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Science Learning Motivation Among Students at Junior and Senior High Schools in Sungai Penuh: A Comparative Study

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Abstract: Student motivation in science learning has significantly changed during the pandemic. Consequently, it is crucial to trace how student motivation in science has evolved. This study uses a descriptive and comparative research approach to obtain a general overview of students' science learning motivation and compare the levels of student learning motivation, providing a comprehensive overview of student motivation at different educational levels. The total sample size for this study is 104 students, selected using purposive sampling techniques from two schools, junior high school (madrasa) 1 and senior high school 1 Sungai Penuh. A questionnaire on students' motivation for learning science, adapted from a previous study, was utilized to collect student motivation data. Student responses were converted into quantitative data using a Likert Scale of 1 to 5. The collected data were processed and analyzed using descriptive and Mann-Whitney U-test statistics. The results reveal a significant difference in the motivation for learning science between senior high school 1 and junior high school (madrasa) 1 students. The group of students from senior high school 1 exhibited a higher level of science learning motivation than those from junior high school (madrasa) 1. When comparing indicators, no significant differences were found in the motivation of students from junior high school (madrasa) 1 and senior high school 1 Sungai Penuh for learning goal orientation, self-efficacy, and self-regulation. The difference in motivation indicators was only significant in task value. These findings can guide classroom teachers in refocusing their teaching practices and assessing the effectiveness of intervention programs. Exploring other factors across various subjects and school levels is also recommended to gain a more comprehensive understanding of the variations in student learning experiences.

Keywords: Comparative Study; Learning Motivation; Science Education; Students.

Introduction

Education is a highly important but complex process. On one hand, education can equip learners with agency and a sense of purpose, along with the competencies they need to shape their own lives and contribute to the lives of others [1]. On the other hand, it involves various parties to achieve its goals, including the government, educators, students, the school environment, and the broader community. Furthermore, education is facing unprecedented challenges driven by pandemic, accelerating globalization, and faster technological developments [1], [2].

During the pandemic, there has been a significant decrease in learning outcomes, including science. One of the main causes is the decline in the quality of online learning. Before the pandemic, learning was conducted face-to-face. Some online learning is carried out reluctantly, and most educators are not prepared for online learning, often referred to as emergency learning [2].

Online learning refers to online learning using technology-based and social media. The pandemic impacts students' education but also specifically affects students' mental and emotional well-being [3]. This condition has led to a decrease in concentration and motivation for learning. This situation invokes and increases boredom in learning [4]. Getting used to online learning also means taking proactive steps, like creating focused programs and new teaching methods to help people with mental health issues. This is to help students deal with the problems that come up because of the present situation and to create an environment that encourages them to stay interested and excited about online learning.

This transition ultimately forces various parties to adapt so that learning can continue through technology-based learning media during online learning. The use of technology has brought about various problems, such as limited infrastructure, low technology literacy, internet connectivity issues, and costs [2]. Additionally, students' motivation to learn and teachers' motivation to teach have decreased due to boredom with the same technology-based teaching methods.

Learning in a repetitive cycle can significantly impact students' motivation to learn science. This decline in motivation also leads to decreased science learning achievement. Concentration and motivation during the learning process influence students' science learning achievement.

In response to this condition, all parties, especially schools at various levels, must be able to adapt immediately. Schools, through teachers, must provide appropriate learning opportunities for students to develop themselves, practice adaptation, and hone their abilities [1],

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especially after the pandemic, focusing on student learning motivation.

The success of this effort depends on how the learning is planned, implemented, and evaluated. All of these processes will form a learning cycle, where the evaluation results will be used as the basis for further planning to improve the quality of learning [5]. The goal is to provide students with improved learning opportunities, creating a supportive and dynamic educational environment. Ongoing reflection on outcomes and adjusting strategies ensures a responsive and effective educational experience for students.

Students must actively participate in learning, interact with their immediate environment, and construct knowledge [6]. Students should also be allowed to develop skills and attitudes [1]. Students' success in developing their knowledge, skills, and attitudes depends on their conditions and motivation to learn, especially science.

Motivation is a personal competency that holds great significance for an individual. Various experts have defined motivation from different perspectives. According to Goleman, motivation is a crucial aspect of a person's emotional intelligence and can be examined through several indicators, including the drive to achieve goals, commitment, initiative, and optimism [7]. Additionally, motivation can be identified based on factors such as orientation to learning goals, task value, self-efficacy, and self-regulation [8], [9]. While indicators of motivation may develop in diverse ways, frameworks or indicators are not significantly different [10], [11]. The drive to achieve goals is a different name for learning goals orientation.

Fundamentally, motivation is a robust inclination or desire to achieve goals [9]. Motivation is a driving force that arises within an individual to achieve a desired goal. Consequently, students who exhibit high motivation in participating in science learning are those with a strong aspiration to attain the objectives of science education. The same conditions apply and vice versa.

The higher the student's motivation for learning, the more optimal the results. Conversely, if a student has low motivation for learning, the results will not be optimal. The overall state of student motivation, including science learning, changed significantly during the pandemic. As a teacher, the main concern is that motivation changes are heading in an undesirable direction, namely, decreasing. One of the main causes is the decline in the quality of learning during the pandemic. Therefore, it is crucial to trace how student motivation in learning, especially in science, has evolved.

If viewed based on the school level of a student, the motivation for learning science between junior high school and senior high school students shares almost the same factors. These factors include being goal-oriented, the aspirations of the students, their abilities during learning, and the influence of the environment and conditions of the students during the learning period. However, the difference in school levels can affect a student's motivation.

Furthermore, it is also important to trace how student motivation differs across different school levels, such as junior and senior high school. The hope is that by analyzing the differences or similarities in motivation levels, we can gain additional insights into the factors influencing learning motivation at distinct academic levels. The research findings are expected to contribute meaningfully to educational literature by presenting novel data and insights. Furthermore, the practical implications of these findings are anticipated to assist in devising more effective teaching strategies, ultimately contributing to an overall improvement in the quality of education.

Research Methods

Descriptive and comparative research with a quantitative approach is applied as the research method. This study aims to describe and compare the level of student learning motivation at different levels of education. The research was conducted in the first semester of the academic year 2023/2024 at two different school levels: senior high school 1 Sungai Penuh and junior high school (madrasa) 1 Sungai Penuh. The total sample size for this study is 104 students, selected using a purposive sampling technique. The sample is divided into 52 students from senior high school 1 Sungai Penuh and 52 students from junior high school (madrasa) 1 Sungai Penuh. The instrument used to collect student motivation data in this study is a questionnaire on students' motivation for learning science adapted from a previous study [8].

The questionnaire consists of four motivation indicators: learning goal orientation, task value, self-efficacy, and self-regulation. The questionnaire consists of 32 statements. Eight statements represent each indicator. The first indicator focuses on the goals and objectives of students related to their studies, especially in learning science. The second indicator is oriented toward the relevance and usefulness of a learning experience for a student. The third indicator refers to the level of confidence a student has in their ability to perform specific tasks. The final indicator pertains to students' ability to control and motivate themselves to achieve learning goals.

The learning motivation questionnaire is translated into Indonesian and designed as a Google Form to give students an easy understanding and a wide opportunity to respond. Student responses are then converted into quantitative data using a Likert Scale ranging from strongly disagree (1) to strongly agree (5).

The collected data were processed and analyzed using descriptive statistics to obtain a general overview of students' science learning motivation from both schools. Data from both groups of students were also analyzed to determine whether there were differences in learning motivation between junior high school (madrasa) 1 and senior high school 1 Sungai Penuh. Comparative analysis was applied, namely *independent samples t-test* or *Mann-Whitney U-test* with the assistance of SPSS *software*. The choice of the comparative test was determined based on the distribution or normality of the data.

Results and Discussion

After collecting and converting the data, descriptive statistical analysis was conducted for each group of students, which was then transformed into quantitative data. The research results are shown in Table 1. Based on the average values (mean), it can be observed that the average motivation of students from senior high school 1 (4.08) is higher compared to students from junior high school

(madrasa) 1 (3.68). Thus, it can be concluded that there is a difference in the average learning motivation of students between the two schools. Furthermore, based on each indicator, it can also be concluded that students' learning motivation at senior high school 1 is higher than that of students at junior high school (madrasa) 1 for each indicator, as shown in Table 1 and visualized in Figure 1.

Table 1. Descriptive Statistical Analysis Results

	N	Range	Min	Maks	Mean	Std. Defiation	Variance	Statistik	Skewness Std. Error
Motivation of Students at Junior High School (Madrasa) 1 Sungai Penuh									
Motivasi	52	2.93	1.91	4.84	3.86	0.62	0.38	-1.06	0.33
Indicator1. Learning Goal Orientation	52	4.00	1.00	5.00	4.08	0.69	0.47	-1.81	0.33
Indicator 2. Task Value	52	3.25	1.63	4.88	3.91	0.65	0.42	-1.26	0.33
Indicator 3. Self-efficacy	52	2.75	2.00	4.75	3.68	0.68	0.46	-0.53*	0.33
Indicator 4. Self-regulation	52	2.88	2.00	4.88	3.77	0.70	0.50	-0.64*	0.33
The Motivation of Students at Senior High School 1 Sungai Penuh									
Motivation	52	1.59	3.19	4.78	4.08	0.34	0.12	-0.54*	0.33
Indicator 1. Learning Goal Orientation	52	4.00	1.00	5.00	4.24	0.62	0.39	-2.83	0.33
Indicator 2. Task Value	52	3.50	1.50	5.00	4.20	0.51	0.26	-2.80	0.33
Indicator 3. Self-efficacy	52	1.88	2.75	4.63	3.89	0.39	0.16	-0.43*	0.33
Indicator 4. Self-regulation	52	2.12	2.63	4.75	4.00	0.36	0.13	-0.65*	0.33

*The data is distributed normally

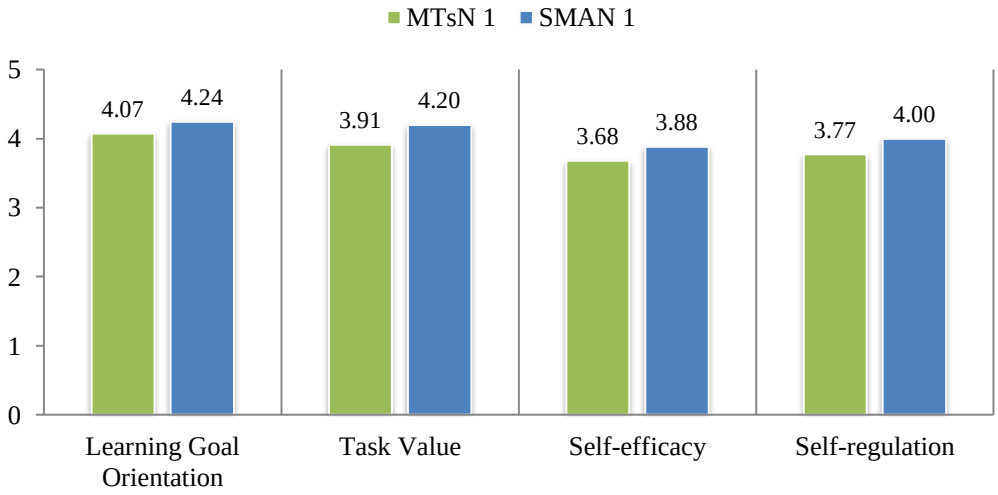

Figure 1. Comparison of Student Motivation between Junior High School (Madrasa) 1 And Senior High School 1

Based on Figure 1, it can be observed that in the learning goal orientation indicator, the level of science motivation for students at senior high school 1 Sungai Penuh is higher, with a mean value of 4.24. In comparison, junior high school (madrasa) 1 Sungai Penuh ranges around 4.07. In the second indicator, representing the level of science learning motivation based on task value, senior high school 1 Sungai Penuh outperforms with a difference of 0.29 mean points compared to junior high school (madrasa) 1 Sungai Penuh, scoring around 4.20 and 3.91, respectively.

Regarding the self-efficacy indicator, the scores of 3.68 and 3.88 show that the desire to learn science at senior high school 1 is still higher than that at junior high school (madrasa) 1. Lastly, for the self-regulation indicator, the level of motivation for learning science in senior high school 1 Sungai Penuh is at 4.00 points. In comparison, the level of motivation for learning science in junior high school (madrasa) 1 Sungai Penuh is lower by 0.23 points compared to senior high school 1 Sungai Penuh, standing at 3.77 points.

However, further tests are needed to determine whether the differences in overall student motivation and each of these indicators are significant. The applied tests are the Independent Samples t-test or Mann-Whitney U-test, depending on the normality of the data. The normality or distribution of data can be determined based on the skewness data in Table 1. The data is considered evenly distributed when the skewness value is not greater than one and is less than -1 [12]. However, only some data groups are classified as having a normal distribution, as indicated by asterisks (*). Thus, the overall and each indicator's comparison tests will be conducted using the Mann-Whitney U-test.

The results of the Mann-Whitney U-test with the assistance of SPSS software for overall student motivation in learning science between junior high school (madrasa) 1 and senior high school one are presented in Table 2 for mean ranks and Table 3 for the statistical test result.

Table 2. Overall Mean Ranks

School	N	Mean Rank	Sum of Ranks
Junior High School (Madrasa) 1	52	46.28	2406.50
Senior High School 1	52	58.72	3053.50

Table 3 presents the Mann-Whitney U value, Wilcoxon W, z-score, and significance level, indicating that the level of motivation for learning science at senior high school 1 Sungai Penuh and junior high school (madrasa) 1 Sungai Penuh is significantly different. This is evidenced by the significance value of 0.035, which is less than 0.05. It is considered significant because the means of the two data sets are significantly different, as seen from the difference in mean ranks between senior high school one and junior high school (madrasa) 1 Sungai Penuh, as shown in Table 2. The group of students from senior high school 1 has a higher mean rank, indicating a higher level of science learning motivation than those from junior high school (madrasa) 1.

Table 3. Mann-Whitney U-test Results

	Motivasi
Mann-Whitney U	1028
Wilcoxon W	2406
Z	-2.104
Asymp. Sig. (2-tailed)	0.035*

*The difference is significant

Then, the comparisons for each indicator are shown in Table 4 for mean ranks and Table 5 for the statistical test result.

Table 4. Mean Ranks for Each Indicator

Indicator	School	N	Mean Rank	Sum of Ranks
1	Junior High School (Madrasa) 1	52	47.48	2469.00
	Senior High School 1	52	57.52	2991.00
2	Junior High School (Madrasa) 1	52	43.82	2278.50
	Senior High School 1	52	61.18	3181.50
3	Junior High School (Madrasa) 1	52	47.48	2469.00
	Senior High School 1	52	57.52	2991.00
4	Junior High School (Madrasa) 1	52	47.94	2493.00
	Senior High School 1	52	57.06	2967.00

Table 5. Mann-Whitney U-test Results for Each Indicator

	1. Learning Goal Orientation	2. Task Value	3. Self-efficacy	4. Self-regulation
Mann-Whitney U	1091	900.5	1091	1115
Wilcoxon W	2469	2278.5	2469	2493
Z	-1.705	-2.975	-1.708	-1.551
Asymp. Sig. (2-tailed)	0.088	0.003*	0.088	0.121

*The difference is significant

Based on Table 5, the test results for indicators 1, 3, and 4 have significance values exceeding 0.05. This implies that no significant differences were found in the motivation of students from senior high school one and junior high school (madrasa) 1 Sungai regarding the indicators of learning goal orientation, self-efficacy, and self-regulation. The same statistical significance score was found in learning goal orientation and self-efficacy ($\rho = 0.088$).

Meanwhile, for indicator 2 (task value), the statistical results show a significance value below 0.05 ($\rho = 0.003$), with the average rank scores for each school level at 43.82 for junior high school (madrasa) 1 and 61.18 for senior high school 1. These results indicate that the group of students from senior high school 1 has a higher level of science learning motivation only in indicator 2 (task value) than the group of students from junior high school (madrasa) 1.

From the descriptive and comparative analysis results, it is evident that the level of science learning motivation among students at senior high school 1 Sungai Penuh is higher than that among students at junior high school (madrasa) 1 Sungai Penuh. When considering the indicators of students' science learning motivation, the comparison can be explained per indicator as follows:

Learning Goal Orientation

Learning goal orientation is a crucial aspect of students' adaptive motivational beliefs in science learning [8] and predicts student engagement [13]. Data on students' learning goal orientation are utilized to comprehend their

purpose in developing knowledge, skills, and attitudes in science learning. According to the comparative results, it is evident that the learning goal orientation in science among students at senior high school 1 (4.24) is higher compared to that in junior high school (madrasa) 1 (4.07). However, the difference between the groups of students from the two schools is insignificant.

Both schools exhibit relatively high learning goal orientation. Students from both schools agreed on three statements with high scores related to learning goal orientation, specifically, understanding their tasks as students, grasping science content, and comprehending the material taught by the teacher. Although still relatively high, the junior high school (madrasa) 1 student group had the lowest average score regarding the aim of learning science—learning new material or content—while the senior high school one student group was found to have the lowest score regarding the aim of learning science, namely, learning as much science material as possible. It can be concluded that both groups of students agree that the quantity of material is not the main concern in learning science.

Previous studies have shown that goal orientation significantly influences students' attitudes toward science and their scientific achievements [14]. Furthermore, students with high goal orientation are more likely to participate in various engagement indicators, such as reflective and integrative learning, higher-order learning, quantitative reasoning, and student–faculty interaction [13]. This condition is worth exploring in greater detail across different school levels.

Task Value

Based on the data and analysis conducted, it was observed that the group of students from junior high school (madrasa) 1 had average scores for different task values, and this difference was found to be significant. The senior high school 1 (4.20) student group exhibited higher task values compared to the junior high school (madrasa) 1 (3.91) student group. Noteworthy differences between the student groups from the two schools were only identified in the task value indicator, while the other indicators showed insignificant differences.

Three statements significantly contributing to the variance in task value between the two student groups were related to the relevance of learning to their lives, the practical help gained from what they learned, and the perceived practical value of science learning. The greatest disparity in mean scores between the two groups of students was observed about these three statement ideas. Interestingly, both groups of students from different school levels scored low on statements about applying science learning in everyday life. In other words, students from both schools perceive that what they learn may not necessarily apply to their daily lives. This is worth exploring in greater detail across different school levels.

Students' perspectives on the learning process and assigned tasks substantially impact their motivational states. Students who believe they can excel in tasks tend to be more optimistic about the grades they will attain. When students encounter tasks they can master effectively, their learning motivation increases, influencing their approach to learning and ultimately enhancing their academic achievements [15]. Hence, it is crucial to bolster students' confidence in their perceptions of task value. Internal locus of control and self-efficacy indirectly impact persistence and satisfaction, while task value directly and indirectly, affects student persistence [16].

When students appreciate the value of the assigned science tasks, they are more likely to engage in science learning, enhancing their science achievement [8]. Task value becomes an expectation influencing students' learning motivation. Therefore, in addition to goal orientation in learning, task value significantly influences students' scientific achievements and attitudes toward science [14].

Self-efficacy

Self-efficacy, along with epistemological beliefs, constitutes one of the two crucial aspects of motivation. [17]. Task value and self-efficacy can directly predict students' learning goals in different ways; however, task value not only predicts learning goals but is also associated with the goals of a student's performance approach [18]. Self-efficacy is a powerful predictor of students' choices, the effort they expend, and their persistence in facing difficulties [8]. So self-efficacy is also crucial, viewing it as the belief in one's ability to achieve goals.

Based on the analyzed data, the average value of self-efficacy was also found to be different and higher for senior high school students (3.88) compared to junior high school (madrasa) 1 (3.68). However, the difference was also insignificant, as was the case for the learning goal orientation indicator. Among the eight statements representing self-efficacy, the difference in scores between the two groups of students was found not to be much different, not exceeding 0.3 for each statement. Self-efficacy results from a cognitive process involving decisions, beliefs, or expectations. It encompasses an individual's motivation to assess the extent to which they estimate their ability to perform specific tasks or actions required to achieve desired outcomes [19]. This finding is worth exploring in-depth to understand the factors that affect self-efficacy.

Of all these statements, only 1 statement or idea had a high value for both groups of students, which was related to the belief that they could complete a difficult task if they tried. Both groups of students also exhibited similarities in several other statements or ideas but with low scores, such as confidence in mastering the skills being taught, finding solutions to difficult problems, and self-confidence in their scientific proficiency.

The self-efficacy indicator has the lowest average score for both schools compared to other indicators. These findings indicate that teachers, especially in the field of science, need to consider aspects of student self-efficacy in the science learning process over an extended period. Self-efficacy, or the level of confidence a student has when completing tasks assigned by a teacher, is a component that can boost learning motivation within a student.

One way to enhance self-efficacy in students is by guiding beliefs and abilities because it can reignite motivation within the student. Teachers can also design learning using interesting strategies and approaches such as puzzle-based learning [20]–[22], game-based learning [23]–[25], project-based learning, and utilizing technology in

learning [26], [27]. This learning has been proven to increase student learning motivation.

Self-regulation

Self-regulation of effort is a fundamental element of students' learning engagement in science [8]. It is grounded in self-awareness and encompasses the management of internal states, impulses, and resources [7]. Additionally, it reflects a student's capacity to navigate achievements and establish goals to attain desired accomplishments as a reward for their efforts. Students with enhanced self-regulation skills are more inclined to be academically motivated [28].

Self-regulation was found to differ for groups of students from different school levels. The self-regulation of senior high school students (4.00) is higher than that of junior high school (madrasa) 1 students (3.77). However, these differences were also found to be insignificant, similar to the cases of the learning goal orientation and self-efficacy indicators.

Both groups of students from both schools concurred on two statements or ideas with high value. First, they will not miss important points in learning when they concentrate. Second, they persist until they finish their assigned tasks. However, neither group of students agreed on questions or ideas with the lowest scores. The senior high school 1 student group expressed difficulty concentrating in class, while the junior high school (madrasa) 1 student group reported challenges completing assignments when the tasks were not interesting.

The most significant differences in scores for self-regulation indicators were found in statements related to task choice. Senior high school 1 students tend to prioritize completing the first assignment, even if there are other more interesting activities. Meanwhile, junior high school (madrasa) 1 students tend to pause and opt for more engaging activities.

Overall, students exhibit relatively high self-regulation. Previous studies on student competence found that high school students demonstrated good self-regulation (mean score: 3.98) [10]. Students with high self-regulation are perceived as capable of employing various strategies flexibly, supplementing these strategies with various forms of adaptation [28].

Self-regulated students focus on activating, changing, and sustaining specific learning practices in social and solitary contexts. In an era where essential qualities for lifelong learning are lacking in many students, the teaching of self-directed learning processes becomes particularly relevant [9].

Overall, motivation is an important aspect of learning, particularly in the context of science education. Students with high learning motivation are more likely to participate in all learning processes to achieve desired learning outcomes. The level of science learning motivation among students is influenced by various factors, including indicators explored in this study (learning goal orientation, task value, self-efficacy, and self-regulation), categorized as intrinsic factors. Additionally, motivation is affected by extrinsic factors such as the learning process, peer influence, and the environment.

We recognize the critical role of science learning for students at different school levels. An essential goal of science education is to empower students by fostering the belief that they can succeed in science learning and by cultivating the adaptive learning strategies necessary to bring that success [8].

Conclusion

Based on the Mann-Whitney U test, we found a significant difference in the motivation for learning science between senior high school 1 and junior high school (madrasa) 1 ($\rho = 0.035$). The group of students from senior high school 1 (mean rank: 4.08) exhibited a higher level of science learning motivation compared to the group of students from junior high school (madrasa) 1 (mean rank: 3.86). When comparing indicators, no significant differences were found in students' motivation from senior high school 1 and junior high school (madrasa) 1 for learning goal orientation, self-efficacy, and self-regulation. Similar statistical significance scores were observed for learning goal orientation and self-efficacy ($\rho = 0.088$). However, the group of students from senior high school 1 showed a higher level of science learning motivation in task value than those from junior high school (madrasa) 1 ($\rho = 0.003$). These results are reinforced by numerous studies that elucidate various factors influencing a student's motivation to learn.

These findings can guide classroom teachers in refocusing their teaching practices and assessing the effectiveness of intervention programs. We recognize that different school levels and environments have their strengths and weaknesses, closely tied to the diversity of methods and techniques employed by schools in their teaching. These differences can also influence the learning patterns and motivation of students. In order to gain a more comprehensive understanding of the impact of various factors on student learning across different educational levels, further research should be conducted to investigate additional variables that may contribute to the disparities in learning outcomes observed across different subjects and school levels.

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