Teacher Education and Curriculum Studies
2025, Vol. 10, No. 1, pp. 15-22
https://doi.org/10.11648/j.tecs.20251001.13

Research Article

Association Between Teachers' Ability to Foster Cognitive Thinking and School Ranking in Academic Performance

Joel Matiku Joshua*

School of Education, Mwalimu Nyerere University of Agriculture and Technology, Butiama-Mara, Tanzania

Abstract

This paper examined the association between teachers' ability to foster cognitive thinking and school ranking in academic performance. The tendency to rank school performance in academics has been a common practice in Tanzania whereby schools are listed from the highest to the lowest based on the average academic performance of their students. Teachers' ability to foster variables such as convergent, divergent and metacognitive thinking was measured using TOP among 36 teachers and 444 secondary school students. Data was analyzed using SPSS whereby a t-test analysis revealed that teachers in the schools ranked high than in low academic performing schools demonstrated ability to foster convergent, divergent and metacognitive thinking to their students during teaching learning sessions in the classroom. Difference in timing of the fostering these cognitive thinking was also observed with the ranking categories. It was concluded that conscious efforts by teachers to timely pair fostering of cognitive thinking and academic content is crucial in making difference in academic and school performance. Discussion is made around practical, social and economic implications of the findings and it is recommended that teachers should be reminded through in service trainings to improve their ability to consciously pair fostering of cognitive thinking and academic content during their classroom sessions.

Keywords

Academic Performance, School Performance, Fostering Cognitive Skills, Metacognitive Thinking, Creative Thinking

1. Introduction

In recent past, a tendency to define school performance in comparison to other schools in Tanzania had been a common practice. In the practice, after sitting for national standard four, standard seven, form four or even form six examinations; a performance list ranking school's position in the relevant examination has been commonly released. This tendency worked as a motivation of the schools to work hard so that their position keeps improving. On the other hand, some negative stories clouded the academic practice as some schools struggled to maintain their position to consistently appear in the group of high performing schools while on the other hand some schools consistently appeared among the group of low performing schools. The term school ranking means this distinctive pattern of school performance positioning in form four national examinations. This pattern raises curiosity as to what makes difference in terms of students' cognitive processes and the teaching-learning practices within the classroom between high performing and low performing schools.

Students' academic performance has been closely linked

*Corresponding author: joel.joshua@mjnuat.ac.tz (Joel Matiku Joshua), matikujoel.joshua81@gmail.com (Joel Matiku Joshua)

Received: 28 January 2025; **Accepted:** 12 February 2025; **Published:** 27 February 2025

with a multifaceted number of factors including cognitive abilities, environmental stimuli, personal motivation, and teaching methodologies. It has further been revealed that most of these factors are malleable and thus, can be fostered to enhance academic performance. Some proposed strategies to foster students' cognitive abilities and ultimately improve their academic performance have also been mentioned including active learning techniques, memory-enhancing techniques, creating conducive learning environments, fostering effective teacher-student interactions, promoting mental well-being and encouraging innovative thinking [9]. In similar vein, Kayacheng [10] has argued for intentional and conscious efforts to foster students' creativity and the need of classroom teachers to conduct self-assessment towards successful achievement of the creativity fostering behaviors. This is because in this rapidly changing world, students need skills that can enable them solve the unexpected course of events in their own way rather than routine practices implied in the learned academic formulas. This is possible through fostering students' creative and metacognitive thinking skills such as critical thinking and problem solving, communicating and collaborating, creativity and innovation as well as ability to trace their thinking path by making self-evaluation [8, 11]. Creativity and critical thinking are essential ingredients defining much credibility in individuals and thus, pivotal to students' academic performance as well as in their after school life. It is then important that teachers should endeavor to engage students to initiate their creative and critical thinking ability at almost all their schooling life from the time they receive them from their parents to the time they send them back from school [1]. The importance of fostering creative and metacognitive thinking needs to be emphasized given the fact that studies have consistently indicated that societies need creative thinking in designing, improving quality of life and problem solving. It has also been found that creative thinking enhances human positive attitude [7]. Furthermore, it has been argued that a combination of multiple creativity types rather than a single type of the same could positively and significantly influence regional economic development [2, 4]. This is in line with the findings and the argument that creative industries enhance economic development and thus, if the nation is to accelerate sustainable economic development, development of human creative capabilities that takes into consideration fostering creative thinking and talents needs to be emphasized [6, 17, 18, 22]. Cognitive thinking including creativity, metacognition and mindfulness also relate to effective communication between parents and adolescents, which can ultimately result in family harmony for effectively economic development [5, 26].

1.1. Theoretical Underpinnings

According to the Item Response Theory, both item parameters and learners' latent traits predict one's academic performance, and that people at the higher levels of latent traits have higher probability of responding correctly to an item [26]. The term item parameters in the theory refer to important features of the items in a test such as item difficulty, discrimination indices, and the role of pseudo-guessing when items are too difficult. The term latent traits on the other hand, refer to underlying variables of interest, which are usually intuitively understood, such as intelligence and creativity. It is the scholastic ability and its attributes, including getting good grades, learning new material easily, relating various sources of information, using study time effectively, reading ability, and arithmetic ability [12]. In this study, specific latent traits, namely; creative and metacognitive thinking can be subsumed under which, three traits can be derived, and these are divergent thinking, convergent thinking and metacognitive thinking. Creative thinking refers to intelligent, goal-directed attempts at finding novel solutions to more or less well-defined problems within a specified domain that result in novel products [13]. Creative thinking was adopted to mean specific measures of divergent and convergent thinking. Divergent thinking is a characteristic of creativity which allows one to produce as many plausible answers as possible to a given problem [14]. It is the ability to form many possible original ideas to a given situation with fluency and speed. For instance, one can be asked to list as many uses of a drum, a piece of empty land, a knife, a piece of paper, a stick or a tree. The more novel a suggestion is the higher is one rewarded in creative thinking. Convergent thinking on the other hand, refers to the ability to come up with a single but correct solution to a given potential or actual problem [15]. It means one's ability to produce correct solution to the mathematical insight tasks, verbal insight tasks and spatial insight tasks. Metacognitive thinking on the other hand refers to thinking about thinking itself [20]. It is one's knowledge and control of one's cognitive processes [13]. It refers to one's awareness of thinking processes and reading strategies one uses as one continues to understand texts materials, which is as crucial as far as the role of feedback in learning is concerned [3, 16].

While Item Response Theory has informed the guiding principles behind individual academic performance, the theory of school learning has proposed some variables that account for much of the variations in school learning. The theory emphasizes that the cognitive entry behaviors, affective entry characteristics, and the quality of instruction determine the nature and type of learning outcomes. The two basic assumptions underlying this theory include the history of the learner which becomes the core of school learning, and secondly, the possibility to modify the characteristics of the learner through designed instructions. Quality of instruction variables are defined in the theory as those pertaining to the quality of teaching itself. This is "the extent to which the cues, practice, and reinforcements of the learning are appropriate to the needs of the learner". The situation of academic underperformance in Tanzania raises the questions such as: How are these school's learning theoretical variables applied in school settings? Can the current stock of teachers apply the

theory and timely promote creative and metacognitive thinking among secondary school students? What could be the contribution of the teachers' ability to foster these cognitive thinking on the school performance?

1.2. Objectives of the Study

The general objective of the present study was to investigate the association between teachers' ability to foster cognitive thinking and school ranking in academic performance. This purpose was achieved by addressing two specific objectives, which are:

1) Find out difference in teachers' ability to timely foster divergent, convergent, and metacognitive thinking by school ranking.
2) Investigate the difference in teacher's ability to foster creative and metacognitive thinking in classrooms by school ranking.

2. Methodology

2.1. Sampling Procedures

The selection of the sample of secondary schools adopted a purposive sampling technique. The great heterogeneity and uneven distribution of secondary schools in the region ruled out the use of random sampling. Table 1 shows the sampled schools and inclusion criteria. In the final analysis, 6 secondary schools in each district were selected for inclusion. These were selected on the basis of set criteria such as national and regional rank in form four examinations, school ownership to include traditional government, community, and non-government secondary schools. In each of the two districts, schools were arranged in their academic performance rank both at national and regional level to obtain the high performing schools and the low performing schools.

Table 1. *The Sample Selected Schools.*

School	National Rank	Regional Rank	Quality		Ownership			No. of F. IV	Selected
			High	*Low*	*Gov.*	*Comm.*	*Non-Govt.*		
Msalato	24	1	✓		✓			118	50
Huruma	27	2	✓				✓	50	50
Chinangali	2870	93	✓			✓		138	50
Dodoma	547	10		✓	✓			250	50
Doreta				✓			✓	45	30
Mpwapwa	159	5	✓		✓			84	50
Kimaghai	99	22	✓			✓		64	50
Ving'hawe	2368	81		✓		✓		72	50
Mazae	2125	67		✓		✓		64	50
Mwanakianga	1996	61		✓		✓		101	50
Pwaga	2870	93		✓		✓		71	50
Madanya N.V				✓		✓	✓	69	50
Total								1,126	580

Thus, the sampled schools from the group of high performing schools included one traditional government secondary school, one community secondary school, and one non-government secondary school in each district, making a total of six secondary schools from a group of high performing schools. The same procedure was followed to obtain schools from a group of low performing secondary schools. The sampled schools in all two districts were thus, twelve, including six high performing and six low performing secondary schools. A total of 580 students were thus, included in the sample. In addition, three (3) teachers from each sampled school were observed. The selection of teachers was purposefully done. Teachers teaching Geography, English, and History were selected since these were the subjects of interest to the researcher.

It was expected that a set of instruments employed would help to study the total number of 580 students. However, after data collection all instruments were checked to ensure that

responses were meeting the researcher's expectations. This check-up process revealed that some instruments were incomplete to the extent that the required sets of data for analysis could not answer research questions. As such, all incomplete instruments were excluded in the process of analysis. Therefore, the total actual number of sample size used in the final analysis was 444 students and 36 teachers. This was 76.6% of the total number of questionnaires distributed to respondents.

2.2. Measures

Teacher's ability to develop creative and metacognitive thinking was tapped using a Teacher Observation Protocol. The protocol was adopted from a classroom observation protocol developed by Kokack [15] designed to improve the preparation of science and mathematics teachers in elementary, middle, and high schools, and to attract a more diverse group of students to the teaching profession. Their protocol was named 'The OCEP-Teacher Observation Protocol (O-TOP). That protocol consisted of ten factors to be observed in the classroom session. The factors are habits of mind with 7 items, metacognition with 6 items, students' discourse and collaboration with 5 items, rigorous challenging of ideas with 6 items, students preconceptions and misconception with 5 items, conceptual thinking with 5 items, divergent thinking with 5 items, interdisciplinary connections with 4 items, pedagogical content knowledge with 6 items, and multiple representations of concepts with 2 items. All the items in the protocol are about 71.

The Teacher Observation Protocol (TOP), which was used in this study, was adopted to incorporate only items relevant on measuring the variables of interest which were divergent, convergent, and metacognitive thinking. The protocol consisted of three factors to be observed including fostering of divergent thinking with 13 items, fostering convergent thinking with 7 items, and fostering metacognitive thinking with 8 items. Examples of items checking if the teacher fostered divergent thinking were *'Teacher encouraged input and challenged pupils' ideas'* and *'Teacher was non-judgmental of pupil opinions'*.

Examples of items checking if the teacher fostered convergent thinking were, *'Teacher encouraged pupils to extend concepts and skills'* and *'Teacher related integral ideas to broader concepts'*. Examples of items checking if the teacher fostered convergent thinking were, *'Teacher encouraged pupils to explain their understanding of concepts'* and *'Teacher encouraged pupils to explain in own words both what and how they learned*.' The protocol required the researcher to observe whether the teacher fostered creative and metacognitive thinking abilities or not, and the timing of the fostering episodes of the abilities in the classroom in a given lesson. This requirement faced two difficulties to achieve. First, it would be difficult to timely and accurately capture every action that would be interpreted as really fostering creative and metacognitive thinking to students. Secondly, it was necessary to ensure that researcher bias in judging presence or absence of the ability is kept to the minimum. To overcome these difficulties, a video camera was used to record the classroom interaction sessions. The video tapes were then given to two juries to observe and check the presence and or absence of the specific items measuring teachers' ability to foster creative and metacognitive thinking. The juries were university lecturers in the field of education, who were also the experts in the selected subjects' combinations. Before starting assessing the video clips, a discussion with the juries was made to make them familiar with how to identify the fostering criteria as identified in the protocol. The judgments by the juries were compared to the researcher's observations, discussed, and then averaged to obtain teachers' scores. Three teachers from each school were observed, making a total of 36 teachers for all 12 sampled schools. The teachers were purposefully selected basing on the subjects they taught. The subjects selected were Geography, English, and History. The subjects were selected because they were the ones that the researcher was familiar with.

2.3. Reliability of the TOP

The Teacher Observation Protocol reached an internal consistency of Cronbach's alpha coefficient of $\alpha = .97$. These were considered very acceptable reliability indices of the instruments used for this study. Reliability of the teacher observation protocol instrument was confirmed by checking for inter-coder consistency. Two juries were given the video films together with the criteria for observation. The juries were the learned individuals in the field of education. The researcher and the observers discussed the items in the protocol for agreement on what is and what is not meant by fostering the divergent, convergent, and metacognitive thinking by the teacher. To ensure the reliability of the agreement among the juries and the researcher, the Cohen's Kappa Measure of Agreement was calculated and it reached the value of.70, with a significance of $p < .01$. According to [19], a value of.5 for Kappa represents moderate agreement,.7 and above represents good agreement, and above.8 represents very good agreement. Therefore, the inter-coder agreement among the juries on fostering creative thinking and metacognitive thinking in this study was considered a good agreement.

3. Research Findings

3.1. The Timing of Fostering Cognitive Thinking in the Classroom

Table 2 reveals that divergent thinking skills were highly fostered than other skills, followed by convergent thinking skills; while metacognitive thinking was the least fostered skill in both high and low performing schools. However, the

extent of fostering was higher in the high performing schools than in the low performing schools. It is also obvious from the table that while the magnitude of fostering creative and metacognitive skills increased with time for the high performing schools the same decreased with time for the low performing schools. This means that teachers in high performing schools relatively highly fostered the skills from the first 10 minutes of the classroom sessions but as the time increased they also increased the fostering of the skills. On the other hand teachers in the low performing schools started by relatively lowly fostering the skills but decreased the fostering of the same as the time went on.

Table 2. Teachers' Ability to Timely Fostering Divergent, Convergent, and Metacognitive Thinking.

School Ranking		Timing of Fostering Episodes									
Thinking Skills Fostered		First 10 min.		11 - 20 min.		21 - 30 min.		31 - 40 min.		Overall Skill Fostering	
		M	SD	M	SD	M	SD	M	SD	M	SD
High Performing Schools (N=18)	Divergent Thinking	10.3	7.4	8.0	2.7	22.4	11.9	18.5	13.7	59.2	26.8
	Convergent Thinking	4.7	2.0	4.7	2.0	7.2	3.9	10.4	7.7	27.1	11.8
	Metacognitive Thinking	2.9	1.9	4.2	1.4	9.7	6.5	13.7	10.3	30.6	18.4
Low Performing Schools (N=18)	Divergent Thinking	8.6	6.9	5.1	3.7	3.7	4.9	3.7	4.2	21.1	15.6
	Convergent Thinking	3.2	1.6	3.2	1.6	2.4	2.2	2.7	2. 7	11.3	6.5
	Metacognitive Thinking	2.5	1.9	2.9	2.9	1.4	1.5	2. 8	2.6	9.6	6.7

3.2. Difference in Teachers' Ability to Foster Cognitive Thinking by School Ranking

Table 3. Differences in Fostering Creative and Metacognitive Thinking with School Ranking.

Variable	School Ranking	Descriptive		Levene's Test for Equality of Variances		t-test for Equality of Means						
				F	*Sig.*	*t*	*df*	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
		Mean	S.D	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower
Fostering Divergent Thinking	High Performing Schools	59.2	26.8	27.58	.000	18.21	34	.000	38.12	2.09	34.01	42.24
	Low Performing	27.1	11.8									
Fostering Convergent Thinking	High Performing	30.6	18.4	44.05	.000	17.33	34	.000	15.719	.91	13.93	17.50
	Low Performing	21.1	15.6									
Fostering Metacognitive Thinking	High Performing	11.3	6.5	96.55	.000	15.82	34	.000	20.95	1.32	18.34	23.56
	Low Performing	9.6	6.7									

Results in Table 3 indicate that there was a statistically significant difference between teachers in high performing schools (M = 30.6, SD = 18.4), and teachers in low performing schools (M = 21.1, SD = 15.6); t (34) = 17.33, p =.000 (two tailed) in fostering convergent thinking in the classroom. This interprets that teachers in high performing schools demonstrated higher ability in fostering convergent thinking skills relative to teachers in low performing schools. Further, according to data in Table 3, there was a statistically significant difference between teachers in high performing schools (M = 59.2, SD = 26.8), and teachers in low performing schools (M = 27.1, SD = 11.8); t (34) = 18.21, p =.000 (two tailed) in fostering divergent thinking in the classroom. This means that teachers in high performing schools demonstrated higher ability in fostering divergent thinking skills than their counterpart teachers in low performing schools. As indicated in Table 3, there was a statistically significant difference between teachers in high performing schools (M = 11.3, SD = 6.5), and teachers in low performing schools (M = 9.6, SD =6.7); t (34) = 18.82, p =.000 (two tailed) in fostering metacognitive thinking in the classroom meaning that teachers in high than in low performing schools demonstrated higher ability in fostering metacognitive thinking skills in the classroom.

4. Discussion

4.1. Implications for School Learning

To improve individual academic performance and ultimately school performance, creative and metacognitive thinking need to be developed among students. Thinking that is able to address both routine and insight problems. Thinking that is flexible to shift from one kind of task to another. This means that one student should be assisted to develop divergent, convergent and metacognitive thinking so that a particular kind of thinking may be called in practice when a problem demanding it arises. Three levels of creative learning with both cognitive and affective dimensions are divergent functions, complex thinking and feeling processes; and involvement in real challenges [23, 24, 26]. Divergent functions refer to the level at which parents and teachers start to engage children in creative learning. Cognitively, the child is led to master the abilities to cognize and store information in their memory before they fully engage in divergent thinking components such as fluency, flexibility, originality, and elaboration. Affectively, parents and teachers should guide the children to become self - confident, tolerant for ambiguity, sensitive to problems and develop risk taking behavior. At this level children thus, become open to experience as they develop readiness to participate in several exposures, willing to respond and become curious. Complex thinking and feeling processes is the creative learning level in which the foundation is laid upon which creative learning develops by involving various important techniques basic to creative learning. Cognitively, higher level and more complex thinking skills such application, analysis, synthesis, evaluation are employed. The child is expected to develop and master analogies, metaphors and apply methodological and inquiry skills. Affectively, the child is guided to deal with complex feelings and tensions, imagery, and develop psychological freedom and safety. Lastly, the child should be guided in the third level of creative learning which is known as involvement in real challenges. In this is level the child is involved in the real problems and challenges. Cognitively, one is involved in independent inquiry, self-direction, resource management, and product development. Affectively, the child should be guided to internalize values and demonstrate personal commitment to productive living and toward self-actualization.

In the developing countries generally and in East Afrca in particular, where schools are experiencing similar characteristics, generalizability of these findings to explain academic and school performance is recommended. This is because given the urbanization alarming rate which is so fast in these countries, and that cannot match the pace of social services supply in the rural populations similar to those supplied in urban areas; rural populations might remain in the group of low performing not only schools but also in other economic and social needs that are the fruits of good education one can enjoy in life. Cognitive variables of the students are crucial if and should be paired by the surrounding social variables not only in explaining academic and school performance but also in explaining daily human performance.

4.2. Creative and Metacognitive Thinking and Future Development of Secondary Education

In any given education system, secondary education occupies an extremely, important pivotal role, both in the functioning of the whole education system, and the operations of the economy in general. With the current trend in academic performance in secondary school education in Tanzania, it is convincing to argue that for longtime to come, the labor force in the country, will be predominantly composed of secondary school leavers. The role of this semi - educated group of citizens should not be ignored given the fact that youth of secondary school age need to be able to consolidate and broaden their ideas, knowledge, skills, principles and aptitudes they acquired and developed at the primary education level; being prepared for tertiary and higher education, vocational, technical, and professional training or be ready for the world of work.

Having lost the former two, these students need preparation to join the world of work in vocational, technical, and professional training. These students need some necessary cognitive and affective skills to enable them match the world of work. Even those who successfully pass examinations and join higher levels of education will still need the necessary skills to smoothly adapt tertiary and higher education, vocational,

technical, and professional training. It is therefore, of great importance that students at secondary school level acquire convergent thinking skills in mathematical reasoning, verbal reasoning, scientific and spatial reasoning. They will also need divergent thinking in terms of fluency, flexibility, elaboration and original thinking skills [12, 21]. Metacognitive thinking skills are also of great importance in terms of declarative knowledge, procedural knowledge, and conditional knowledge. Secondary school students also need other metacognitive skills such as planning, information management, monitoring, debugging, and evaluation. This does not mean that they don't need other non-cognitive skills such as learning how to learn, self-confidence, holding a conversation, and holding down to a task. They need both cognitive and non-cognitive concurrently as these determine their subsequent success both in higher learning and the world of work.

5. Conclusions and Recommendations

This paper investigated the association between teachers' ability to foster cognitive thinking and school ranking in academic performance in Tanzania. Teachers' ability to foster variables such as convergent, divergent and metacognitive thinking was measured using TOP. It has been found that teachers in the schools ranked high than in low academic performing schools demonstrated ability to foster convergent, divergent and metacognitive thinking to their students during teaching learning sessions in the classroom. Difference in timing of the fostering these cognitive thinking was also observed with the ranking categories. It is worthy concluding that conscious efforts by teachers to timely pair fostering of cognitive thinking and academic content is crucial in making difference in academic and school performance. Teachers should thus, be reminded through in service trainings to improve their ability to consciously pair fostering of cognitive thinking and academic content during their classroom sessions.

Abbreviations

TOP	Teacher Observation Protocol
GPA	Grade Performance Average
F.IV	Form Four
SPSS	Statistical Package for Social Sciences

Author Contributions

Joel Matiku Joshua is the sole author. The author read and approved the final manuscript.

Conflicts of Interest

The author declares no conflicts of interest.

References

[1] Abe, E. and Birabil, S. (2022). Fostering Creativity and Critical Thinking in 21st Century Classroom. Innovare Journal of Education, (10), 8-12. https://doi.org/10.22159/ijoe.2022v10i3.44671

[2] Balogun, O. S., Olaleye, S. A. and ibidoja, O. J. (2020). University students academic performance: An approach of Tau Statistics. Proceedings of the 36th International Business Information Management Association (IBIMA), 4-5 November 2020, Granada, Spain.

[3] Bloom, B. S. (1976). Human Characteristics and School Learning. New York: Mcgraw Hill.

[4] Cerisola, S. (2018). Creativity and local economic development: The role of synergy among different talents. Papers in Regional Science, 97(2): 199-215. https://doi.org/10.1111/pirs.12254

[5] Tampubolon, M. Yusufu, S. and Dahlan, T. (2022). Mindfulness as the Fundamental Element in Developing Effective Communication between Late Adolescents and Parents. International Journal of Education 14(2). https://doi.org/10.17509/ije.v14i2.43876

[6] Matiza, V. M. (2020). The role of creative industries in economic development: the human factor development approach. African Journal of Inter/Multidisciplinary Studies 2(1), 50-61.

[7] Mawardino, M. and Fauzan, A. (2018). The Influence of Treffinger Model on Creative Thinking Ability in Terms of Cognitive Style. Advances in Social Science, Education and Humanities Research, volume 178, 1st International Conference of Innovation in Education (ICoIE 2018): Atlatis Press.

[8] Ndiung, S., Dantes, N., Ardana, I. M., & Marhaeni, A. A. I. N. (2019). Treifnger's creative learning model with RME principles on creative thinking skill by considering numerical ability. International Journal of Instruction, 12(3), 731-744. https://doi.org/10.29333/iji.2019.12344a

[9] Gemma, E. D & Mjokaya (2024). Influence of cognitive ability on students' academic achievement in public secondary schools in Arusha District Council, Tanzania. Journal of Research Innovation and Implications in Education, 8(3), 463 - 473. https://doi.org/10.59765/73yt8ws

[10] Kayacheng, S. (2017). Fostering student creativity through teacher behaviors. Thinking Skills and Creativity, 23, 58-66. https://doi.org/10.1016/j.tsc.2016.11.002

[11] Kusaeri, & Aditomo, A. (2019). Pedagogical beliefs about critical thinking among Indonesian mathematics pre-service teachers. International Journal of Instruction, 12(1), 573-590. https://doi.org/10.29333/iji.2019.12137a

[12] Irungu, M. N., & Grace, N. (2011). Determinants of academic performance in Kenya certificate of secondary education in public secondary schools in Kiambu county, Kenya. Journal of Education and PPractice, 4(12), 38-43.

[13] Joshua, J. M. (2021). The role of feedback on school performance. African Journal of Accounting and Social Science Studies (AJASS), 2(2) 43-58.

[14] Kao, C. (2022). How broad cognitive abilities contribute to traditional analogies, creative analogies, and general creativity. Thinking Skills and Creativity, 45, 101068: https://doi.org/10.1016/j.tsc.2022.101068

[15] Kocak, O., Göksu I., and Goktas, Y. (2021). The factors affecting academic achievement: A systematic review of meta analyses. International Online Journal of Education and Teaching (IOJET), 8(1). 454-484.

[16] Kyaruzi, F. (2019). The role of self-efficacy and use of teachers' feedback on students' mathematics performance in Tanzanian secondary schools. Journal of Education, Humanities and Sciences, 8(1), 2019: 30-46.

[17] Liang, M. Yao, L. Wei, W., Scheizer, K. m Ren, X., and Wang, T. (2024). Executive functions and divergent thinking in young adults: Evidence from individual differences and cognitive training studies. Thinking Skills and Creativity; 53, 101610: https://doi.org/10.1016/j.tsc.2024.101610

[18] Markus, H. R., & Kitayama, S. (2010). Cultures and selves: A cycle of mutual constitution. Perspectives on Psychological Science, 5, 420-430, https://doi.org/10.1177/1745691610375557

[19] Peat, J., Mellis, C., Williams K., and Xuan W. (2001). Health Science Research: A handbook of quantitative methods. https://doi.org/10.4324/9781003115922

[20] Stanley, P. (2022). Review, Santrock, Essentials of Life-span development. Boston.

[21] Suwaidan, S. H. and Radeh, N. A. (2021). The effectiveness of divergent thinking strategies in developing deep understanding skills when teaching second intermediate class students the social studies. Psychology and Education; 58(1): 2146-2157.

[22] Taylor, C., Zaghi, A., Kaufman, J., Reis, S. and Renzulli, J. (2020). Divergent thinking and academic performance of students with attention deficit hyperactivity disorder characteristics in engineering. Journal of Engineering Education, 109; https://doi.org/10.1002/jee.20310

[23] Kaufman, J. C., Reis, S. M. and Renzulli, J. S. (2020). Divergent thinking and academic performance of students with attention deficit hyperactivity disorder characteristics in engineering. Journal of Engineering Education; 109: 213-229.

[24] Treffinger, D. J. (1980). Encouraging Creative Learning for the Gifted and Talented. Ventura, CA: Ventura Country Schools.

[25] Wainwright, C. L., Flick, L. and Morrell, P. (2003). The Development of Instrument for Assessment of Instructional Practices in Standard-Based Teaching. The Journal of Maathematics and Science: Collaborative Expllorations, 6, 21 - 46.

[26] Steinberg, L., Thissen, D., & Wainer, H. (2000). Validity. In H. Wainer, N. J. Dorans, D., Eignor, R. Flaugher, B. F. Green, R. J. Mislevy, L. Steinberg, & D. Thissen (Eds.), Computerized adap-tive testing: A primer (2nd ed., pp. 185-229). Mahwah: Erlbaum.