The Profile of Mathematics Academic Motivation Among High School Students During COVID-19 Pandemic

Riza Permata Diffendry[1] Niken Widi Astuti[1*]

[1]*Faculty of Psychology, Universitas Tarumanagara, West Jakarta 11440, Indonesia*
[*]*Corresponding author. Email: nikenw@fpsi.untar.ac.id*

ABSTRACT
This study aims to investigate the level of academic motivation in mathematics during COVID-19 period. Academic motivation is an encouragement that comes from both internal and external factors around student to achieve learning goal. Cross-sectional descriptive quantitative methods used in this study. Academic motivation measured using Academic Motivation Scale (AMS) by Vallerand et al. which adapted in mathematical context in this current study. 252 high school students from Greater Jakarta participated in this study. 21 high school students that did not match the criteria for participants. So that only 231 sample included in the final analysis stage. The results shows high score of intrinsic motivation to know and introjected regulation, while moderate level of academic motivations observed in five other dimensions. Research implication and suggestion for future research discussed in this paper.

Keywords: *Academic motivation, mathematics, high school students, education during pandemic COVID-19*

1. INTRODUCTION

Since early 2020, the whole world facing crisis caused by COVID-19 pandemic. Various preventive measures are taken to slow down transmission rates such as lockdown in several countries and many restrict outside activities to limit physical contacts from one to another. The restriction also enforced by Indonesian government, and one area affected by this regulation is in education, where all learning activities must be carried out from home via online learning [1].

Online learning defined as the use of internet and technology to, where students can access learning materials through website, email, video conferencing, chat applications provided by the education institution [2]. Although online learning has been around for decades, many still reporting technical issues during the process, such as connection instability or disruption in internet connection [2], but if used optimally it also facilitate the teacher. Furthermore, Gadanidis et al. [3] also emphasised the need of creativity from students in term of online reading, shows the importance of students factor in the effectiveness of online learning. A common problem that often reported in students is the low level of learning motivation they have even in offline/face to face learning process [4]. Previous studies consistently shows a significant role of learning motivation, or also known as academic motivation in learning process. Low academic motivation often negatively impact on a student's future [5], and there are several factor that might contributes to low academic motivation, such as the lack of attention from teachers and parents, the teaching strategy used to deliver the materials, life problems experienced by students, perception of subjects difficulty [5].

Low academic motivation can be observed especially in certain subjects, such as mathematics. Programme for International Student Assessment (PISA) reported that Indonesia ranked 72 out of 77 in mathematics [6]. Mathematics, reportedly, believed to be the most feared subjects in school because it deals with numbers and consist of various formulas that students find difficult to understand [4,7]. In addition, mathematics also consists of abstract concepts, making the students perceived it as a very complicated and difficult subjects [8], which reflected in fairly lower academic motivation in mathematic subjects. Li and Schoenfeld [9] pointed this as problematic as mathematics is the gateway of development in science and technology, and current trend also shows an increase in demand for individual with competency in quantitative and computation. Thus, highlighted the increasing need to investigates the level of academic motivation in mathematics subject during COVID-19.

1.1. Related Work

1.1.1. Academic motivation

Academic motivation is one of the most studied constructs in educational psychology because of its importance in understanding learning process [10]. In general, motivation can be defined as power to drive one's behaviour and

Copyright © 2021 The Authors. Published by Atlantis Press SARL.
This is an open access article distributed under the CC BY-NC 4.0 license -http://creativecommons.org/licenses/by-nc/4.0/.

feeling of what to do [11]. Schunk et al. [12] defined academic motivation as the presence behavior due to academic functioning and success. Academic motivation concept deeply rooted from self-determination theory, which divided learning motivation into two different types: intrinsic and extrinsic motivation [10].

1.1.1.1. Intrinsic motivation.

Intrinsic motivation focused on individual behaviour which acted to acquire one's satisfaction [10,13]. Vallerand et al. [10] differentiates intrinsic motivation into three types: (a) intrinsic motivation to know (IMTK), which focuses on individual satisfaction when carrying out activities related to learning, exploring, and understanding new knowledge, (b) intrinsic motivation toward accomplished things (IMTA) focuses on individual satisfaction and pleasure from the process in achieving goals, and (c) intrinsic motivation to experience stimulation (IMTE) focuses on the sensation of satisfaction that comes from an activity carried out by individuals.

1.1.1.2. Extrinsic motivation.

Extrinsic motivation focused on behaviour that derives from certain consequences, such as external rewards, social acceptance, and avoidance of punishment. There were three distinct type of extrinsic motivation: (a) identified regulation (IR) focused on preference over behaviour which in accordance with one's value, which; (b) introjection regulation (INR) involving the earlier stage of internalization process in certain behaviour; and (c) external regulation, which heavily focused on the behaviour as outcome of external factor such as reward and punishment.

1.1.1.3. Amotivation.

Vallerand et al. [10] also provide one more dimension of academic motivation, which is amotivation. In contrast, amotivation is a state when individual lack in motivation, either intrinsically or extrinsically. This happened because of the uncertainty between the results and the actions one's take. This also occur when individuals who are already motivated have feelings of incompetence.

1.1.2. Online mathematics

Rabova [14] outlined the benefits and risks of teaching mathematics via internet. It heavily depends on teacher's ability to operates the technology and teaching strategy in delivering the subjects. However, if used optimally, internet use can help students' understanding in mathematical concepts.

1.2. Our Contribution

In the sudden shift from offline to online learning due to prevention step taken to slow the number of COVID-19 cases, there is a rising need to investigates students' learning motivation, and this study especially aim to describe academic learning motivation in mathematics during COVID-19 pandemic among High School Students.

1.3. Paper Structure

The first section discussed this study background. Section 2 describes research participants, instrument used to measure academic motivation, and explain our data analysis plan. Section 3 presents analysis result and its interpretation followed by discussion. In Section 4, we will conclude current study, and discussed limitation of this study and direction for future research.

2. METHODS

2.1. Participants

We used purposive and snowball sampling to select our research participant. In initial data collection, 252 high-school students participate in this study, however 21 data excluded from the final analysis for not fitting the criteria as research participant. Table 1 present descriptive information of participant characteristics. Based on the data obtained from 221 participants, there were 163 female participants (70.6%), enrolled in science 120 (51.9%), and 106 is sitting in class XII (45.9%). Most of the participants lives in Tangerang (n=153, 66.2%). In this study, many participants used cellphones as the main device used to learn mathematics online 135 (58.4%), using WiFi (n=177, 76.6%)

2.2. Instruments

Academic motivation measured using *Academic Motivation Scale* (AMS), developed by Vallerand et al. [10] adapted into Indonesia language by Marvianto and Widhiarso [15] and we adjusted it into mathematics context. In total AMS consists of 28-items, where participants were asked to response using 7-point Likert Scale. In general, AMS measures 3 types of academic motivations: (a) **intrinsic motivation** consists of three subdimension, each measured using 4-items: *intrinsic motivation to know (IMTK)* (α=0.86), *intrinsic motivation toward accomplishment (IMTA)* (α=0.73), dan *intrinsic motivation to experience stimulation (IMTE)* (α=0.83); (b) **extrinsic motivation** consists of three subdimension, each measured using 4-items: *identified regulation (IR)* (α=0.84), *introjection regulation (INR)* (α=0.80), dan *external regulation (ER)* (α=0.71); and (c) **amotivation** (α=0.75) measured using 4-items.

Table 1 Characteristics of participants

Characteristics	Frequencies	Percentages
Sex		
Male	*68*	*29.4*
Female	*163*	*70.6*
Major		
Science	*120*	*51.9*
Social	*111*	*48.1*
Grade		
X	54	23.4
XI	71	30.7
XII	106	45.9
Location		
Jakarta	59	25.5
Bogor	9	3.9
Depok	7	3.0
Tangerang	153	66.2
Bekasi	3	1.3
Device		
PC	5	2.2
Laptop	82	35.5
Handphone	135	58.4
Tablet	2	0.9
Other	7	3.0
Internet Sources		
WiFi	177	76.6
Mobile tethering	49	21.2
Other	5	2.2

2.3. Data Analysis

Statistical analysis in this study performed using SPSS version 15. Descriptive analysis performed to calculates mean and standard deviation of each dimension of academic motivation. Categorization process will follow the norm provided by Marvianto and Widhiarso [15], then we will count the frequency of participants in each category. Table 2 shows the categorization of the level of Academic Motivation Scale. Nonparametric comparison analysis performed to identify difference of academic motivation across group characteristics.

Table 2 Category of academic motivation

Category	Score per Dimensions
Low	$4 \leq X < 13$
Moderate	$13 \leq X < 21$
High	$21 \leq X \leq 28$

Table 3 Mean, standard deviation and category of dimension of academic motivation

Dimension of AMS	Mean	SD	Category
Intrinsic Motivation To Know (IMTK)	19.83	0.32	*Moderate*
Intrinsic Motivation Toward Accomplishment (IMTA)	21.85	0.27	*High*
Intrinsic Motivation To Experience Stimulation (IMTE)	16.57	0.34	*Moderate*
Identified Regulation (IR)	18.12	0.33	*Moderate*
Introjected Regulation (INR)	21.00	0.31	*High*
External Regulation (ER)	17.04	0.31	*Moderate*
Amotivation (AMO)	14.19	0.33	*Moderate*

3. FINDINGS AND DISCUSSIONS

Based on descriptive analysis result showed in Table 4, and compare it with the norm, we can categorize IMTA (M=21.85, SD=0.27) and INR (M=21.00, SD=0.31) of Senior High School students in high level, while they have moderate level of IMTK (M=19.83, SD=0.32), IMTE (M=16.57, SD=0.34), IR (M=18.12, SD=0.33), ER (M=17.04, SD=0.31), and amotivation (M=14.19, SD=0.33). This shows that in general high school students in this study has moderate to high level of academic motivation in mathematics.

3.1. Comparison

We test the normality assumption before examining the differences in academic motivation with different students in different characteristic groups by using skewness, kurtosis, and Shapiro-Wilk Test. Table 5 shows the summary of the results. Although skewness and kurtosis value are indicating normal univariate distribution, however Shapiro-Wilk test shows significant level of deviation from normality. Therefore we use nonparametric test (Mann-Whitney U and Kruskall-Wallis) to determine the difference of the level of academic motivation according to the sex, major, grade, location, and device used in online learning.

Significant differences in four subdimensions of academic motivation (IMTK, IMTE, IR) were found in students major. Result shows that science students tend to have higher academic motivation (both internally and externally) compared with students in social major. This perhaps can be explained by the nature of each major, where science major involved more natural science subjects such as physics, chemistry, which also rooted in mathematics. This led to students in science has higher motivation in mathematics subjects.

Result also shows that type of devices used in online learning and type of internet connection play a role in students' mathematic academic motivations.

Table 4 Normality assumption using skewness, kurtosis, and Shapiro-Wilk test

Dimension of AMS	Skewness	Kurtosis	Shapiro-Wilk Test p-value
Intrinsic Motivation To Know (IMTK)	-.19	-.50	0.00
Intrinsic Motivation Toward Accomplishment (IMTA)	-.91	.89	0.00
Intrinsic Motivation To Experience Stimulation (IMTE)	-.01	-.43	0.08
Identified Regulation (IR)	.00	-.52	0.01
Introjected Regulation (INR)	-.64	-.1	0.00
External Regulation (ER)	-.2	-.1	0.09
Amotivation (AMO)	.19	-.44	0.02

Student using mobile phone significantly has lower IMTA and INR, and students using WiFi tend to have higher academic motivation (IMTK, IMTE, IR, and INR). Previous research led by Darko-Adjei [16] found that

smartphone tend to freeze during learning process, and the screen and key sizes are not developed optimally to facilitate learning process. The result from this comparison analysis shows that teacher as facilitator in learning process need to differentiate how to deliver materials between science and social major students. Further insight, if the students have the privilege to have PC or laptop, it is better for them to use them compared with smartphone for optimal learning experiences.

Tabel 5 AMS comparison across sex, major, grade, residence, device, internet connection, and location

Dimension	p-value of Nonparametric Test						
	Sex	**Major**	**Grade**	**Residence**	***Device***	**Internet Connection**	**Location**
IMTK	0.49	0.01*	0.59	0.85	0.16	0.03*	0.35
IMTA	0.74	0.15	0.73	0.45	0.00*	0.78	0.78
IMTE	0.01	0.00*	0.33	0.37	0.79	0.02*	0.28
IR	0.22	0.04*	0.29	0.36	0.41	0.04*	0.12
INR	0.13	0.03*	0.28	0.28	0.01*	0.03*	0.47
ER	0.75	0.22	0.44	0.11	0.28	0.11	0.17
AMO	0.05	0.25	0.07	0.79	0.16	0.22	0.96

4. CONCLUSIONS

In conclusion, this study shows that during the pandemic of COVID-19, although high school students must shift their face-to-face learning to online learning, students still has moderate to high level of mathematic academic motivation. Furthermore, the result indicates that student's major, device used for online learning, and internet connection used plays role in their motivation to learn mathematics.

Limitation of this study addressed as follows. First, the characteristics of research participants in this study not evenly distributed, therefore the generalization of the result from this study must be considered carefully. Secondly, this study only involving limited number of sample, therefore it might not be representative for all high school students learning mathematics. Though similar result also found in previous study [16]. In the future, researcher might investigates the role teaching strategy involved in mathematics online learning in student's motivation in learning mathematics.

ACKNOWLEDGMENT

This work was supported by Faculty of Psychology, Universitas Tarumanagara, Jakarta, Indonesia. And I express gratitude for Mrs. Niken Widi Astuti, M.Si., Psi as my main supervisor and Ms. Meylisa Permata Sari, S.Psi., M.Sc as my second supervisor.

REFERENCES

[1] R.H.S. Aji, Dampak COVID-19 pada Pendidikan di Indonesia: Sekolah Keterampilan dan Proses Pembelajaran, Jurnal Sosial dan Budaya, 7(5) (2020) 395-402. DOI: 10.15408/sjsbs.v7i5.15314

[2] I. Dhull, MS. Sakshi, Online Learning, International Education & Research Journal (IERJ), 3(8) (2017) 32-34.

[3] G. Gadanis, L. Graham, D. McDougall, G. Roulet, On-line Mathematics: Visions and Opportunities, Issues, and Challenges, and Recommendations. The Fields Institute, 2002

[4] L.N. Laili, M.S. Wati, S.A. Ramadhianti, S. Subiyantoro, Pengembangan Puzzle Trigonometri untuk Meningkatkan Motivasi Belajar Matematika Siswa Sekolah Menengah Atas, Jurnal Komunikasi Pendidikan, 3(2) (2019) 101-107. DOI: https://doi.org/10.32585/jkp.v3i2.324

[5] A. Nurcahya, Kumparan, Lemahnya Motivasi Belajar pada Siswa Di sekolah, 2018, https://kumparan.com/alsri-nurcahya/lemahnya-motivasi-belajar-pada-siswa-di-sekolah-1527306102088/full

[6] T. Kurnia, Liputan 6, Skor terbaru PISA: Indonesia merosot di Bidang Membaca, Sains, dan Matematika, 2019, https://www.liputan6.com/global/read/4126480/skor-terbaru-pisa-indonesia-merosot-di-bidang-membaca-sains-dan-matematika

[7] F. Annemarie, H.F. Geraldi, R. Pekka (Eds.), International handbook of mathematical learning difficulties, Springer, Cham, Switzerland, 2019

[8] D. E. Rahayu, Budiyono, E. P. Astuti, Penguasaan Definisi dan Rumus Dikaitkan dengan Penggunaannya pada Mata Pelajaran Matematika Kelas VII Semester Genap SMP Negeri 1 Mirit Tahun Pelajaran 2011/2012, Pendidikan Matematika, 4(1) (2013) 1-6.

[9] Y. Li, A. H. Schoenfeld, Problematizing teaching and learning mathematics as "given" in STEM education, International Journal of STEM Education, 6(44) (2019) 1-13. DOI: https://doi.org/10.1186/s40594-019-0197-9

[10] R. J. Verreland, L. G. Pelletier, M. R. Blais, N. M. Briere, C. Senecal, E. F. Vallieres, The Academic Motivation Scale: A Measure of Intrinsic, Extrinsic, dan Amotivation in Education, Educational and Psychology Measurement, 1992, pp. 1003-1017.

[11] L. A. King, The science of psychology (3rd ed.), McGraw-Hill Education, 2014

[12] D. H. Schunk, P. R. Pintrich, J. L. Meece, Motivation in education: Theory, research, and application (3rd ed.), Upper Saddle River, NJ: Merrill/Prentice-Hall, 2008

[13] R. M. Ryan, E. I. Deci. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. American Psychologics. 55(1) (2000) 68-78. DOI: https://doi.org/10.1037110003-066X.55.1.68

[14] J. Rabova. The impact of web sites on teaching and learning mathematics. Procedia: Social and Behavioral Sciences. 93 (2013) 631-635. DOI: https://doi.org/10.1016/j.sbspro.2013.09.252

[15] R. D. Marvianto, W. Widhiarso. Adaptasi Academic Motivation Scale (AMS) versi Bahasa Indonesia. *Gadjah Mada Journal of Psychology*, 4(1) (2018) 87-95.

[16] N. Darko-Adjei. The use and effect of smartphone in students' learning activities: Evidence from the University of Ghana, Legon. Library Philosophy and Practice. 2851 (2019) 1-37.