Prevalence and Underlying Factors Influencing Academic Dishonesty in Mathematics among Students at a State University in the Philippines

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https://doi.org/10.24191/ajue.v20i3.27855

Received: 7 March 2024
Accepted: 16 August 2024
Date Published Online: 28 October 2024
Published: 28 October 2024

Abstract: Mathematics is often considered a complex subject, which may cause students to engage in academic dishonesty (AD) to improve their grades. AD in mathematics may take forms such as copying answers during exams, using unauthorized aids like calculators or formula sheets, and sharing solutions to homework problems without attempting the work independently. This also emerged as a widespread issue within the academic community, challenging teaching quality and academic integrity. Thus, this study generally examined the prevalence rates of AD in Mathematics and the influence of demographic factors among 105 tertiary education mathematics students (32 males and 73 females) at one higher education institution in Leyte. Participants were selected using purposive and convenience sampling. The study employed a concurrent nested mixed methods design, with qualitative data nested within the quantitative component, to explore possible explanations for AD. Quantitative data were collected using a 17-item Likert-type scale survey on AD, while qualitative data were gathered through semi-structured interviews. Results revealed that students admitted to engaging in AD, with cheating on assignments being the most prevalent, followed by cheating on tests. Demographic factors such as gender and mathematics performance did not significantly influence AD, except for year levels. This suggests that both males and females engage in AD at similar rates, regardless of the specific type of cheating behavior. Further, other underlying factors, such as difficulties in understanding mathematical concepts, struggle with self-regulation and emotional well-being, and external influences and expectations were found to be more common justifications for engaging in AD. Mathematics educators are encouraged to incorporate solution-based quizzes, tests, and supervised activities to create controlled environments and respond promptly to instances of dishonesty in Mathematics.

Keywords: Academic Dishonesty, Demographic Factors, Mathematics Education, Prevalence

1. Introduction

The challenge of teaching mathematics is exacerbated by the growing incidence of dishonesty among students, which is a concerning trend observed in scholarly research. Mathematics is often regarded as one of the most challenging subjects due to its abstract nature and the necessity for precise

problem-solving skills (Howe & Deitte, 2021; Panaoura et al., 2024). This can also lead to a disesteem of the subject, particularly when students struggle to grasp complex concepts or keep pace with the course content. The pressure to perform well in mathematics, coupled with the fear of failure, can drive students to engage in dishonest practices as a coping mechanism. Consequently, students may believe it is more acceptable to commit dishonesty in mathematics (Anderman & Won, 2017). Furthermore, previous studies (Baran & Jonason, 2020; Chala, 2021; Garcia, 2023) indicate that academic dishonesty (AD) is becoming more acceptable among students, particularly when they observe their peers engaging in and seemingly benefiting from dishonest practices without facing significant consequences.

AD is an umbrella term for several unethical behaviours that students engage in. Different forms of AD include plagiarism and infringement of copyright laws, cheating on examinations, forgery, and falsifying academic documents (Noorbehbahani et al., 2022; Alexandron et al., 2022). It could also be any misconduct diminishing academic integrity as conformance to set rules, norms, and expectations (Yu et al., 2018) or any deceptive behaviour in completing educational activities (Anderson, 2022; Chala, 2021). Specific to mathematics, AD can take different forms, such as copying answers during exams, using unauthorised aids like calculators or formula sheets, plagiarising, and sharing solutions to homework problems without putting in independent effort. These behaviours are often rationalised by students who view them as necessary shortcuts to handle the rigorous demands of the subject. Moreover, AD has become a pervasive and pressing concern in the academic community (Sendur, 2022) and has garnered significant attention and examination in several countries (Finchilescu & Cooper, 2017; Musau & Boibanda, 2017; Thomas, 2021) despite the students' awareness that it is a moral or ethical breach, as their stance does not necessarily reflect the actual incidence of collusion (McGowan, 2016).

Although several studies in the Philippines (Aguilar, 2021; Gutierrez & Padagas, 2019; Moralista & Oducado, 2020; Quintos, 2017) have examined the prevalence and severity of AD, including students' and teachers' perceptions during online classes, reasons for committing AD, mitigation approaches, and the occurrence in higher education, there is still a paucity of literature concerning AD in mathematics. Specifically, there is a dearth of research on how demographic factors such as gender, year level, and academic performance influence the occurrence of AD in mathematics courses, which may likewise play a significant role in influencing students' decisions to engage in dishonest behaviours. AD in mathematics is a widespread global phenomenon and is often cited as a subject that students find challenging. Studies from various countries (Beruin, 2022; Diego, 2017; Frigillano, 2021; Pagaddu, 2021) have similarly reported mathematics as a complex subject prone to AD. Also, the technical and objective nature of mathematics, where answers are either right or wrong, might lead students to justify dishonest behaviour as a means to achieve the correct result, rather than truly understanding the underlying principles.

Furthermore, the complexity of mathematics, combined with its technical and objective nature, where answers are either right or wrong, may provide an environment where AD is more likely to occur. Students may rationalise dishonest behaviour as a means to achieve the correct result, rather than truly understanding the underlying principles. If students perceive a subject as difficult and believe that cheating is a common and accepted practice, it can undermine academic integrity and compromise the quality of education. Hence, by determining the prevalence of AD in mathematics and identifying its various manifestations, mathematics educators can develop solutions to reduce or eliminate AD, improving the quality of learning and academic integrity. For instance, if certain demographics are more susceptible to AD, educators can design strategies to support students' understanding and reduce the likelihood of dishonest behaviour. Additionally, this study asserts that AD persists in mathematics courses and that students' demographic factors may be used to predict such circumstances.

Given the rationale mentioned above, this study generally examined the prevalence rates of AD in Mathematics courses among teacher education mathematics students at one higher education institution in Leyte, Philippines. Specifically, it determined (1) the demographic factors of the students in terms of gender, year level, and performance in mathematics courses; (2) the prevalence rates of AD in terms of cheating on tests, cheating on assignments, plagiarism, and other forms of AD; (3) the underlying reasons of students regarding AD, including factors that may influence their decisions to engage in cheating, plagiarism, or other forms of AD; (4) the differences between the prevalence rates of AD, gender, and year levels of the students; and (5) the relationship between students' mathematics performance and AD prevalence. The study hypothesised significant differences between the

prevalence rates of AD, gender, and year levels of the students, and a significant association between students' mathematics performance and AD prevalence.

2. Literature Review

Academic dishonesty is a pervasive issue within educational institutions and has garnered significant scholarly attention due to its implications for teaching quality and academic integrity. Bylieva et al. (2020) categorised AD practices into four distinct types: cheating, involving the unauthorised use of materials; plagiarism, comprising the use of ideas and content without proper attribution; fabrication, entailing the creation and presentation of fictitious information; and facilitating AD, often referred to as collusion, which involves aiding others in committing AD. These practices contrast with academic integrity, which promotes honesty, trust, fairness, respect, and responsibility in academic work. Previous studies have also indicated that a breach in academic integrity such as misconduct would erode the credibility of the educational system (Dannhoferová et al., 2022; Kudeikina et al., 2022; Vanderburg & Weber, 2023).

The motivations behind students' engagement in AD are diverse. Other studies (Baran & Jonason, 2020; Diego, 2017; Hendy et al., 2021; Krou et al., 2020) have identified factors contributing to AD among students, including personality traits, perceptions of peer behaviour, and cultural differences. Academically prepared students tend to be less inclined toward AD, whereas those heavily involved in leisure activities are more prone to such behaviours (Błachnio, 2019). The rapid progression of technology has further complicated this issue, providing new opportunities for cheating and plagiarism. While earlier studies (Balbuena & Lamela, 2015; Binder et al., 2016; Grira & Jaeck, 2019) attributed widespread academic misconduct to poor institutional policies and unsupportive academic environments, more recent studies (Désiron & Petko, 2022; Hua, 2023; Mdhlalose & Mlambo, 2023) asserted that the influence of technology should not be disregarded. The increasing influence of technology like digital tools and online resources can make it easier for students to engage in dishonest behaviours. The use of digital platforms in education could also increase students' access to unauthorised materials and engagement in inappropriate collaboration, which may worsen the issue. Likewise, the study by Yu et al (2018) stated that the lack of self-control among students significantly predicts academic misconduct.

Regarding gender differences, Case et al. (2019) noted that males exhibit higher levels of AD engagement than females, which could indicate differences in moral and ethical considerations. Meanwhile, Lento et al. (2018) found that females perceived AD as a more severe problem than males and took more steps to control it. They also noted that females display greater consistency in their efforts to curb AD, often drawing on their professional training and teaching experiences. In contrast, Chala (2021) reported that an equal number of males and females cheated, although females exhibited more severe attitudes toward AD. Further, several studies (Musau & Boibanda, 2017; Krou et al., 2020; Lonsdale, 2017; Zhang et al., 2017) have shown that males are more likely to engage in AD than females in both examinations and assignments. This may be due to differences in subjective standards and morals, as females often have higher expectations for themselves and their behaviour. Nevertheless, the influence of gender on AD in mathematics education specifically remains underexplored, which necessitates further examination to clarify the dynamics involved.

Furthermore, Liu and Alias (2022) found that senior undergraduates in China were more likely to engage in AD than sophomores. This contradicts previous findings by Fosgaard (2018) and Lonsdale (2017), who found that AD is less prevalent among older students and more common among younger ones. However, Zhang et al. (2017) also found that AD is more likely observed in seniors than freshmen students, suggesting that seniors may be more tolerant of the behaviour. Moreover, students' grades have been identified as a predictor of AD, with students under pressure to obtain higher grades more likely to cheat (Bujaki et al., 2019). Regarding plagiarism, Ogilvie and Stewart (2010) noted that perceived shame and sanctions were constructs that overlapped to a high degree, with shame being the most significant predictor of plagiarism intentions. Among low self-efficacy students who indicated higher levels of previous involvement in plagiarism reported a higher likelihood of engaging in plagiarism. This also underscores the significant role of student's mathematics performance as a critical determinant of academic misconduct.

Students with lower mathematics performance are more inclined to resort to AD to enhance their grades, a tendency influenced by a myriad of factors encompassing their beliefs and attitudes (Cuadrado et al., 2019; Cabuquin & Abocejo, 2023; Zhang et al., 2017). As per Anderman and Won's (2017) findings, specific categories of AD exhibit a higher prevalence than others. Their study revealed that a substantial proportion of students admitted to engaging in various forms of AD. This highlights the widespread occurrence of dishonest behaviour in academic environments. Other studies also reported various forms of AD, including the use of external sources, plagiarism, lying, and cheating, reflecting the presence of these behaviours among students (Chala, 2021; Ives & Giukin, 2019).

Generally, previous literature reveals that while AD has been explored to some extent, the prevalence of AD within mathematics education, especially concerning demographic factors such as gender and year level, remains underexplored and warrants further investigation. Additionally, the students' mathematics performance and ethical considerations play a substantial role in determining their likelihood of involvement in AD. Similarly, while previous studies have examined AD across various disciplines, few have specifically addressed the unique pressures and motivations that influence mathematics students to resist or engage in AD. This study seeks to fill this gap by analysing the occurrence of AD in mathematics courses and investigating the reasons behind its prevalence, as perceived by students.

3. Methodology

This section offers a detailed overview of the methods and procedures used in this study. We start by explaining the selected research design and its underlying rationale. Additionally, it provides a summary of the step-by-step progression of the study, including the method and process of data collection and analysis.

3.1 Research Design

This study utilised a mixed-method approach, specifically employing a concurrent nested design. The rationale for using this design was derived from the need to understand the prevalence of AD in mathematics education. The concurrent nested design enables the simultaneous collection of quantitative and qualitative data, with one form of data providing supportive or explanatory insights for the other (Ntumi et al., 2023; Warfa, 2017). This study's qualitative component is nested within the quantitative component to provide possible explanations for AD occurrence. This nested design is particularly suited to examining AD in mathematics education because it addresses both the extent of the issue (quantitative) and the underlying reasons and justifications for AD (qualitative), which offers a better understanding of AD in mathematics.

Primarily, the study gathered quantitative data and analysed it using descriptive and comparative designs. The descriptive method was employed in assessing the demographic factors and frequency of AD as specified by the students. Meanwhile, a comparative method was employed to test the differences between the prevalence of AD and the students' demographic characteristics. The qualitative data were then used to deepen the interpretation of the quantitative findings and to corroborate the assumptions made in the study. The qualitative data were categorised using Braun & Clarke's (2012) thematic analysis method.

3.2 Study Setting and Participants

This study employed purposive and convenience sampling techniques to recruit participants. Specifically, researchers targeted Bachelor of Secondary Education Major in Mathematics (BSEd-Math) students at a certain state university in Leyte, the Philippines. A total of 105 students participated in the study. Pre-service teacher education mathematics students were purposefully selected, given their extensive exposure to mathematics courses and their future roles as educators, making them a relevant group for investigating AD in mathematics education. The sample size of 105 was determined based on practical considerations, including the availability and willingness of students to participate, as well as resource constraints such as time and accessibility within the academic term.

Given the challenges in coordinating with students' diverse schedules and learning modalities, random sampling was not feasible. Instead, convenience sampling was employed alongside purposive sampling to ensure an adequate number of participants. This approach allowed the researchers to gather a representative sample while addressing the logistical limitations of the study. For the qualitative component, semi-structured interviews were conducted with 16 teacher education mathematics students, as the point of data saturation had been reached with this number. The selection for interviews was also based on purposive sampling, focusing on students who displayed varied responses in the survey to capture a wide range of experiences and gain insights into the underlying factors that influence AD.

3.3 Instrumentations

Building on established methodologies, this study employed a self-report survey. The first part of the survey collected data on student demographics, including gender, year level, and mathematics performance. Mathematics performance was assessed using the university's grading system, which categorised performance as follows: Excellent (1.0-1.4), Superior (1.5-1.9), Very Good (2.0-2.4), Good (2.5-2.9), Passed (3.0), Conditional Failure (3.1-4.0), and Failure (4.1-5.0). The second part of the survey assesses students' engagement in AD using a 5-point Likert-type scale (ranging from 1- Never to 5- Almost every time). In this study, the scale was interpreted as follows: "1- Not Prevalent, 2- Less Prevalent, 3- Moderately Prevalent, 4- Prevalent, and 5- Very Prevalent". It consists of four main constructs: cheating on tests, cheating on assignments, plagiarism, and other forms of AD. Each construct was evaluated using specific items: five items for cheating on tests, five for cheating on assignments, three for plagiarism, and four for other forms of AD.

Table 1. Number of Items and Cronbach's Alpha for each AD Construct

Construct	Number of Items	Cronbach's Alpha
Cheating on Tests	5	0.78
Cheating on Assignments	5	0.74
Plagiarism	3	0.71
Other Forms of AD	4	0.75
	Overall Instrument	0.76

The survey instrument was adapted from the original scale developed by Lin and Wen (2006), with minor modifications made to align the instrument with the specific context of mathematics education in a state university in Leyte, Philippines. Modifications included rephrasing certain items to reflect the terminology and scenarios relevant to mathematics courses. To ensure the instrument's validity, a validation procedure was undertaken. Initially, two mathematics education experts reviewed the instrument for content validity, focusing on the relevance and clarity of each item. Then, the instrument was pilot-tested with a non-sampled group of engineering students from the same institution, chosen because of their similar exposure to mathematics courses. The reliability of the instrument was confirmed through the calculation of Cronbach's alpha for each construct, as shown in Table 1. The overall Cronbach's alpha of 0.76, interpreted as acceptable internal consistency (Ursachi et al., 2015), confirmed the instrument's reliability and provided the necessary green light for the researchers to proceed with the actual data gathering.

In addition, semi-structured interviews were conducted to gain a better understanding of the factors that influence AD in Mathematics. This type of interview was chosen to allow flexibility in exploring participants' responses in more detail, particularly in uncovering the factors that may contribute to AD among students. The interview guide was carefully designed to align with the study's objectives, focusing on essential aspects such as students' motivations for engaging or avoiding AD, the challenges they faced in understanding mathematical concepts, and their perceptions of external

pressures or influences. Sample questions such as *"What factors do you think contribute to your decision to engage in academic dishonesty in your mathematics courses?"* and *"Can you share any instances where you felt pressured to cheat, and what motivated that decision?"* were included to elicit detailed and reflective responses.

3.4 Ethical Considerations

Strict anonymity measures safeguarding privacy and ensuring participant well-being were enforced, excluding any collection of names and any identifiable details. Participants received detailed information on research procedures, confidentiality measures, and data usage, followed by informed consent. Participation was voluntary, with no pressure to join or consequences for declining. Students could freely choose to participate or withdraw at any time without any impact on their academic standing. Furthermore, the researchers assured participants that the acquired data would only be used to fulfill the study's objectives and treated with the utmost confidentiality.

3.5 Data Gathering Procedure

Permissions were obtained from the school and department heads before data acquisition. The research objectives and the instrument used were included in the communication letter to ensure transparency and verify that there were no potential violations that could result in the refusal of the procedure. Upon receiving approval, participants were given a briefing on the research content, questions, and tasks. Ample time was allotted for them to respond to all survey items.

Moreover, semi-structured interviews were conducted to gather more in-depth and authentic responses, going beyond what was obtained through the self-report surveys. The interviews were conducted face-to-face with 16 student participants studying teacher-education mathematics. Each interview lasted for approximately 15 to 25 minutes. The participants' narratives were transcribed after each interview, coded, and subjected to thematic analysis. Each participant was assigned unique codes to guarantee confidentiality and anonymity. The participants' details were stored securely in a file, while the audio recordings, including the transcribed data, were saved on Google Drive.

The transcribed and coded data from the participants' narratives were presented back to them to ensure the truthfulness and trustworthiness of the collected data. The data for the study was collected during the second semester of the academic year 2022-2023 and stored in a Google Drive folder that was accessible only to the researchers. The audio recording was promptly removed upon completion of the transcription.

3.6 Data Analysis

Textual and tabular presentations summarised the collected data on the students' AD in Mathematics. The study used frequency counting, weighted means, standard deviations, and percentages to assess the extent of AD occurrences in mathematics. Furthermore, based on the normality test, the distribution of the study variables departed significantly from normality for the cheating in tests (W= .965, p-value = 0.007), cheating in assignments (W= .975, p-value = 0.044), plagiarism (W= .911, p-value = 0.000); and others (W= .719, p-value = 0.00). Hence, Mann-Whitney U and Kruskal-Wallis tests were used to analyse the differences between AD occurrences, gender, and year levels. Kendall's Tau-b test analysed the association between mathematics performance and AD occurrences. The statistical data analyses were formally done using the JAMOVI statistical analysis software.

Further, the synthesised data collected from interviews were systematically and thematically analysed in line with Braun and Clarke's (2012) six stages of conducting thematic analysis: *(1) Familiarising with the data:* The researchers listened to the audio recordings and read the written transcripts multiple times. The researchers noted the most significant responses expressed by the students; *(2) Generating its initial codes:* The researchers manually grouped the significant statements with initial codes; *(3) Searching for the themes:* Potential themes were generated by looking through the initial codes and significant statements; *(4) Potential themes review:* After conducting a thorough search for themes, the researchers carefully examined and evaluated each potential theme. The objective

was to determine the relevance of these themes to the underlying reasons why students engage in academic dishonesty (AD), such as factors that may have influenced their decisions to resort to cheating, plagiarism, or other forms of AD.

Following this, the researchers merged some of the themes that seemed to be similar, resulting in a handful of emerging themes. The final rereading and review of each theme was also done to find the most relevant themes in the data set. *(5) Naming and defining the themes:* In this phase, the researcher defined and labelled each generated theme and analysed the significance of each theme to the obtained data. The researchers discussed in detail the distinguishing features of each theme; and *(6) Providing the final report:* The researcher produced the final report based on the analysed data, ensuring that there were no repetitions or other concerns that could affect the accurate presentation of the findings. To ensure credibility and trustworthiness, the transcribed and coded data along with the interpretations from the semi-structured interviews were presented to the participants for their review and confirmation.

4. Results and Discussion

In this section, we presented our analysis and interpretation of the data collected from surveys with study participants.

4.1 Demographic Factors of the Students

The distribution of the students' demographic factors is presented in Table 2. As shown in the table, 105 mathematics education students, composed of 32 males (30.48%) and 73 females (69.52%), responded to the study. Similarly, there were a total of 29 freshmen (27.62%), 40 sophomores (38.09%), and 36 juniors (34.29%). The students' mathematics performance, as measured by their grade point average (GPA) in Mathematics, suggests difficulty obtaining higher grades in Mathematics courses. Most students (57.14%) had a GPA between 1.5 and 1.9, with progressively fewer in lower ranges (34 between 2.0-2.4, 8 between 2.5-2.9, and only 3 between 1.0-1.4). With the data concentrated at lower intervals, this pattern further reinforces the idea that it becomes more challenging to achieve higher grades in mathematics courses.

Table 2. Distribution of Students' Demographics

Variables	Frequency	Percent
Gender		
Male	32	30.48
Female	73	69.52
Year Level		
Freshmen	29	27.62
Sophomores	40	38.09
Juniors	36	34.29
Mathematics Performance		
Excellent	3	2.86
Superior	60	57.14
Very Good	34	32.38
Good	8	7.62

Note: No. of cases = 105

4.2 Prevalence Rates of AD in Mathematics

Table 2 reveals that the most common forms of AD in mathematics involve students directly aiding each other. These include copying assignments, collaborating on individual tasks, offering unauthorised assistance during exams, and sharing completed work. These findings demonstrate a

concerning trend: students are more likely to engage in AD when they see others doing it. This stresses the significant role of peer influence and pressure in academic misconduct, making it a critical factor for fair assessments, ethical learning, and student integrity. It is crucial to actively address peer-to-peer misconduct to promote academic integrity in the classroom. Another characteristic noticeable among the most common forms of AD is its significance in the field, given that assessments constitute a significant fraction of the student's grades. Most students felt pressure to resort to AD due to the assessment's challenging topic, lack of relevant knowledge, or time constraints. Furthermore, this study revealed that using prohibited devices and manipulating grade scores and documents were not prevalent forms of AD in mathematics. Stringent monitoring, the ease of verification, and the potential severity likely contribute to the lower prevalence of these circumstances than others. The gravity of potential consequences, including expulsion and reputational damage, could be critical factors influencing students' decisions to avoid these specific forms of AD.

Table 3. Distribution of AD Prevalence in Mathematics Courses

AD Forms	Items	$\bar{X}$	Std. Dev.	QD
Cheating on tests	Copied from other students	2.29	0.84	LP
	Passed answers to other students	2.62	0.96	MP
	Used prohibited crib notes	1.39	0.64	NP
	Obtained the test questions illegally	1.15	0.55	NP
	Used unauthorized electric equipment	1.19	0.50	NP
	Overall Mean	1.73	0.698	LP
Cheating on assignments	Copied from other students	2.88	0.81	MP
	Worked on an assignment with others when asked for individual work	2.74	1.09	MP
	Provided a paper or assignment for another student	2.41	1.03	LP
	Gave forbidden help to others on their assignments	2.69	0.85	MP
	Did less of my share of work in a group project	2.00	0.88	LP
	Overall Mean	2.54	0.932	MP
Plagiarism	Fabricated a bibliography/reference	1.42	0.80	NP
	Copied materials without footnoting them	1.85	0.92	LP
	Referenced materials without truly reading them	2.04	0.99	LP
	Overall Mean	1.77	0.903	LP
Others	Falsified grade scores	1.09	0.34	NP
	Changed test or assignment answers after being given grade scores	1.18	0.43	NP
	Falsified school documents	1.12	0.47	NP
	Made a fraudulent excuse to postpone exams and/or assignments	1.50	0.81	LP
	Overall Mean	1.22	0.51	LP

Note: No. of Cases = 105; 4.50-5.00= Very Prevalent (VP); 3.50-4.49= Prevalent (P); 2.50-3.49= Moderately Prevalent (MP); 1.50-2.49= Less Prevalent (LP); 1.00-1.49= Not Prevalent (NP)

Zhao et al. (2022) highlighted that peer cheating had the most significant impact on factors like age, particularly impacting younger students' susceptibility to cheating due to peer pressure. Several studies (Gentina et al., 2015; Krueger, 2014; Zhang & Yin, 2019) have shown that peer collaboration, especially in mathematics (Pavlin-Bernardić et al., 2016), can facilitate academic cheating with collaborative intent. This can happen through sharing solutions, working together beyond the permitted scope, or dividing tasks unequally. Subsequently, understanding the most common forms of AD would equip mathematics teachers to effectively combat them, ultimately promoting fairer assessments, urging a more ethical learning environment, and strengthening overall academic integrity. The insufficient effort in learning, often fueled by anxiety, fear of failure, or inadequate study habits, aligns with findings from previous studies (Anderman & Won, 2017; Cuadrado et al., 2019), which identified similar factors motivating students toward academic misconduct. Attempts to gain unfair advantages during exams

were somewhat common, with copying assignments from other students, and collaborating with others on individually assigned tasks being the most frequent. Building on previous research suggesting a link between moral beliefs and AD perception (Ives et al., 2016; Ives & Giukun, 2019), this study found that students prone to AD viewed it as more acceptable than those who avoided it. Additionally, Chirikov et al. (2019) highlighted the influence of teacher responses on student integrity. Students under strict faculty guidance, particularly those taught by professors with rigorous consequences for specific misbehavior like cheating or plagiarism, demonstrated less tolerance towards academic misconduct, suggesting that stringent disciplinary measures might deter students from engaging in AD.

4.3 Prevalence of students committing AD at least once in Mathematics

Table 4 exhibits the number of students who admitted to cheating in the AD form at least once, identified by analysing their means. Each student manifesting a mean higher than 1 has done the misdeed in the specific type, at least once. This gives a general review of where students are more tempted to attempt AD in mathematics. This further suggests that more common forms of AD should be given priority to avoid further proliferation of the act. The table highlights the pervasiveness of AD in mathematics, as 105 students reported cheating on assignments, with 96 also admitting to test cheating, 81 to plagiarism, and 45 to other forms of AD. The high prevalence of assignment cheating suggests it may be the most common form of AD, likely due to its unsupervised nature compared to tests.

Table 4. Prevalence rate of students committing AD at least once in Mathematics

AD Forms	Frequency	Percent
Cheating in Tests	96	91.43
Cheating in Assignments	105	100.00
Plagiarism	81	77.14
Others	45	42.86

Note: No. of cases= 105

Similar to the findings in Table 3, assignment cheating exhibits the highest actual frequency and attempt. Meanwhile, some students may have chosen to try cheating and been dissuaded from doing so, whereas others may have chosen to continue committing the act. Another factor could be the difficulty of committing the act. Since tests are proctored, it would be more complicated for students to attempt such on-the-spot compared to plagiarism, which would not be mostly monitored. One student claimed that

> I am unable to cheat because we are being monitored
>
> (P15)

while another asserted that they do not cheat

> ... because the quiz or exam was proctored
>
> (P3)

These statements denote not only their reluctance to engage in the act, but also their inability to do so.

Students might copy answers from notes, collaborate with classmates, or search for answers online during unsupervised assessments, believing the lack of supervision makes these actions more acceptable and less likely to result in consequences. This lack of oversight during assignments might explain why students are more likely to engage in activities like copying solutions from unauthorised sources, sharing answers with classmates, or seeking help from online forums for correct answers. Other

studies have shown that unsupervised assessments lead to higher cheating rates than supervised ones (Dendir & Maxwell, 2020; Alvarez et al., 2022). Differences in AD between supervised and unsupervised assessments are substantial, with research consistently showing significantly higher rates of cheating in unsupervised settings (Azar & Applebaum, 2020; Vazquez et al., 2020; Janke et al., 2021; Dyer et al., 2020). Following the rational choice theory (Cornish & Clarke, 1987, as cited in Nagy & Groves, 2021), it is only upon great scrutinization of the situation that an action shall be done through a cost-benefit analysis. This is exemplified by the students' rationalisation of how they should act during supervised and unsupervised environments, given that proctored tests lead to higher probabilities of getting caught.

In line with this study's findings, other studies also identified tests and assignments as the most prevalent forms of AD (Balbuena & Lamela, 2015; Bachore, 2016; Alvarez et al., 2022), despite not focusing on specific subjects. Flom et al. (2021) identified a higher prevalence of cheating on ongoing tasks than on formal assessments such as essays and exams, suggesting that the pressure of deadlines and procrastination among students may play a role. Meanwhile, Ampuni et al. (2019) found a high prevalence of AD among university students associated with lower moral integrity and higher levels of moral disengagement. The fear of getting caught is also a strong deterrent; thus, educators can leverage this by implementing strict supervision and monitoring, using various assessment methods, and promoting open communication about academic integrity.

4.4 Reasons for Engagement in and Avoidance of AD

Academic Dishonesty (AD) is a moral issue and therefore requires justification for its conduct, as students tend to rationalise and consider different options before engaging in such acts. To better understand the justifications for and potential deterrents of AD, students were asked about their reasons for engaging in it, regardless of frequency, and their strategies for avoiding it. However, the intertwined nature of justifications and avoidance strategies in student responses hampered pinpointing the drivers of individual AD types. A single explanation does not encompass all AD forms. Some students provided multiple reasons, overlapping with those identified by Balbuena and Lamela (2015) and Sariasih and Tisnawijaya (2019), such as academic pressure, subject difficulty, lack of knowledge, and laziness. In this study, Braun and Clarke's (2012) six stages of conducting thematic analysis were utilised to explore the underlying reasons of students regarding AD, including factors that may influence their decisions to engage in cheating, plagiarism, or other forms of AD.

Table 5. Justifications for AD engagement and AD avoidance

Justifications for AD Engagement	Justifications for AD Avoidance
Difficulties in understanding mathematical concepts	Classroom dynamics and assessment methods
Struggle with self-regulation and emotional well-being	Ethical and moral values
External influences and expectations	Competence and Competitiveness

Table 5 presents the reasons why students engage in AD and the reasons why they avoid such behaviour. Students primarily justified their engagement in AD due to difficulties in understanding mathematical concepts, struggles with self-regulation and emotional well-being, and external influences and expectations, such as peer and family pressure. On the other hand, students also identified justifications that discourage them from engaging in AD. The dynamics of the classroom and the assessment methods used by teachers play a significant role in this regard. Ethical and moral values, which are developed through upbringing and personal belief systems, serve as another strong deterrent. Students who prioritise integrity are more likely to resist the temptation to engage in dishonest practices. Similarly, a sense of competence and competitiveness acts as a deterrent, especially among students who take pride in their abilities and prefer to achieve success through honest means rather than shortcuts.

Justifications for AD Engagement

Theme 1: Difficulties in understanding mathematical concepts

Students' perceptions of mathematics as a demanding discipline often contribute to instances of academic misconduct, particularly citing difficulties in understanding mathematical concepts as justifications. These justifications may revolve around specific concepts like learning trigonometry, calculus, and advanced topics, suggesting a probable link between perceived difficulty and academic integrity violations. Some students expressed that:

> Due to my busy schedule, which includes work and other commitments, I often find myself short on time for studying major subjects. Balancing the demands of both my major and minor subjects puts me feeling stretched thin, making it difficult to dedicate enough time to understand the material for quizzes and tests, especially in my major.
>
> (P14)

> Mathematics poses significant challenges for me, especially when it comes to learning trigonometry and calculus. My primary objective is to achieve a passing grade in this subject. Unfortunately, this has led me to resort to cheating.
>
> (P1)

The students' justifications, which often cite specific challenging mathematical concepts, support the study's idea about the stigma of difficulty in mathematics courses. This is also consistent with research by McCabe et al. (2012), who found that the perception of course difficulty increases the likelihood of cheating. Shmeleva and Semenova (2019) further support this by demonstrating that students who struggle academically are more likely to engage in dishonest behaviour. Building on these findings, some students even view cheating as an acceptable means to improve their performance in mathematics courses. This is also where peer collusion is highly done, with some of the reasons being shared by one student:

> I tend to simply copy answers from my classmates, especially when the maths problems given are confusing. This helps me obtain a passing grade in the subject
>
> (P6)

While this study did not specifically examine student acceptability of potential AD scenarios, other research indicates its potential impact on reported prevalence. For instance, in a study by Dyer et al. (2020), it was discovered that students' reports of engaging in dishonest behaviours, such as copying during unsupervised assessments, were directly influenced by their perception of the acceptability of these actions. This finding suggests that future research on AD should encompass evaluations of the act itself and its perceived acceptability to achieve a more comprehensive understanding of the phenomenon.

Theme 2: Struggle with self-regulation and emotional well-being

Students often struggle with mathematics because they do not have a thorough understanding of basic mathematical principles. This lack of knowledge can be attributed to their tendency to avoid difficult mathematical concepts, which could be the result of struggling with self-regulation and well-being, as well as their perception of mathematics as a challenging subject. One student stated that:

> Sometimes, I am too bored to study mathematics since the lessons are difficult to understand (P13)

Another stated:

> Often during lessons, I lose focus and become inattentive to the details being taught. I am also too lazy to study, especially since Mathematics is difficult and I lose motivation easily (P16)

The difficulty in concentrating, which is associated with low self-regulation, can result in a lack of attention during classes (Tang, 2017), especially when there are distractions. However, relying solely on students' self-regulation is insufficient. The absence of enjoyable activities that cater to different learning styles and active learning strategies also contributes significantly to disengagement, emphasising the importance of effective teacher intervention (Vale & Barbosa, 2023). Although some students may appear indolent, their behaviours may stem from deeper issues such as lack of interest, teacher's teaching ability, or inadequate support systems, which highlights the necessity to create an engaging learning environment that addresses students' challenges in learning mathematics.

Moreover, high test anxiety among students could hinder performance, leading to decreased focus, cognitive overload, and difficulties applying learned concepts during assessments. Moreover, studies like Xie et al. (2018) suggest that the impact of test anxiety on performance may even differ between genders, suggesting the need for gender-sensitive assessment practices. A particular student (P16) also stated:

> I feel nervous in my mathematics class, especially during surprise quizzes and exams (P16)

conveying the pressure experienced by spontaneous tests. Eshet et al. (2021) revealed that AD in unsupervised online exams was significantly more likely among students experiencing higher test anxiety, which itself was predicted by past performance and the learning environment. The presence of teachers during face-to-face exams, possibly through their stress-reducing and accountability-promoting roles, can be a crucial factor in upholding academic integrity.

Theme 3: External influences and expectations

Academic pressure, fueled by the fear of disappointing oneself and others, can significantly influence students to resort to AD. This pressure is often exacerbated by an excessive emphasis on grades in evaluations, causing students to feel desperate for a quick solution to improve their academic standing, even if it means compromising their academic integrity. One student stated that:

> I often resort to cheating because I am afraid of failing (P2)

Another student expressed:

> I am unsure about how to handle my academic difficulties, especially in mathematics. I feel pressured to pass this subject, so I resort to asking answers to my classmates (P9)

Moreover, academic and family pressure may contribute to students' desire to improve their grades, which in turn increases the likelihood of engaging in AD. This pressure creates an environment that encourages AD by pushing students toward unethical behaviours. These behaviours are often motivated by concerns about maintaining high grades, securing prestigious jobs, or meeting unrealistic family expectations (Saana et al., 2016). When students face excessive pressure from their families to excel academically, they may resort to unethical practices (Finchilescu & Cooper, 2017). This can be observed in the reasons given by students for engaging in AD. One student said:

> I commit academic dishonesty to aim for higher scores so that there would be less disappointment to my families and friends
>
> (P11)

Meanwhile, another student stated:

> I cheat to pass the subject. I am afraid that I might disappoint my parents' expectations
>
> (P8)

Similarly, when students feel pressured to excel academically, the fear of failure becomes overwhelming. This pressure may stem from parental expectations or the individual's ambition to succeed. Academic pressure could drive students to engage in unethical practices, such as cheating or plagiarism, to meet expectations and avoid disappointment from their families. While not all students under pressure resort to AD, it is crucial to recognize the vulnerability created by such stressors and promote alternative approaches to academic success based on ethical learning and strong support systems. On the other hand, specific factors associated with academic and family pressure could create an environment discouraging AD. One possible justification is that high academic and family stress can encourage a strong work ethic and promote a sense of personal responsibility in students. When students are driven by a genuine desire to succeed and are motivated by their own goals and aspirations, they may be less likely to resort to AD (Kite et al., 2022). In such cases, the intrinsic motivation to learn and achieve may outweigh the external pressures, reducing the inclination towards cheating.

Furthermore, peer influence was a common premise in the prevalent forms of AD. This could be attributed to various factors, such as the perceived benefits of working with peers in cheating, the acceptance of such behaviour within certain social groups, or the pressure to adhere to peer expectations. The desire to avoid being seen as selfish and enhance their reputation motivated some students to benefit their peers. However, others were driven by genuine altruism or a strong sense of solidarity, exemplified by the "one for all, all for one" attitude. Studies (Diego, 2017; Shmeleva & Semenova, 2019) suggest a possible connection between perceived peer behaviour and actual engagement in AD, as a notable percentage of students who believe their peers engage in AD are more likely to do so themselves. One student has expounded on this justification:

> I want to help my classmates, and I do not want to be labelled as selfish. Besides, I also derive benefits from this arrangement, as they also assist me, and I am determined to enhance my grades.
>
> (P5)

Similarly, another student stated that:

> I am hesitant to cheat. Instead, I give them my answers upon request because I sympathise with those who are having difficulties and cannot arrive at the answer on their own
>
> (P15)

Justifications for AD Avoidance

Theme 4: Classroom dynamics and assessment methods

This study also identified classroom dynamics and assessment methods as a deterrent to AD. Three factors often worked in tandem: teacher disposition, assessment type (supervised vs. unsupervised), and potential consequences. This interplay influenced the specific forms of AD

observed, with less prevalent methods like using mobile devices during exams being more likely to be deterred by strict teachers and the threat of consequences like confiscation:

> If I used my cellphone to search for something during my exams and get caught, the teacher would confiscate it
>
> (P10)

Specifically, student respondents mentioned avoiding AD due to fear of getting caught. Plus, the fear of potential consequences implemented in classrooms, influenced by the teacher's strictness, prevents students from engaging in misconduct during supervised assessments. This indicates that a combination of vigilant monitoring and clear consequences can effectively prevent certain forms of AD. Similarly, a common teacher intervention for cheating is a significant grade reduction, as expressed by one student:

> My mathematics instructor is strict during class hours. She gives zero marks to students who are caught cheating
>
> (P3)

This was supported by another student who also said:

> I want to avoid any negative impact on my grades as a result of engaging in cheating
>
> (P7)

In contrast, students sometimes engage in a cost-benefit analysis before resorting to AD. They weigh the perceived severity of their situation against the potential benefits of cheating and the anticipated consequences of getting caught. One student stated that:

> There are times when the level of risk is higher. There are also situations that I actively try to avoid, as I consider them to be more severe offences compared to others
>
> (P14)

This risk assessment often leads to avoidance of dishonesty in more high-stakes situations, suggesting that students act strategically based on their understanding of severity and potential outcomes. Meng et al. (2014) highlighted that student misconduct is more likely when they perceive the benefits of dishonesty as outweighing the potential consequences, even if they are aware of the risks. While factors like perceived benefits over consequences can encourage dishonesty, studies demonstrate various effective deterrents: faculty intervention emphasising the severity of consequences (Yu et al., 2018), and student involvement in policy and enforcement (Stoesz et al., 2019).

Theme 5: Ethical and moral values

Students also cited their ethical and moral values as the reason for not engaging in AD. Students with high moral and ethical values are less likely to commit AD due to their strong sense of integrity and personal responsibility:

> I want to be honest and fair to myself and everyone.
>
> (P2)

According to Smith et al. (2018), individuals with high moral standards are motivated by a sense of justice and fairness, making them more inclined to adhere to ethical principles. These students place a high value on authenticity and honesty in their academic pursuits, which acts as a deterrent against engaging in dishonest practices. One student argued:

> I do not wish to be stigmatised as a dishonest individual solely based on one instance of being caught engaging in cheating behaviour

(P12)

Some simply stated that it is unjustifiable:

> Dishonesty should be avoided by students because it is ethically wrong, regardless of their intentions.
>
> (P7)

supported by another student who stated:

> Simply because those are the rules and regulations of the class
>
> (P6)

According to Johnson (2015), students with a strong moral compass exhibit greater responsibility, recognizing the reputational consequences of dishonest actions. These students are driven by a deep commitment to fairness and personal integrity, making them less likely to engage in AD. Anderson (2022) likewise affirmed that students with strong moral beliefs are more likely to make ethical choices. Their well-developed moral framework equips them to carefully weigh the ethical implications of their actions. They are to weigh the short-term gains of AD against the long-term negative consequences, including jeopardising their academic integrity and potentially limiting their future opportunities.

Students with strong moral values tend to demonstrate higher academic self-efficacy (Li et al., 2023). This stems from their belief that success earned through ethical means reflects their true abilities, unlike achievements tainted by dishonesty. They see education as a journey of personal and intellectual growth, not merely a path to an end goal. Consequently, their values fuel their motivation to work diligently, refine their skills, and achieve genuine success. Furthermore, other studies suggest potential gender-based differences in moral values and perceptions (Lento et al., 2018; Ampuni et al., 2019; Zhang et al., 2017) which could contribute to the observed discrepancies in AD prevalence.

Theme 6: Competence and Competitiveness

Despite the complexity of mathematics and students' desire to succeed, some students remained steadfast in their commitment to academic integrity by refusing to cheat to understand mathematical concepts. Even if this meant risking failure on assessments, some students believed that assessments were valuable learning opportunities that helped them identify areas where they needed to improve. Competitive students are less likely to commit AD due to their intense drive for achievement and personal success. Yang et al. (2023) stated that highly competitive students value performance and perceive AD as a threat to their achievement. These students, who are motivated by self-improvement, may view cheating as contradicting their abilities and goals. Competitive students tend to prioritise fairness and integrity and understand how cheating disrupts the level of competition, creating an unfair advantage over their peers. This emphasis on fairness aligns with students' broader ethical and moral beliefs, evident in their desire for fair treatment within the classroom setting. Consequently, their competitive nature is an internal deterrent against dishonest behaviours as expressed by one student:

> If I cheated to show people that I am good in mathematics, it would be the same as deceiving myself
>
> (P4)

Similarly, another student indicated:

> I love to solve mathematics problems by myself. Even if my answer may not be precise, I am trying to do my best to find the right solution without copying someone else's work as a reference
>
> (P10)

Aside from self-deception, others choose to avoid it for self-efficacy:

> If I cheat frequently, I would not be able to assess my learning. I would remain unaware of my weaknesses and strengths. Additionally, I strive to demonstrate to myself and others that I am capable of independent learning and accomplishing goals honestly.
>
> (P8)

Another factor contributing to the lower likelihood of AD among competitive students is their fear of negative consequences. Li et al. (2019) stressed that competitive individuals tend to be highly aware of the potential repercussions of cheating. They are more concerned about the potential damage to their reputation, academic standing, and future opportunities. This fear of negative consequences is a deterrent, as they weigh the potential benefits of cheating against the potential harm it may cause. Furthermore, competitive students are often motivated to continually improve their skills and knowledge, leading them to prefer the long-term benefits of genuine learning over short-term gains through dishonesty (McCabe et al., 2012). Students also recognize that AD is a form of self-deception and that engaging in it would lead to overestimation of one's abilities and to the inability to determine one's competence. Competitive academic environments may have the potential to discourage AD among students. Bretag et al. (2019) observed a decrease in overall cheating prevalence when students are aware of other's academic achievements. This suggests that social dynamics in competitive settings might play a role. One possibility is that students facing constant awareness of their peers' performance feel held accountable, leading them to act with integrity. Additionally, peers themselves could act as informal social control mechanisms, discouraging dishonesty out of fear of disapproval or reputational damage.

4.5 AD prevalence across students' demographic factors

This study also examined the prevalence of AD among students, considering factors such as gender, year levels, and mathematics performance. Table 6 presents the summarised results, highlighting AD prevalence across the identified demographic factors.

Table 6. Mann-Whitney U test between AD Prevalence of Male and Female students

Group		N	Mean Rank	Mann-Whitney U test	
				Z	p
Cheating in Tests	Male	32	44.52	-1.911*	.056
	Female	73	56.72		
Cheating in Assignments	Male	32	49.77	-.725*	.468
	Female	73	54.42		
Plagiarism	Male	32	52.89	-.025*	.980
	Female	73	53.05		
Others	Male	32	56.59	-.892*	.372
	Female	73	51.42		

Note: *Not significant at $\alpha < 0.001$; No. of cases= 105

Previous studies stressed that gender may be used as a contributing factor to the prevalence of AD (Krienert et al., 2021; Quraishi & Aziz, 2017; Özcan et al., 2019; Pavlin-Bernardić et al., 2016). Based on the result, the Mann-Whitney U test found no statistically significant differences in cheating in tests (Z=-1.911, p=.056), assignments (Z=-.725, p=.468), plagiarism (Z=-.025, p=.980), and other forms of AD (Z=-.892, p=.372) between males and females. This suggests that there is not enough evidence to conclude that gender differentiates any form of AD examined in this study. It implies further that males and females engage in AD at similar rates, regardless of the specific type of cheating behaviours. This aligns with previous research by Friedman et al. (2016), who found no significant gender differences in dishonest behaviour even with varying consequences.

The result further supports Azar and Applebaum's (2020) study, which revealed dishonesty among students using a test-retest method in a mathematics competition. While they found that boys were slightly more honest in the unsupervised setting, both genders engaged in similar levels of AD. However, other studies suggest gender differences in the prevalence of AD, with males reportedly engaging in it more frequently (Gallant et al., 2015; Zhang et al., 2017; Ampuni et al., 2019). While this study determines that gender does not have a significant influence on engagement in AD, it is crucial to acknowledge potential limitations. The sample in this study was significantly skewed towards females, which could potentially affect the results. Additionally, this study did not assess students' moral beliefs, which other research suggests may influence the relationship between gender and the frequency of AD. Future research should address these limitations by using a more balanced sample and incorporating measures of moral beliefs to further substantiate the result.

Table 7. Kruskal-Wallis Test between AD Prevalence and Students' Year Levels

Group		N	Mean Rank	Kruskal-Wallis Test	
				χ^2	p
Cheating in Tests	Freshmen	29	31.00	21.863**	.000
	Sophomore	40	63.66		
	Juniors	36	58.88		
Cheating in Assignments	Freshmen	29	54.50	3.308*	.191
	Sophomore	40	58.33		
	Juniors	36	45.88		
Plagiarism	Freshmen	29	57.12	3.366*	.186
	Sophomore	40	56.58		
	Juniors	36	45.60		
Others	Freshmen	29	56.95	.938*	.626
	Sophomore	40	50.55		
	Juniors	36	52.54		

Note: ** Highly significant at $\alpha < 0.001$; *Not significant at $\alpha < 0.001$; No. of cases= 105

The Kruskal-Wallis test revealed a significant difference in the prevalence of cheating on tests across year levels (Z=21.863, p=.000), indicating that some year groups had higher rates than others. However, no significant differences were found for other forms of AD such as cheating on assignments, plagiarism, and others. This suggests that year level may be an indicator for predicting test cheating, but not necessarily other forms of AD. To determine which year groups differed in test cheating, a post hoc Mann-Whitney U-test was conducted, and the results are presented in Table 8.

Table 8. Post hoc Mann-Whitney U test summary for year-level differences regarding cheating in tests

Year Levels	Year Level	n	Mean Ranks	p
Freshmen vs. Sophomores	Freshmen	29	22.91	.000**
	Sophomores	40	43.76	
Freshmen vs. Juniors	Freshmen	29	23.09	.000**
	Juniors	36	40.99	
Sophomores vs. Juniors	Sophomores	40	40.40	.186*
	Juniors	36	36.39	

Note: **Significant at $\alpha < 0.001$; *Not significant at $\alpha < 0.001$; No. of cases= 105

The post hoc Mann-Whitney U-test identified freshmen students as exhibiting significantly lower levels of test cheating compared to both sophomores and junior students. This finding, evidenced by the mean ranks in Table 8, seems counterintuitive, suggesting that freshmen engage in test cheating less frequently than both sophomores and juniors. However, other studies indicated that the year of study was found to be a significant predictor of AD, with junior, senior, and sophomore students being more susceptible to engaging in academic misconduct (Valenzuela et al., 2022; Idrus et al., 2016). Thomas (2021) reported that seniors found morally questionable acts more justifiable than younger individuals. This finding is supported by Liu and Alias' (2022) study, which found that senior undergraduates in China were more likely to engage in morally questionable behaviour compared to sophomores. One possible explanation could be the perceived fairness of classroom environments, where freshmen students might find instructions and expectations clearer and more consistent, leading to less perceived need for dishonesty.

While it is surprising that freshmen students exhibit lower rates of cheating in mathematics courses, several potential explanations should be explored. One possible cause could be the continuing decline in competitive behaviour among children and adolescents (Lee et al., 2022; Hu & Zhu, 2018), which may be a trend that college students follow over time. If college students are indeed following this trend, it could explain their willingness to collude, as peer influence has been shown to play a crucial role. Freshmen students, being new and less connected, may have less exposure to peer pressure to cheat.

Zhang et al. (2017) also found that seniors have higher cheating rates than freshmen students. Oran et al. (2016) also discovered increased cheating tendencies among junior students, which they attribute to the prevalence of theoretical courses at that level. These findings may suggest a trend of increased cheating as students progress through their academic years. However, another possible explanation could be the difference in course loads, particularly the number of mathematics courses taken. Freshmen students may have fewer mathematics courses compared to students in other years, which limits direct comparisons and potentially influences their perceived engagement in test cheating. Nevertheless, due to the non-longitudinal nature of this study, it is not possible to definitively conclude whether their behaviour changes over time

Table 9. Kendall's Tau-b test between Mathematics Performance and AD Prevalence

Variables		τ_b-value	p-value
Mathematics Performance	Cheating in tests	-0.125*	0.078
	Cheatings on assignments	-0.031*	0.662
	Plagiarism	0.109*	0.130
	Others	-0.034*	0.656

Note: *Not Significant at $\alpha < 0.001$; No. of cases= 105

Kendall's Tau-b test showed that there is no association between mathematics performance and the prevalence of all AD forms. The result suggests that students' mathematics performance may not be influenced by the prevalence of AD, nor is it associated with the frequency of AD occurrences. Students engage in AD to complete and improve their academic activities, regardless of their performance. GPA in mathematics may not moderate AD prevalence due to the competitive nature of academic studies (Kiekkas et al., 2020), which could lead both individuals with higher and lower GPAs to engage in misconduct. Hence, this could be attributed to the simultaneous belief in competitiveness and persistence, especially considering that Mathematics courses are perceived as challenging.

This result, however, contradicts other studies (Koscielniak & Bojanowska, 2019; Kiekkas et al., 2020; Henning et al., 2013) that claim GPA can significantly influence AD, suggesting that students with lower GPAs are more likely to engage in such behaviour. One possible explanation for this is the heightened pressure that these students face in attempting to validate themselves. Another reason could be their limited understanding of the assessed material or their lack of effort in challenging situations. Additionally, the motivation behind committing AD is often to improve grades out of fear of failure,

or, in the students' own words, to "survive college." Senel et al. 's (2020) model also suggests that students with lower academic performances tend to have lower moral attitudes and, therefore, a higher tendency to cheat. Meanwhile, in contrast to this idea, Yaniv et al. (2017) conducted a study that found a positive correlation between higher GPAs and a higher prevalence of AD. They argued that students who achieve higher academic success experience pressure not only to maintain their achievements but also to surpass them.

5. Conclusion and Recommendations

This study investigated the occurrence of academic dishonesty (AD) in mathematics and the influence of students' demographic factors on AD. The findings revealed that cheating on assignments was the most common form of AD, followed by cheating on tests, plagiarism, and other forms of AD. Moreover, students provided various justifications for engaging in AD, including difficulties in understanding mathematical concepts, struggle with self-regulation and emotional well-being, and external influences and expectations. Conversely, students refrained from AD due to classroom dynamics, assessment methods employed by teachers, ethical and moral values, and competence and competitiveness. The results also indicated that demographic factors such as gender and mathematics performance did not significantly influence AD. This suggests that both males and females engage in AD at similar rates, regardless of the specific type of cheating behaviour, and mathematics performance was not associated with the prevalence of all forms of AD. However, the study revealed a notable disparity in the occurrence of cheating on tests across different year levels. Freshmen students were found to cheat on tests less frequently, which could be attributed to their limited exposure to academic pressures, fewer mathematics courses taken, and possibly a higher perceived value of assessments in mathematics, due to being new and less integrated into the tertiary environment.

Given that peer influence and collusion have a significant impact on the prevalence of AD, it would be beneficial to implement stricter monitoring of students during quizzes and tests. Practical strategies, such as physical manipulation of the test environment and the use of set-categorised questionnaires (e.g., alternating between Set A and Set B tests), could be employed to deter collusion. Another potential solution is to administer solution-based quizzes and tests in mathematics. Although this may require more effort from instructors, it would enable them to identify students who have used the same process, made the same mistakes, and arrived at the same answers. For assignments, it is proposed to reframe collusion as an opportunity to build rapport with other students, rather than branding it as cheating. This would promote collaborative learning, which would benefit students both academically and professionally. To support this, the weight of grades attributed to assignments could be reduced, while the weight of monitored tasks like quizzes and tests could be increased. This would create a stronger incentive for academic integrity during assessments that have more significant outcomes. Furthermore, educators must avoid demographic stereotyping in their monitoring and disciplinary practices. This means that gender and mathematics performance should not be used as criteria for determining who should be penalised for dishonest acts or who should be monitored more closely. Instead, greater effort should be made to enhance students' overall respect for academic integrity and to emphasise school regulations and the consequences of breaching them.

To minimise the opportunities for AD, the use of supervised activities is strongly encouraged. This would enable educators to create controlled environments and respond immediately to any misconduct. It would also allow teachers to identify the methods students use to cheat and develop specific interventions to combat AD effectively. Additionally, involving students in discussions about the learning process and the consequences of AD, especially at the beginning of the academic year or during orientation sessions, could cultivate a sense of ownership and responsibility among students. When students actively participate in establishing rules, they are more likely to respect and follow the regulations they have helped create. Given the growing role of technology in education, it would be beneficial for educators to be able to detect when students are using software to cheat. Achieving this would also increase digital literacy among educators and students while minimising AD. For future researchers, it is important to note the limitations identified in this study, such as the scope of demographic factors considered, to provide a more comprehensive understanding of AD. The inclusion

of other prevailing variables, within a larger group of students, is recommended to enhance the understanding of AD in the academic community.

6. Acknowledgements

The authors would like to acknowledge and thank the participants for voluntarily taking part in this study, as well as the administration for granting permission to collect the necessary data. The authors also express gratitude to the reviewers for their assistance in improving this paper.

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