal, and social competencies (Aini & Masrurotullaily, 2024). Pedagogical competency encompasses teachers' abilities in the learning and teaching process, which must keep pace with current developments. These competencies can be used to manage effective learning, including: the ability to identify each student, create and implement learning plans, evaluate, and develop student talents and potential (Listiani & Sulistyorini, 2021). Thus, evaluation is a primary task for teachers. Assessment of learning outcomes is expected to help students improve their higher-order thinking skills by encouraging them to think broadly and deeply about the material being studied (Suwarno et al., 2022).

Higher Order Thinking Skills (HOTS) are essential skills that need to be mastered in schools to adapt to 21st-century needs (Aini et al., 2020). HOTS are skills that require critical and creative reasoning or logic to solve problems (Listiani & Sulistyorini, 2021) and focus on measuring critical thinking and problem-solving skills (Ali et al., 2021). The cognitive level dimensions based on Bloom's Taxonomy that constitute HOTS include: analyzing (C4), evaluating (C5), and creating (C6) (Andreansyah & Aini, 2023). Teachers' familiarity with solving HOTS questions is crucial for students (Putri & Aini, 2023).

The primary task of teachers is to evaluate learning, and the results are closely related to their ability to design test instruments. Test instruments designed by teachers aim not only to measure knowledge but also HOTS; therefore, teachers should possess the ability to design HOTS questions (Izzati & Febrian, 2021). The process of developing HOTS questions requires mastery of the teaching material and teacher creativity in selecting appropriate stimulus questions to the situation and environmental conditions (Suwarno et al., 2022). Higher-order thinking skills can be trained in students by familiarizing them with the use of HOTS questions in the learning process (Ali et al., 2021). Developing HOTS questions requires mastery of the teaching material and teacher creativity in selecting stimulus questions (Suwarno et al., 2022). Higher-order skills include problem-solving, critical thinking, creative thinking, reasoning, and decision-making (Ali et al., 2021). Decision-making is a crucial skill for an effective teaching and learning environment (Murtafiah et al., 2023; Yurtseven et al., 2014).

Decision-making is a choice made based on a person's judgment (Yurtseven et al., 2014) and refers to a person's way of thinking to solve a problem in order to find the best solution with all its advantages and risks (Maulana & Rochintaniawati, 2021). Decision-making involves the process of identifying and selecting several possible solutions to a problem or situation faced, which are then followed up on or used as problem-solving steps (Aulianata et al., 2024; Yurtseven et al., 2014). Decision-making aims to evaluate pollution that can be realized and achieve positive results through the application of this process (Yurtseven et al., 2014). Decision-making represents the activity of choosing something from several different alternatives that involves mental processes, logical thinking, and considering available options (Suwarno et al., 2022). It can be said that decision-making is a problem-solving activity by identifying several available alternatives and considering all the advantages and risks to resolve the problem at hand.

Previous research has shown a significant positive correlation between decision-making skills and problem-solving abilities (Yurtseven et al., 2014). This ability influences problem-solving (Setyaningrum & Widiyastuti, 2020). Therefore, decision-making is an important skill for students and needs to be practiced in the learning process (Aulianata et al., 2024). Students need to master decision-making skills so they can adapt and survive the challenges of 21st-century life (Maulana & Rochintaniawati, 2021). The quality of learning implemented by teachers is highly dependent on their thought processes in decision-making. In the context of learning, decision-making is defined as a teacher's thought process in determining activities from a series of alternatives when designing and implementing learning. Decision-making is also known as a thought process that begins with generating, clarifying, and assessing the reasonableness of ideas (Murtafiah et al., 2020).

In the teaching and learning environment, students play an active role and achieve outcomes related to the use of their decision-making skills (Yurtseven et al., 2014). Decision-making skills are not only important for students; teachers also need to master them. Decision-making by teachers involves generating diverse ideas, which must be explained by considering the similarities and differences between these ideas (Suwarno et al., 2022).

Mathematics Education students, as pre-service teachers, are a crucial asset in developing teacher competency in Indonesia. At the student level, they learn how to master four teacher competencies, including pedagogical competency. Pre-service teacher students should be able to design test instruments to evaluate student learning outcomes. These instruments also include HOTS questions. Therefore, this study will focus on the decision-making process of pre-service teacher students in designing HOTS problems from available LOTS questions. However, previous research indicates that lecturers' ability to design HOTS questions is still suboptimal (Ali et al., 2021). This undoubtedly impacts student performance, particularly pre-service teacher students. The quality of pre-service teacher students influences learning outcomes (Aini & Masrurotullaily, 2024).

Previous research by Suwarno et al. (2022) showed that as many as 51% of pre-service teacher students failed to upgrade questions from LOTS to HOTS. This is a crucial skill that pre-service teacher students must master in relation to pedagogical competency. The decision-making process students go through ultimately leads to their success in upgrading questions to HOTS. Therefore, this study will examine the relationship between student learning achievement in the form of GPA (with low, medium, and high levels) and the success of increasing the level of questions to HOTS questions, which are the product of the student decision-making process.

METHODS

This study used a quantitative approach with a correlational design to analyze the relationship between students' GPA and their success in transforming C3-level geometry problems into HOTS tasks at the C4, C5, and C6 levels. This success is a product of the students' decision-making process. Seventy fourth -semester were selected purposively based on the criteria of having completed courses related to mathematics evaluation and learning.

The GPA data used in this study were obtained from students' official academic transcripts, which documented their academic achievement over four semesters. These data were collected from the academic records of the Mathematics Education Study Program, Faculty of Tarbiyah and Teacher Training, UIN Kiai Haji Achmad Siddiq Jember. By using transcript-based data from the study program, students' academic achievement was measured through formal institutional records rather than self-reported information, thereby strengthening the accuracy and credibility of the GPA data used in the analysis. GPA data were categorized based on their data distribution, as shown in the following Table 1.

Table 1. Interval of GPA Level

Interval	GPA Level
GPA < ($\bar{x}$ - SD)	Low
($\bar{x}$ - SD) ≤ GPA ≤ ($\bar{x}$ + SD)	Moderate
GPA > ($\bar{x}$ + SD)	High

Data were collected through a test-based assignment in which pre-service mathematics teachers were asked to transform C3-level geometry problems into higher-order thinking problems corresponding to the C4, C5, and C6 levels. The classification of students' success was determined by examining the quality of the developed items in relation to the cognitive processes specified in the Revised Bloom's Taxonomy. Problems categorized as C4 were expected to reflect analytical processes, including differentiating, organizing, and attributing; C5 problems were evaluated based on the extent to which they involved checking and critiquing; whereas C6 problems were assessed in terms of their capacity to promote generating, planning, and producing. In addition to the cognitive level, the assessment also considered the appropriateness of the mathematical content involved, particularly numerical aspects, as well as the relevance, coherence, and meaningfulness of the context constructed in each problem. The evaluation of the developed items was conducted by the researchers, who are doctoral-level lecturers in mathematics education, to ensure that the classification of successful and unsuccessful HOTS problem development was grounded in both theoretical criteria and professional judgment. Furthermore, the data were categorized dichotomously as successful or unsuccessful

The GPA level data and success in improving the question level were then compiled into a contingency table. The statistical test used was a chi-square test using SPSS. If the assumptions of the chi-square test were not met, a Monte Carlo chi-square test was conducted. This method was chosen if the expected frequency assumption was not met.The hypotheses were formulated as follows: (a) H_0: There is no relationship between GPA category and success in improving the HOTS question level, and (b) H_a: There is a relationship between GPA category and success in improving the HOTS question level. The testing criteria used a significance level of $\alpha = 0.05$.

RESULTS AND DISCUSSION

The results of the GPA documentation that have been categorized based on normative references using the mean and standard deviation are presented in the following Table 2.

Table 2. GPA Level of Pre-service Mathematics Teachers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low	6	8.6	8.6	8.6
	Moderate	63	90.0	90.0	98.6
	High	1	1.4	1.4	100.0
	Total	70	100.0	100.0	

The success of students in elevating the question level to C4, C5, and C6 is presented in the following Table 3.

Table 3. Frequency of Success in Elevating HOTS Question

Tasks level	Unsuccessful	Successful
C4	59	11
C5	67	3
C6	69	1

The data shows a trend that the higher the targeted cognitive level, the lower the student's success rate. This pattern indicates that students experience increasing difficulty developing questions at a more complex cognitive level. The crosstab for student success in raising the question level to C4 is presented in the following Table 4.

Table 4. Crosstab of C4 Level

			C4		
			Unsuccessful	Successful	Total
GPA Level	Low	Count	6	0	6
		Expected Count	5.1	.9	6.0
	Moderate	Count	52	11	63
		Expected Count	53.1	9.9	63.0
	High	Count	1	0	1
		Expected Count	.8	.2	1.0
Total		Count	59	11	70
		Expected Count	59.0	11.0	70.0

The results of the chi-square test using the Monte Carlo method are shown in the following Table 5.

Table 5. SPSS Output of Chi Square Tests of C4 Level

				Monte Carlo Sig. (2-sided)			Monte Carlo Sig. (1-sided)		
					99% Confidence Interval			99% Confidence Interval	
	Value	f	Asymptotic Significance (2-sided)	Significance	Lower Bound	Upper Bound	Significance	Lower Bound	Upper Bound
Pearson Chi-Square	.450[a]		.484	.647[b]	.634	659			

	Value	f	Asymptotic Significance (2-sided)	Monte Carlo Sig. (2-sided) Significance	99% Confidence Interval Lower Bound	Upper Bound	Monte Carlo Sig. (1-sided) Significance	99% Confidence Interval Lower Bound	Upper Bound
Likelihood Ratio	.534		.282	.476[b]	.463	489			
Fisher's Exact Test	.194			.647[b]	.634	659			
Linear-by-Linear Association	692[c]		.406	.617[b]	.605	630	.403[b]	390	416
N of Valid Cases	70								

a. 3 cells (50.0%) have expected count less than 5. The minimum expected count is .16.
b. Based on 10000 sampled tables with starting seed 2000000.
c. The standardized statistic is .832.

The Table 5 shows a significance value of 0.647 (p > 0.05), thus accepting H_0. This means there is no significant relationship between GPA category and success in developing HOTS questions at level C4.

The following Table 6 presents a crosstab for student success in raising the question level to C5.

Table 6. Crosstab of C5 Level

			C5 Unsuccessful	C5 Successful	Total
GPA_Level	Low	Count	6	0	6
		Expected Count	5.7	.3	6.0
	Moderate	Count	60	3	63
		Expected Count	60.3	2.7	63.0
	High	Count	1	0	1
		Expected Count	1.0	.0	1.0
Total		Count	67	3	70
		Expected Count	67.0	3.0	70.0

The results of the chi-square test using the Monte Carlo method are shown in the following Table 7.

Table 7. SPSS Output of Chi Square Tests of C5 Level

	Value	f	Asymptotic Significance (2-sided)	Monte Carlo Sig. (2-sided) Significance	99% Confidence Interval Lower Bound	Upper Bound	Monte Carlo Sig. (1-sided) Significance	99% Confidence Interval Lower Bound	Upper Bound
Pearson Chi-Square	348[a]		.840	1.000[b]	.000	1.000			
Likelihood Ratio	647		.724	1.000[b]	.000	1.000			
Fisher's Exact Test	.667			1.000[b]	.000	1.000			
Linear-by-Linear Association	166[c]		.684	1.000[b]	.000	1.000	.762[b]	751	773
N of Valid Cases	70								

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is .04.
b. Based on 10000 sampled tables with starting seed 2000000.
c. The standardized statistic is .408.

Based on the table above, the results of the Monte Carlo chi-square test showed a significance value of 1.000 ($p > 0.05$), thus accepting H_0. This means there is no significant relationship between GPA category and success in developing HOTS level C5 questions.

The contingency table for students' success in raising the question level to C6 is presented in the following Table 8.

Table 8. Crosstab of C6 Level

			C6		
			Unsuccessful	Successful	Total
GPA_Level	Low	Count	6	0	6
		Expected Count	5.9	.1	6.0
	Moderate	Count	62	1	63
		Expected Count	62.1	.9	63.0
	High	Count	1	0	1
		Expected Count	1.0	.0	1.0
Total		Count	69	1	70
		Expected Count	69.0	1.0	70.0

The results of the chi-square test using the Monte Carlo method are shown in the following Table 9.

Table 9. SPSS Output of Chi Square Tests of C6 Level

				Monte Carlo Sig. (2-sided)			Monte Carlo Sig. (1-sided)		
					99% Confidence Interval			99% Confidence Interval	
	Value	f	Asymptotic Significance (2-sided)	Significance	Lower Bound	Upper Bound	Significance	Lower Bound	Upper Bound
Pearson Chi-Square	113[a]		.945	1.000[b]	1.000	.000			
Likelihood Ratio	212		.899	1.000[b]	1.000	.000			
Fisher's Exact Test	.374			1.000[b]	1.000	.000			
Linear-by-Linear Association	054[c]		.817	1.000[b]	1.000	.000	.913[b]	906	920
N of Valid Cases	70								

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is .01.
b. Based on 10000 sampled tables with starting seed 2000000.
c. The standardized statistic is .232.

The Monte Carlo chi-square test results showed a significance value of 1.000 ($p > 0.05$), thus H_0 was accepted. This means there is no significant relationship between GPA category and success in developing HOTS questions at the C6 level.

The results of this study demonstrate consistent findings across the three HOTS cognitive levels (C4, C5, and C6): there is no significant relationship between student GPA category and success in developing HOTS questions. Students' GPA in the mathematics evaluation and learning course was not a significant predictor of their ability to develop HOTS questions. This indicates that high academic achievement does not guarantee students' ability to design questions at a high cognitive level. This finding is consistent with previous research that found that mathematics teachers experience significant difficulties in developing questions at the C5 and C6 levels compared to those at lower cognitive levels (Widana, 2017). These difficulties are caused by a lack of understanding of the characteristics of each cognitive level and limitations in designing question contexts that require high-level thinking processes. Previous research also states that students' decision making varies in problem-solving (Murtafiah et al., 2020).

Anderson and Krathwohl (2001) explains that level C4 (analyzing) requires the ability to break information into its components and understand the relationships between those components. Level C5 (evaluating) requires the ability to make judgments based on specific criteria and standards, while level C6 (creating) is the highest level, requiring the ability to combine elements into something new, coherent, and original. The increasing complexity at each level appears to be a significant challenge for students, regardless of their GPA. C6 level problems require not only mastery of mathematical content but also the ability to design situations or contexts that require students to produce original and innovative products or solutions (Brookhart, 2010). This aligns with the findings of this study, which showed the highest failure rate at level C6. Students must not only understand mathematical concepts but also be able to imagine how they will use that knowledge to create something new. Other research indicates that teachers' difficulties in developing HOTS questions are also caused by a lack of models or examples of HOTS questions to refer to, as well as a lack of specific training on HOTS question development (Apino & Retnawati, 2017). This is relevant to the context of this research, where student teachers may not have received instruction focused on developing HOTS problem

Eleven students successfully developed C4-level questions, all of whom had moderate GPAs. Similarly, at levels C5 and C6, the students who succeeded also came from moderate categories. This reinforces the finding that success in developing HOTS questions is not solely determined by GPA. This aligns with research that found that teachers' ability to develop assessments does not always correlate with their academic qualifications (Kusaeri & Aditomo, 2019). This also aligns with (Sa'dijah et al., 2021), who found that the quality of teachers' decision making, reflected in how problems are given, solved, checked, and refined into new ideas, depends on contextual enactment rather than fixed academic credentials, reinforcing the view that decision-making skills in HOTS instruction are best developed through deliberate practice and reflection rather than assumed from GPA alone. There are other factors such as teaching experience, practical reflection, and professional learning opportunities that have a greater influence on assessment development capabilities than formal academic achievement (Retnawati et al., 2018).

CONCLUSION

Based on the results of the research and discussion regarding the relationship between student GPA categories and the success of developing HOTS questions, several conclusions can be drawn as follows: (1) there is no significant relationship between GPA categories and the success of developing HOTS questions at all cognitive levels tested. The results of the chi-square test using the Monte Carlo method showed a significance value of 0.647 for level C4, 1.000 for level C5, and 1.000

for level C6 (all p > 0.05). This finding indicates that academic achievement reflected in GPA was not significantly associated with students' ability to design questions with a high cognitive level.

Methodologically, future studies should go beyond classifying students' products as successful or unsuccessful by examining their decision-making trajectories during HOTS task development. Some students may fail to produce valid HOTS geometry tasks not merely because of limited content knowledge, but because their transformation from C3 to C4, C5, or C6 is not guided by rational and systematic decisions. Therefore, qualitative studies using think-aloud protocols, task-based interviews, or cognitive task analysis are needed to reveal how pre-service teachers identify cognitive demands, choose task modification strategies, and justify the HOTS level of the problems they develop.

REFERENCES

Aini, A. N., & Masrurotullaily. (2024). Measuring preservice mathematics teachers' Technological Pedagogical and Content Knowlede in the post-pandemic era. *Jurnal Pendidikan Matematika*, *18*(2), 231–244. https://doi.org/10.22342/jpm.v18i2.pp231-244

Aini, A. N., Mukhlis, M., Annizar, A. M., Jakaria, M. H. D., & Septiadi, D. D. (2020). Creative thinking level of visual-spatial students on geometry HOTS problems. *Journal of Physics: Conference Series*, *1465*(1), 12054. https://doi.org/10.1088/1742-6596/1465/1/012054

Ali, A., Arif, W. P., Ichsan, I. Z., Sigit, D. V., Darussyamsu, R., Dasmo, D., Nurfadhilah, N., & Fachrial, N. F. H. (2021). Kemampuan dosen dalam membuat soal HOTS pada pembelajaran abad 21. *JEP (Jurnal Eksakta Pendidikan)*, *5*(2), 211–218. https://doi.org/10.24036/jep/vol5-iss2/590

Anderson, L. W., & Krathwohl, D. R. (2001). *A Taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives* (L. W. Anderson, D. R. Krathwohl, Peter W. Airasian, K. A. Cruikshank, R. E. Mayer, P. R. Pintrich, J. Raths, & M. C. Wittrock (eds.)). Addison Wesley Longman, Inc.

Andreansyah, M., & Aini, A. N. (2023). Development male students' skills in solving HOTS problem in terms of self confidence. *JDIME : Journal of Development and Innovation in Mathematics Education*, *1*(1), 34–41. https://doi.org/10.32939/jdime.v1i1.2356

Apino, E., & Retnawati, H. (2017). Developing instructional design to improve mathematical Higher Order Thinking Skills of students. *Journal of Physics: Conference Series*, *812*(1). https://doi.org/10.1088/1742-6596/812/1/012100

Aulianata, Y., Muchtadi, & Sandie. (2024). Analisis pengambilan keputusan dalam memecahkan masalah matematis ditinjau dari gaya kognitif siswa kelas VII SMP Negeri 24 Pontianak. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, *09*(04), 255–266. https://journal.unpas.ac.id/index.php/pendas/article/view/19880

Brookhart, S. M. (2010). *How to Assess Higher-Order Thinking Skills in your classroom*. https://eric.ed.gov/?id=ED512044

Izzati, N., & Febrian, F. (2021). Kemampuan mahasiswa calon guru dalam mengembangkan instrumen tes hasil belajar kategori Higher Order Thinking Skill. *Jurnal Gantang*, *6*(1), 75–82. https://doi.org/10.31629/jg.v6i1.2672

Kusaeri, & Aditomo, A. (2019). Pedagogical beliefs about critical thinking among Indonesian mathematics pre-service teachers. *International Journal of Instruction*, *12*(1), 573–590. https://www.e-iji.net/dosyalar/iji_2019_1_37.pdf

Listiani, W., & Sulistyorini, Y. (2021). Kompetensi pedagogik mahasiswa program studi pendidikan matematika dalam menyusun tes matematika HOTS. *Laplace : Jurnal Pendidikan Matematika*, *4*(1), 99–106. https://doi.org/10.31537/laplace.v4i1.467

Maulana, A. K., & Rochintaniawati, D. (2021). Analisis keterampilan pengambilan keputusan siswa kelas XI SMAN 1 Cihaurbeuti. In *ISEJ: Indonesian Science Education Journal* (Vol. 2, Issue 2). https://siducat.org/index.php/isej/article/view/265

Murtafiah, W., Lestari, N. D. S., Yahya, F. H., Apriandi, D., & Suprapto, E. (2023). How do students' decision-making ability in solving open-ended problems? *Infinity Journal*, *12*(1), 133–150. https://doi.org/10.22460/infinity.v12i1.p133-150

Murtafiah, W., Sa'dija, C., Chandra, T. D., Susiswo, & Zayyadi, M. (2020). Novice and experienced mathematics teachers' decision making process in designing math problem. *Journal of Physics: Conference Series*, *1464*(1), 12030. https://doi.org/10.1088/1742-6596/1464/1/012030

Putri, I. S., & Aini, A. N. (2023). Analisis kemampuan berpikir kritis siswa dalam menyelesaikan soal HOTS ditinjau dari keaktifan pada pembelajaran cool-critical-creative-meaningful. *Math Educa Journal*, *7*(1), 1–10. https://doi.org/10.15548/mej.v7i1.5855

Retnawati, H., Djidu, H., Apino, E., & Anazifa, R. D. (2018). Teachers' knowledge about Higher-Order Thinking Skills and its learning strategy. *Problems of Education in the 21st Century*, *76*(2), 215–230. https://doi.org/10.33225/pec/18.76.215

Sa'dijah, C., Murtafiah, W., Anwar, L., Nurhakiki, R., & Cahyowati, E. T. D. (2021). Teaching Higher-Order Thinking Skills in mathematics classrooms: Gender differences. *Journal on Mathematics Education*, *12*(1), 159–179. https://doi.org/10.22342/jme.12.1.13087.159-180

Setyaningrum, D. R., & Widiyastuti, E. (2020). Profil kemampuan pengambilan keputusan dalam pemecahan masalah matematika siswa SMK ditinjau dari gaya berpikir. *Prosiding Seminar Nasional Matematika Dan Pendidikan Matematika*. https://seminarmat.ump.ac.id/index.php/semadik/article/view/320/47

Suwarno, S., Nusantara, T., Susiswo, S., & Irawati, S. (2022). The decision making strategy of prospective mathematics teachers in improving LOTS to be HOTS problem. *International Journal of Nonlinear Analysis and Applications*, *13*, 2008–6822. https://doi.org/10.22075/ijnaa.2022.5776

Widana, I. W. (2017). *Modul penyusunan soal Higher Order Thinking Skills*. Direktorat Pembinaan SMA, Direktorat Jenderal Pendidikan Dasar dan Menengah.

Yurtseven, R., Üyesi, Ö., Baysal, E. A., Ocak, G., & Baysal, E. A. (2014). Analysis of the relationship between decision making skills and problem solving skills of primary school students. *International Online Journal of Education and Teaching (IOJET)*, *8*(3), 2117–2130. https://iojet.org/index.php/IOJET/article/view/1441