Exploring The Impact of Online Assessment Tools and Digital Proctoring on Academic Integrity in Higher Education: Case of Universiti Kuala Lumpur

Mohd Farid Shamsudin*, Arman Hj Ahmad, Affendy Abu Hassim

Universiti Kuala Lumpur, Malaysia

*mfarid@unikl.edu.my; arman@unikl.edu.my; arman@unikl.edu.my

Abstract. The objective of this study is to examine the impact of online assessment tools and digital proctoring on academic integrity, specifically focusing on the role of students' perceptions of fairness as a mediator in higher education. A quantitative survey was conducted at Universiti Kuala Lumpur to examine the discussed dynamics among undergraduate students Although online assessment tools significantly influence academic integrity, the research suggests that the direct impact of digital proctoring on academic honesty is very weak. Conversely, perceiving digital proctoring as fair amplifies its impact, underscoring the crucial significance of fairness in the assessment procedure. Within the realm of higher education, this research illuminates the complex interaction between technology, equity, and academic honesty. Furthermore, it demonstrates the intricate interplay that exists among these three components. The study offers explicit guidelines for educational institutions to keep a harmonious equilibrium between ethical conduct and technology advancements in assessment practises. These recommendations are derived from the insights offered in the research.

Keywords: Academic Integrity, Online Assessment, Digital Proctoring, Fairness Perception, Higher Education, Educational Technology.

1 Introduction

Wahyu Widodo et al. (2021) state that the integration of digital technology in higher education has brought about transformative possibilities, but has also presented new challenges, particularly concerning the integrity of academic research. The proliferation of online materials and digital tools, such as e-books, digital libraries, and course management systems, has significantly transformed the process of learning. This has raised concerns over the preservation of integrity in academic assessments. The rapid development of online assessment technologies and digital proctoring has become a prominent subject of conversation in order to maintain academic integrity and equity (Wijayanto et al., 2023).

J. Handhika et al. (eds.), *Proceedings of the 4th International Conference on Education and Technology (ICETECH 2023)*, Atlantis Highlights in Social Sciences, Education and Humanities 25,
https://doi.org/10.2991/978-94-6463-554-6_2

The objective of this study is to examine the influence of technology improvements on the integrity of academic work, specifically focusing on how they shape students' perceptions of fairness and their commitment to ethical conduct. This study examines the efficacy of these techniques in deterring unethical behaviours and analyses their influence on students' views of fair treatment. By doing this, we provide valuable insights that contribute to the ongoing discourse on how to achieve a harmonious equilibrium between upholding academic honesty and progressing technology capabilities in higher education.

We anchor our investigation in the context of Universiti Kuala Lumpur, examining the pressing issue of academic integrity in light of the widespread availability of online resources and digital technologies. The increased adoption of online learning platforms introduces new avenues for potential academic dishonesty, thereby challenging the integrity of assessments and the credibility of educational credentials (Meiryani et al., 2022). This study aims to provide an evidence-based analysis of the effectiveness of online assessment tools and digital proctoring in promoting fairness and integrity, ultimately guiding policy decisions in higher education.

2 Literature Review

2.1 Integration Of Online Assessment

The adoption of online assessment tools in higher education has seen a remarkable increase, evolving with the digitisation of educational realms. Online assessments are applauded for their flexibility, accommodating a wide spectrum of candidates such as working professionals, part-time students, and individuals juggling familial or other obligations (Kusnadi et al., 2023). This adaptability facilitates testing according to individuals' unique schedules and commitments. However, while commendable, this flexibility also introduces potential pitfalls, such as issues related to time management, particularly for those who might find self-discipline challenging.

Security, particularly enhancing anti-cheating mechanisms, is pivotal in online assessments (Putri et al., 2022). Robust technological strides have been made to safeguard the integrity of these digital examinations, ensuring their credibility in academic and professional landscapes. Nevertheless, it's crucial to recognise the imperfections within these security systems. A nuanced approach, marrying technological innovation with meticulous monitoring and fostering a culture of academic integrity, is imperative for maintaining assessment credibility.

The immediacy of results and feedback in online assessments is another noteworthy merit, optimising the assessment procedure and furnishing candidates with essential insights for learning and improvement. Despite these advantages, it's crucial to discern that instantaneous feedback might not always be optimal, particularly in high-stakes or standardised assessments (Putri et al., 2022). Furthermore, the immediate disclosure of results might escalate stress and anxiety among candidates, which could inadvertently influence their performance adversely.

Online assessments also herald a new era of accessibility and inclusivity, dismantling geographical constraints and facilitating participation from individuals with var-

ied needs, such as those with disabilities or residing in remote locales (Belawati et al., 2023). However, realising the full spectrum of inclusivity within online assessments remains a work in progress. Challenges such as inconsistent internet access, a deficit in necessary assistive technologies, and the necessity for enhanced digital literacy among certain demographics are pivotal issues that warrant attention and resolution.

While praised for its adaptability, the adoption of online assessments in higher education also introduces challenges such as self-discipline and time management issues. Recent studies have highlighted the efficiency and accessibility of these methods, particularly in response to the COVID-19 pandemic (Belawati et al., 2023; Harapan et al., 2018; Rejeki et al., 2023; Soeselo et al., 2022). However, a more balanced discourse is needed to address this approach's potential risks and limitations, such as reduced interpersonal interaction and the potential for academic dishonesty.

In conclusion, while online assessments offer many benefits, they also bring a constellation of complexities and challenges that require thoughtful navigation. Elements such as flexibility, security, immediacy of feedback, and accessibility are instrumental in bolstering the stature of online assessments within educational paradigms. However, a conscientious effort is necessary to navigate and address the prevailing discussions and dilemmas intrinsic to these domains, aiming to optimise online assessments' efficacy, fairness, and comprehensive potential.

2.2 Digital Proctoring

Digital proctoring emerges as a formidable sentinel in safeguarding the integrity of online education, acting as a virtual bulwark against academic deceit (Hidayanto et al., 2022). Its role is instrumental in fortifying the reliability of online assessments and fostering an environment of flexibility for both students and instructors. As a guardian against academic dishonesty, digital proctoring ensures that the sanctity of a student's work is maintained, especially in a landscape where online education is blossoming. However, this technological sentinel is not without its controversies (Darojat et al., 2023). It has fanned the flames of debate concerning privacy infringement, technological disparities, and accessibility challenges.

Additionally, the lens of scrutiny is also directed towards its efficacy in thwarting dishonest practices. A pervasive sentiment leans towards exploring more innovative assessment techniques specifically curated for the online educational environment, which digital proctoring might potentially stifle.

Digital proctoring, which appears as a measure to combat academic dishonesty, has its own set of controversies, including concerns about privacy and technological disparities. Studies by Archer (2023) and Udechukwu, (2020) illustrate the ethical and practical dilemmas associated with digital proctoring. A balance must be struck between upholding academic integrity and respecting students' privacy and mental well-being.

In synthesising a pathway forward, striking a thoughtful equilibrium is essential—one that marries the preservation of academic integrity with a sensitivity towards the evolving discourse on privacy, technological equity, and assessment innovation. (Ali et al., 2023). Thus, the journey towards integrating digital proctoring into the educa-

tional tapestry must be navigated with a compass of ethical consideration, technological mindfulness, and a commitment to fostering an environment conducive to genuine learning and assessment.

3 Assessment Methods

The choice of assessment methods significantly impacts academic integrity Mariadi et al., 2022). Formative assessments like quizzes tend to foster a learning-focused environment, which, as suggested, may reduce the inclination to cheat. Conversely, the high-pressure nature of summative assessments like exams can increase the temptation to engage in dishonest behaviours (Liu & Zhang, 2022). This dichotomy highlights the importance of diversifying assessment methods to promote integrity.

The selection of assessment methods, such as formative quizzes, summative exams, assignments, and other assessments, is of utmost importance in shaping the academic journey. Various assessments have different advantages and disadvantages, affecting the likelihood of academic integrity violations (Prastikawati et al., 2020). Formative assessments, like quizzes, measure student comprehension as they progress through their learning journey. These assessments usually have minimal consequences and prioritise continuous feedback. According to a study (Kristiyanti, 2021), formative assessments have positively impacted academic integrity. These assessments prioritise learning rather than performance, which in turn reduces the inclination to engage in cheating. Summative assessments, such as final exams, are crucial for evaluating overall knowledge and achievement due to their higher stakes. According to research conducted by (Zainuddin, 2023), it has been found that when students view summative exams as high-pressure situations, the motivation to engage in academic integrity violations tends to increase.

Continuous assessments allow students to showcase their abilities and understanding through ongoing projects and assignments. The effect of ongoing evaluations on academic integrity can differ. Various studies, such as the one conducted by (Liu & Zhang, 2022), have discovered that students might resort to dishonest practices when they experience ongoing assessment pressure. Conversely, some students may encounter greater difficulties in cheating due to heightened supervision.

3.1 Perceptions of Fairness

The notion of equity in assessments is a crucial element that greatly influences the academic conduct of students. Establishing explicit assessment criteria and ensuring equitable access are crucial elements in fostering a sense of equity and minimising the likelihood of dishonesty. The study conducted by Sanchez-Cabrero and colleagues (2021) emphasises the need of upholding transparency in evaluation procedures to promote ethical conduct among students.

In this investigation, the mediator variable called "Perceptions of Fairness" is crucial for comprehending how the fairness of the assessment process affects the

connection between independent variables and instances of academic integrity violations. Several studies have examined the correlation between fairness and students' academic behaviours (Azizi, 2022). Topuz and Kinshuk (2021) state that views of fairness cover various factors, such as the transparency of evaluation procedures, equitable opportunities, explicit assessment criteria, and effective methods of identity verification. The characteristics play a significant role in shaping students' perceptions of the fairness of evaluations.

The study conducted by Azizi (2022) emphasised the importance of fair and straightforward evaluation procedures in fostering confidence and promoting ethical academic practises among students. In a study conducted by Amrane-Cooper and colleagues (2022), it was discovered that pupils who believe that possibilities for success are distributed fairly are less inclined to participate in actions that are perceived as unfair. A robust association exists between the transparency of evaluation criteria and the honesty of scholarly endeavours. As Ningsih & Mulyono, (2019 highlighted, the assessment guidelines ensure clarity and effective communication. By providing students with clear expectations, these guidelines create a sense of security and minimise any confusion. As a result, they play a significant role in discouraging dishonest behaviours.

Regarding identity verification, research like Sillat et al., (2021) has revealed that students' views on the effectiveness of verification methods can impact their choices to participate in dishonest behaviours. When students have confidence in verifying their identity, they are less inclined to view cheating as a viable choice. The findings emphasise the significance of Perceptions of Fairness as a mediator variable that can shed light on the relationship between independent variables like online assessment tools, digital proctoring, the type of assessment, and academic integrity violations.

4 Methodology

The core objective of this study was to assess the impact of online assessment tools and digital proctoring on academic integrity, focusing particularly on undergraduate students at Universiti Kuala Lumpur. In doing so, we aimed to understand how these technological interventions influence students' perceptions of fairness and their subsequent academic behaviour.

We employed a quantitative research approach organised using the research onion framework, which provided a structured path through the layers of research design. The foundation of this methodology lies in a positivist research philosophy, where we sought to establish a clear, observable relationship between the use of online assessment tools, digital proctoring, and instances of academic integrity violations.

The primary method of data collection involved utilising a self-designed questionnaire in conjunction with a systematic sampling approach. Utilising the study site given by the university, a total of two hundred surveys were distributed electronically. In addition, a QR code was created to facilitate convenient access to the questionnaires. Ultimately, we successfully gathered a dataset comprising 124

comprehensive and consistent responses. We achieved this by thoroughly cleaning the data to ensure its accuracy and consistency.

The study focused on examining online assessment technologies, digital proctoring, and the specific type of examination as independent variables. By considering fairness perceptions as a significant mediator, we conducted a comprehensive analysis to examine their influence on the dependent variable, specifically academic integrity violations. We utilised a specific setup to examine both the direct and indirect impacts of these technology interventions on academic integrity.

In order to analyse the complex relationships between variables and conduct hypothesis testing in this academic context, we choose to utilise SmartPLS for statistical analysis. This decision was consistent with our data-driven methodology. Using this software, we successfully analysed the direct, indirect, and mediating effects of our identified factors, enabling us to fully comprehend their interactions.

Throughout the procedure we employed, ethical issues held paramount significance. Every participant was obligated to provide their informed consent, and we took measures to guarantee their anonymity and maintain their confidentiality during the entire research procedure. This procedure not only adhered to the principles of ethical research, but also guaranteed the complete authenticity of the obtained data.

We want to examine the practicality of online assessment tools and digital proctoring, as well as their impact on academic honesty, by employing this specific methodology. This study offers a significant advancement in understanding the complex dynamics and ethical consequences of digital schooling.

4.1 Sampling Technique

The selection of respondents for the sampling procedure employed in this study was conducted systematically. A total of two hundred questionnaires were distributed to undergraduate students at Universiti Kuala Lumpur for completion and return. The participants were allowed to access the questionnaires using the study portal supplied by the institution, ensuring their immediate availability. The participants willingly completed the survey by clicking on the provided link to the Google Form.

After the data gathering process was finished, a meticulous cleansing procedure was conducted to guarantee the accuracy and consistency of the responses. Throughout the process, responses that were either lacking necessary information or contradictory were excluded, resulting in a final dataset comprising of 124 data points from participants that were utilised for analysis.

The chosen sample consisted of a wide range of undergraduate students, providing valuable insights into their viewpoints regarding the influence of online assessment tools and digital proctoring on academic integrity. The survey's focus on quantitative data allowed for the collection of structured information, enabling statistical analysis to draw significant conclusions related to the research objectives.

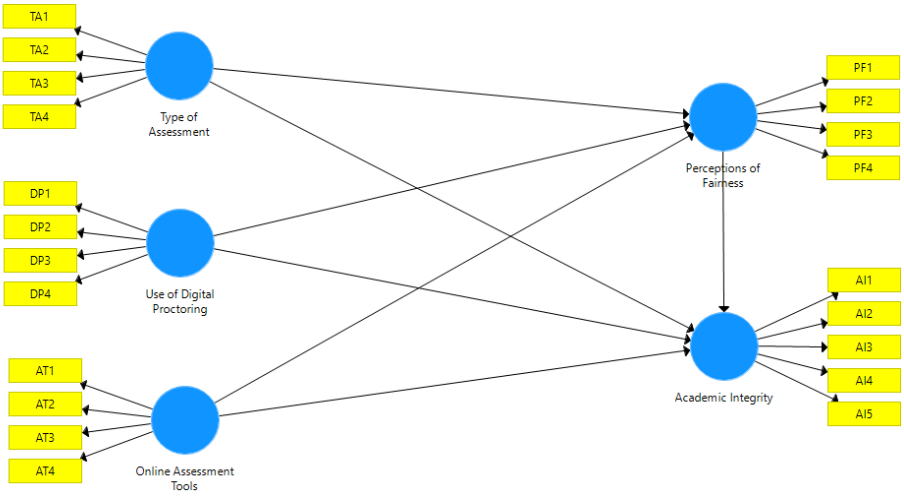

Fig. 1. Measurement model of the study

Table 1. Reliability and validity

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Academic Integrity	0.843	0.888	0.615
Online Assessment Tools	0.861	0.905	0.705
Perceptions of Fairness	0.851	0.899	0.692
Type of Assessment	0.766	0.845	0.578
Use of Digital Proctoring	0.841	0.894	0.678

Starting with Academic Integrity, a Cronbach's Alpha of 0.843 exhibits strong internal consistency among the items used for measurement, suggesting that they are well correlated. The Composite Reliability score of 0.888 further strengthens this, indicating a reliable measurement model. The Average Variance Extracted (AVE) value of 0.615 also shows a good level of convergent validity, proving that the construct is effectively measured by its indicators.

For Online Assessment Tools, the results are quite impressive, with a Cronbach's Alpha of 0.861, showing high reliability. Coupled with a Composite Reliability of 0.905, it confirms that the construct is consistent and reliable. An AVE of 0.705 suggests a substantial amount of variance the construct captures relative to the measurement error, highlighting its validity.

Moving on to Perceptions of Fairness, a Cronbach's Alpha of 0.851 and Composite Reliability of 0.899 underscores the reliability of the items measuring this construct. The AVE value of 0.692 further assures that the construct exhibits a desirable level of convergent validity.

Regarding the Type of Assessment, although Cronbach's Alpha is slightly lower at 0.766, it still indicates acceptable internal consistency. The Composite Reliability is at a decent level of 0.845, suggesting a good level of reliability. However, the AVE is slightly lower at 0.578, indicating a need for improvement in the measurement of the construct.

Lastly, the Use of Digital Proctoring has a Cronbach's Alpha of 0.841 and Composite Reliability of 0.894, ensuring high reliability and internal consistency in the measurement items. An AVE of 0.678 demonstrates that a significant portion of the variance is explained, showcasing its strong convergent validity.

In conclusion, the results show robust reliability and validity in the examined constructs, with slight room for improvement in the Type of Assessment construct.

Table 2. Fornell Larcker

	Academic Integrity	Online Assessment Tools	Perceptions of Fairness	Type of Assessment	Use of Digital Proctoring
Academic Integrity	0.784				
Online Assessment Tools	0.631	0.839			
Perceptions of Fairness	0.535	0.415	0.832		
Type of Assessment	0.533	0.681	0.409	0.760	
Use of Digital Proctoring	0.361	0.343	0.471	0.303	0.823

The Fornell-Larcker criterion is employed to assess the discriminant validity of the constructs used in the study, which include Academic Integrity, Online Assessment Tools, Perceptions of Fairness, Type of Assessment, and Use of Digital Proctoring. In the provided matrix, diagonal values (e.g., 0.784 for Academic Integrity, 0.839 for Online Assessment Tools, and so on) represent the square root of the Average Variance Extracted (AVE), showing the variance captured by the construct versus the variance due to measurement error. The off-diagonal values are the correlations between the constructs.

The criterion for adequate discriminant validity is met when a construct's diagonal value is higher than its off-diagonal values in the corresponding rows and columns, meaning each construct should share more variance with its items than with other constructs (Binz Astrachan et al., 2019). From the given matrix, it seems that most constructs, like Academic Integrity and Online Assessment Tools, meet this criterion

well, signifying satisfactory discriminant validity. However, there might be some areas where a closer inspection might be necessary to ensure that each construct is truly distinct from the others, ensuring the robustness of the measurement model in capturing the theoretical concepts accurately.

Table 3. HTMT

	Academic Integrity	Online Assessment Tools	Perceptions of Fairness	Type of Assessment	Use of Digital Proctoring
Academic Integrity					
Online Assessment Tools	0.731				
Perceptions of Fairness	0.615	0.468			
Type of Assessment	0.629	0.803	0.466		
Use of Digital Proctoring	0.416	0.402	0.540	0.360	

The Heterotrait-Monotrait Ratio (HTMT) is an advanced approach to evaluating discriminant validity in a set of constructs which include Academic Integrity, Online Assessment Tools, Perceptions of Fairness, Type of Assessment, and Use of Digital Proctoring in the study. Values closer to 1 indicate a lack of discriminant validity, while values further away from 1, preferably below 0.85, suggest adequate discriminant validity (Sarstedt et al., 2019).

In the provided HTMT results, the value between Academic Integrity and Online Assessment Tools is 0.731, suggesting a good discriminant validity as it is below the 0.85 threshold. The same is observed for the pair of Academic Integrity and Perceptions of Fairness with a value of 0.615. However, the Type of Assessment and Online Assessment Tools have a value of 0.803, which is still below 0.85 but relatively higher, indicating that there might be a slight overlap between these two constructs.

For the Use of Digital Proctoring, the values are quite low relative to the other constructs, such as 0.416 with Academic Integrity and 0.360 with Type of Assessment, signifying a clear discriminant validity and showing that the constructs are distinct.

In conclusion, the HTMT ratios generally suggest good discriminant validity between the constructs, indicating that they measure distinct theoretical concepts. However, some pairs, like Type of Assessment and Online Assessment Tools, might need closer inspection to ensure their distinctiveness.

Table 4. Model Fitness

	Saturated Model	Estimated Model
SRMR	0.096	0.096
Chi-Square	690.206	690.206
NFI	0.614	0.614

The Goodness-of-Fit results depict how well the estimated model fits the observed data compared to a saturated model (Khan et al., 2019). The saturated and estimated models have been evaluated using various indices such as the standardised root mean square ratio (SRMR), chi-square, and moulded fit index (NFI).

Both models' SRMR values are identical (0.096), sitting below the common threshold of 0.08, which generally indicates a good fit. However, it's slightly above the recommended value in this case, suggesting that the residual variances are slightly higher and that the model could be improved for a better fit.

The Chi-Square values are also equal in both models (690.206). A lower Chi-Square value is typically preferred as it indicates a better model fit, but this value might suggest a significant difference between the expected and observed covariance matrices, hinting at a possible model misfit.

The NFI values in both models are 0.614. The NFI is a comparative index where values closer to 1 indicate a better fit (Hair & Fávero, 2019). An NFI value of 0.614 is below the generally accepted threshold of 0.95, indicating that the model's fit could be significantly improved.

In conclusion, the goodness-of-fit results suggest room for improvement in the model fitting. The estimated and saturated models show similar fit indices, but enhancements might be needed to improve the model's overall adequacy in representing the observed data.

Table 5. R Square

	R Square	R Square Adjusted
Academic Integrity	0.497	0.480
Perceptions of Fairness	0.314	0.297

The R Square values presented in the results provide insight into the proportion of variance in the dependent variables (Academic Integrity and Perceptions of Fairness) explained by the model's independent variables. For Academic Integrity, an R Square value of 0.497 indicates that approximately 49.7% of the variance is explained by the model, which is a moderate amount. The adjusted R Square, which accounts for the number of predictors in the model, is slightly lower at 0.480 but still represents a decent explanatory power of the model.

In the case of Perceptions of Fairness, the R Square value is 0.314, meaning that the model explains about 31.4% of the variance in this dependent variable. The

adjusted R Square is 0.297, slightly lower due to the adjustment based on the number of predictors. This suggests the model has a lower explanatory power for Perceptions of Fairness than Academic Integrity.

In conclusion, the model seems to have a moderate explanatory power for Academic Integrity and a lower one for Perceptions of Fairness, as per the given R Square values. Adjusting for the number of predictors in the model makes a slight difference in the R Square values, indicating that the model's complexity is reasonably well-tuned to the data. However, there might be room to improve the model's explanatory power, perhaps by including additional relevant predictors or refining the existing ones.

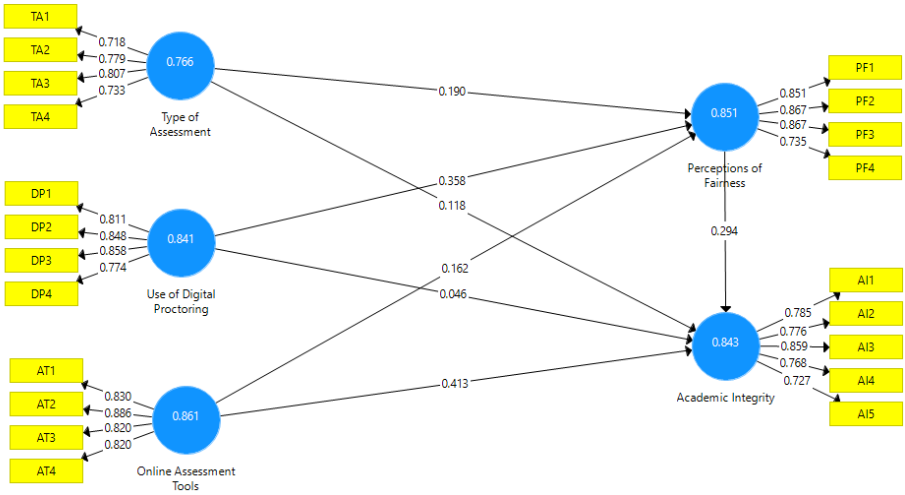

Fig. 2. Measurement model

Table 6. Path Coefficients

	Original Sample	Sample Mean	Standard Deviation	T Statistics	P Values
Online Assessment Tools → Academic Integrity	0.413	0.414	0.096	4.310	0.000
Online Assessment Tools → Perceptions of Fairness	0.162	0.162	0.105	1.553	0.121
Perceptions of Fairness → Academic Integrity	0.294	0.301	0.083	3.545	0.000
Type of Assessment → Academic Integrity	0.118	0.115	0.098	1.201	0.231
Type of Assessment → Perceptions of Fairness	0.190	0.194	0.098	1.935	0.054
Use of Digital Proctoring → Academic Integrity	0.046	0.044	0.073	0.620	0.536
Use of Digital Proctoring → Perceptions of Fairness	0.358	0.368	0.101	3.538	0.000

The table below outlines the path coefficients of various relationships in a structural model and their statistical significance and reliability.

Starting with the relationship between Online Assessment Tools and Academic Integrity, the original sample shows a path coefficient of 0.413, with a p-value of 0.000. This indicates a moderate and significant positive relationship, suggesting that as the utilisation of Online Assessment Tools increases, Academic Integrity also improves significantly.

Examining the relationship between Online Assessment Tools and Perceptions of Fairness, the path coefficient is 0.162 with a p-value of 0.121. This lower p-value implies that this relationship is not statistically significant at conventional levels, meaning the impact of Online Assessment Tools on Perceptions of Fairness is uncertain and might be coincidental.

For the path from Perceptions of Fairness to Academic Integrity, the coefficient is 0.294, and the p-value is 0.000, indicating a statistically significant positive relationship. This suggests that improvements in Perceptions of Fairness are associated with enhancements in Academic Integrity.

In assessing the Type of Assessment about Academic Integrity and Perceptions of Fairness, the coefficients are 0.118 and 0.190, respectively, with p-values of 0.231 and 0.054. These relationships seem not to be strong or only marginally significant, showing that the Type of Assessment might not substantially or consistently impact either Academic Integrity or Perceptions of Fairness.

Lastly, examining the Use of Digital Proctoring, it appears to have a non-significant impact on Academic Integrity (coefficient = 0.046, p-value = 0.536) but a significant impact on Perceptions of Fairness (coefficient = 0.358, p-value = 0.000). This suggests that the Use of Digital Proctoring might not substantially affect

Academic Integrity directly, but it does influence Perceptions of Fairness positively and significantly.

In conclusion, the results show various relationships, some being statistically significant and robust, such as the impact of Online Assessment Tools on Academic Integrity and the Use of Digital Proctoring on Perceptions of Fairness. In contrast, others are less certain or potentially insignificant, necessitating further exploration and validation.

Table 7. Indirect Relationships

	Original Sample	Sample Mean	Standard Deviation	T Statistics	P Values
Online Assessment Tools → Perceptions of Fairness → Academic Integrity	0.048	0.049	0.035	1.372	0.171
Type of Assessment → Perceptions of Fairness → Academic Integrity	0.056	0.060	0.037	1.492	0.136
Use of Digital Proctoring → Perceptions of Fairness → Academic Integrity	0.105	0.112	0.048	2.191	0.029

The table illustrates indirect relationships and their impact on Academic Integrity, incorporating the mediator, Perceptions of Fairness, in a structural model.

Starting with the path from Online Assessment Tools through Perceptions of Fairness to Academic Integrity, the original sample shows a coefficient of 0.048 and a p-value of 0.171. Since the p-value is higher than the conventional threshold of 0.05, it signifies that this indirect relationship is not statistically significant. Thus, it suggests that while Online Assessment Tools might influence Perceptions of Fairness, this pathway does not significantly impact Academic Integrity.

Next, considering the indirect relationship from the Type of Assessment through Perceptions of Fairness to Academic Integrity, the coefficient stands at 0.056 with a p-value of 0.136. Similar to the previous relationship, this p-value exceeds the 0.05 threshold, indicating a lack of statistical significance. It implies that the influence of the type of assessment on academic integrity, mediated by perceptions of fairness, is not strong enough to be considered statistically meaningful.

Lastly, focusing on the Use of Digital Proctoring through Perceptions of Fairness to Academic Integrity, there's a coefficient of 0.105 and a p-value of 0.029. Since the p-value is less than 0.05, this indicates that the indirect relationship is statistically significant. This suggests that the Use of Digital Proctoring significantly influences Academic Integrity when mediated by Perceptions of Fairness, showcasing a meaningful pathway in understanding the impact of digital proctoring on academic integrity.

In conclusion, among the indirect relationships presented, only the pathway involving the Use of Digital Proctoring is significant, affirming its influential role in affecting Academic Integrity through altering Perceptions of Fairness. The other pathways, although representing certain influences, lack statistical significance, pointing towards a need for further exploration and validation of these relationships.

5 Discussions

The findings from both the direct and indirect relationships in the structural equation model offer valuable insights into the intricate interplay among the variables being studied.

There is a strong and statistically significant correlation (0.413, $p < 0.001$) between online assessment tools and academic integrity violations. Based on the data, it appears that there is a correlation between the rise in online assessment tool usage and an increase in academic integrity violations. There could be a reason for this where students discover methods to bypass these tools or feel less discouraged. For instance, individuals may continue to participate in plagiarism or cheating, even with the existence of plagiarism detection software.

The relationship between perceptions of fairness and academic integrity is positive and statistically significant (0.294, $p < 0.001$). It can be inferred that instances of academic integrity violations tend to decline when students perceive assessment procedures to be more equitable. One possible explanation is that when students perceive the assessment process as transparent, equal, and fair, they are less likely to engage in dishonest behaviours because they do not feel the need to do so.

The statistical analysis shows no significant relationship between digital proctoring and academic integrity ($p = 0.536$). It can be inferred that the implementation of digital proctoring does not greatly affect instances of academic integrity violations. It is important to consider that digital proctoring alone may not always discourage students, as other factors could impact their choices regarding academic integrity.

Examining Online Assessment Tools and their Impact on Perceptions of Fairness and Academic Integrity: The statistical analysis reveals no significant relationship between online assessment tools and perceptions of fairness to academic integrity (0.048, $p = 0.171$). It is worth considering that online assessment tools may directly impact academic integrity, with perceptions of fairness playing a limited role in this relationship. The way students perceive fairness may not significantly influence their responses to online assessment tools in terms of integrity.

Assessment Type: Perceptions of Fairness Concerning Academic Integrity The relationship between the type of assessment, perceptions of fairness, and academic integrity is not statistically significant (0.056, $p = 0.136$). Based on the findings, the assessment type does not significantly impact academic integrity as perceived through fairness. Other factors, such as students' intrinsic motivation or ethical values, may have a greater impact.

Exploring the Use of Digital Proctoring and its Impact on Perceptions of Fairness and Academic Integrity: The statistical analysis reveals a significant relationship

between digital proctoring and perceptions of fairness, which impacts academic integrity (0.105, p = 0.029). Based on the data, it can be concluded that there is a clear correlation between the implementation of digital proctoring and a decrease in academic integrity violations. This suggests that when students perceive the digital proctoring system as fair, it significantly impacts academic integrity. Take, for instance, the perspective of students who see digital proctoring as a fair and unbiased method of monitoring exams. Given this scenario, their inclination towards engaging in dishonest behaviours during assessments may decrease.

An intriguing aspect of the study was the unexpected findings related to the impact of digital proctoring on academic integrity. Contrary to the initial hypothesis, the data indicated that digital proctoring did not significantly impact academic integrity violations directly (p = 0.536). This finding challenges the assumption that digital proctoring is a robust deterrent against academic dishonesty. It suggests that the mere presence of surveillance technology does not automatically translate into a reduction in cheating behaviours. This outcome prompts a reevaluation of the effectiveness of digital proctoring as a standalone measure. It underscores the need for a more comprehensive approach to fostering academic honesty.

Additionally, the relationship between the type of assessment and perceptions of fairness, and subsequently academic integrity, was not as strong or significant as anticipated (0.056 p = 0.136). This finding contradicts some prevalent theories suggesting that assessment type strongly influences academic integrity through perceptions of fairness. It raises questions about the multifaceted nature of academic integrity and the possible influence of other unexplored factors, such as individual student characteristics, course content, or the educational environment.

These unexpected results and discrepancies highlight the complexity of the relationship between technology, fairness, and academic integrity in higher education. They underscore the importance of not relying solely on technological solutions but adopting a holistic approach that considers the psychological, ethical, and situational factors influencing student behaviour. These findings also open avenues for further research to explore the nuanced dynamics between these variables and to develop more effective strategies for upholding academic integrity in the digital age.

6 Recommendations

After analysing the findings and results of the study, it is possible to suggest several recommendations for educational institutions and policymakers to improve academic integrity in higher education settings.

Educational institutions should prioritise enhancing clarity and communication regarding the use and objectives of online assessment tools and digital proctoring. Providing students with comprehensive details about these technologies' methodologies, advantages, and ethical considerations is vital. Such transparent communication is key to demystifying these tools, fostering trust, and ensuring compliance with assessment protocols.

Another crucial feature of the digital assessment environment is the prioritisation of justice and fairness. The objective of educational institutions should be to offer equitable and unbiased chances to all students. It is crucial that this plan includes clear and unbiased evaluation criteria and objective assessment methods. By promoting a strong sense of justice and adhering to ethical principles, it is possible to significantly reduce instances of academic integrity violations.

Customising assessment techniques to the specific needs of each course and student group is extremely crucial. Institutions must to consistently evaluate and modify their evaluation methodologies, especially when employing digital proctoring technologies. This is of utmost significance. To maintain academic integrity, it is imperative to ensure that the student community perceives these tactics as fair and essential.

Imparting students with a comprehensive education about academic honesty is another crucial concept. This encompasses the education of students on strategies to prevent plagiarism, cheating, and unauthorised collaboration, along with the integration of discussions on ethics and individual accountability into the curriculum. These educational programmes have the ability to effectively reinforce the principles of academic integrity.

It is absolutely necessary to maintain a consistent schedule for monitoring and evaluating the efficacy of different assessment approaches and instruments. Assessing the fairness and inclusiveness of the utilised assessment methods should be included in this process. Furthermore, it is important to assess the effectiveness of the measures implemented to deter cheating.

By investigating innovative evaluation techniques that use technology, one might discover approaches to evaluating student learning that are both genuine and captivating. Exploring alternative assessment methods may enhance the deterrence of academic dishonesty among students, while increasing the engagement and relevance of the evaluation process.

To summarise, the preservation of academic integrity can be greatly enhanced by the cooperation and sharing of optimal methods across educational institutions globally. By implementing coordinated initiatives and facilitating the sharing of experiences, it is feasible to formulate a comprehensive strategy to foster a culture of integrity within the academic sphere.

7 Conclusions

This study has revealed the complex connection between advancements in technology in education, academic honesty, and students' perceptions of justice. The findings shed insight on the varied nature of academic integrity in higher education contexts and emphasise the need to adopt a nuanced approach to online assessment tools and digital proctoring.

An essential finding from our research is the importance of maintaining transparency and effective communication on the use and purpose of digital proctoring and online assessment tools. Acquiring a comprehensive comprehension of

these technologies and possessing unwavering trust in them is important to uphold academic integrity. Educational institutions must prioritise the development of effective communication strategies to enhance students' understanding and acceptance of these tools.

Furthermore, the research illuminates the crucial role that fairness plays in the assessment process. The fairness of assessments significantly influences students' inclination to be honest in their academic performance. Hence, it is incumbent upon educational establishments to guarantee the impartiality of assessments, the fairness of opportunities, and the objectivity of evaluation protocols. The focus on fairness is crucial, as it ensures both the integrity and the development of an ethical learning environment.

Moreover, the study's findings indicate that while technology is important in upholding academic integrity, it should not be regarded as the complete solution to the issue. Equally important is the integration of discussions on personal responsibility, ethics, and integrity into the educational curriculum. By implementing this integration, we strengthen the principles of academic integrity and foster a culture of ethical conduct among students.

Our findings emphasise the need for educational institutions to adapt their evaluation systems to meet the individual needs of different classes and student groups. Customising assessment techniques can improve the effectiveness and authenticity of evaluating students' knowledge and abilities.

In summary, this study offers a foundation for educational institutions and politicians to make educated choices about the encouragement of academic honesty and the incorporation of technology in evaluation methods. The collected ideas provide a distinct pathway for enhancing academic integrity in higher education. This approach guarantees that assessments are equitable, impartial, and effective in assessing the true aptitude of students.

References

1. Ali, K., Barhom, N., & Duggal, M. S. (2023). Online assessment platforms: What is on offer? European Journal of Dental Education. https://doi.org/10.1111/eje.12807
2. Amrane-Cooper, L., Hatzipanagos, S., & Tait, A. (2022). Developing Student Behaviours that Support Academic Integrity in Distance Learning. Open Praxis. https://doi.org/10.55982/openpraxis.13.4.461
3. Archer, E. (2023). Technology-driven proctoring: Validity, social justice and ethics in higher education. Perspectives in Education. https://doi.org/10.38140/pie.v41i1.6666
4. Azizi, Z. (2022). Fairness in assessment practices in online education: Iranian University English teachers' perceptions. Language Testing in Asia. https://doi.org/10.1186/s40468-022-00164-7
5. Belawati, T., Daryono, D., Sugilar, S., & Kusmawan, U. (2023). Development of an instrument to assess independent online learning readiness of high school students in Indonesia. Asian Association of Open Universities Journal. https://doi.org/10.1108/AAOUJ-09-2022-0139

6. Binz Astrachan, C., Prügl, R., Hair, J. F., & Babin, B. J. (2019). Marketing and branding in family business: Assessing the landscape and charting a path forward. Journal of Family Business Strategy, 10(1), 3–7. https://doi.org/10.1016/j.jfbs.2019.02.003
7. Darojat, O., Idrus, O., & Ardiasih, L. S. (2023). Disruptive Change and Learning Innovations: Challenges and Opportunities for Universitas Terbuka. Turkish Online Journal of Distance Education.
8. Hair, J. F., & Fávero, L. P. (2019). Multilevel modeling for longitudinal data: concepts and applications. RAUSP Management Journal, 54(4), 459–489. https://doi.org/10.1108/RAUSP-04-2019-0059
9. Harapan, H., Alleta, A., Anwar, S., Setiawan, A. M., Maulana, R., Wahyuniati, N., Ramadana, M. R., Ikram, I., Haryanto, S., Jamil, K. F., Kuch, U., & Rodríguez-Morales, A. J. (2018). Attitudes towards Zika virus infection among medical doctors in Aceh province, Indonesia. Journal of Infection and Public Health. https://doi.org/10.1016/j.jiph.2017.06.013
10. Hidayanto, M. B., Prayogo, S., & Lubis, M. (2022). Designing Web Based Proctoring System for Online Examination (SPIRIT 1.0) in Telkom University. ACM International Conference Proceeding Series. https://doi.org/10.1145/3571662.3571669
11. Khan, G. F., Sarstedt, M., Shiau, W. L., Hair, J. F., Ringle, C. M., & Fritze, M. P. (2019). Methodological research on partial least squares structural equation modeling (PLS-SEM): An analysis based on social network approaches. Internet Research, 29(3), 407–429. https://doi.org/10.1108/IntR-12-2017-0509
12. Kristiyanti, K. L. (2021). The Implementation of Online Formative Assessment in English Learning. Journal of Educational Study. https://doi.org/10.36663/joes.v1i2.155
13. Kusnadi, I. H., Hizraini, A. A., Aswita, D., Munandar, H., & Fathurohman, A. (2023). The Analysis of Online Learning Devices Development Using The PjBL-Steam Model to Improve Student Environmental Literacy. Journal on Education. https://doi.org/10.31004/joe.v6i1.3250
14. Liu, Y., & Zhang, H. (2022). Exploring the Influencing Factors and Validity of Formative Assessment in Online Learning. Journal of Education and E-Learning Research. https://doi.org/10.20448/jeelr.v9i4.4288
15. Mariadi, M., Mirizon, S., & Sitinjak, M. D. (2022). The challenges of online assessment amidst covid-19 pandemic disruption: The voice of EFL lecturers. Englisia: Journal of Language, Education, and Humanities. https://doi.org/10.22373/ej.v10i1.13704
16. Mariadi, M., Mirizon, S., & Sitinjak, M. D. (2022). The challenges of online assessment amidst covid-19 pandemic disruption: The voice of EFL lecturers. Englisia: Journal of Language, Education, and Humanities. https://doi.org/10.22373/ej.v10i1.13704
17. Meiryani, M., Andini, V., Aisyah, A. P., Priandhana, F., Adi, M. P. H., & Gani, E. (2022). The Effect of Technology on Education in Indonesia in the Era of the COVID-19 Pandemic. ACM International Conference Proceeding Series. https://doi.org/10.1145/3549843.3549845
18. Prastikawati, E. F., Wiyaka, W., & Adi, A. P. K. (2020). Online backchannel as a formative assessment in improving writing skills. Journal on English as a Foreign Language. https://doi.org/10.23971/jefl.v10i2.2044
19. Putri, R. T., Sofendi, & Mirizon, S. (2022). Barriers in Technology Integration: EFL Lecturers and Students' Experience in English Learning and Instruction amidst Covid-19 Pandemic Disruption. Indonesian Journal Of Educational Research and Review. https://doi.org/10.23887/ijerr.v5i2.50274
20. Rejeki, S., Adnan, M., Che Ahmad, C. N., & Murtiyasa, B. (2023). An Integrated RME and PIL Mathematics Module for Technical Vocational High School Learning: A Need

Analysis. European Journal of Education and Pedagogy. https://doi.org/10.24018/ejedu.2023.4.2.485
21. Sánchez-Cabrero, R., Casado-Pérez, J., Arigita-García, A., Zubiaurre-Ibáñez, E., Gil-Pareja, D., & Sánchez-Rico, A. (2021). E-assessment in E-learning degrees: Comparison vs. face-to-face assessment through perceived stress and academic performance in a longitudinal study. Applied Sciences (Switzerland). https://doi.org/10.3390/app11167664
22. Sarstedt, M., Hair, J. F., Cheah, J. H., Becker, J. M., & Ringle, C. M. (2019). How to specify, estimate, and validate higher-order constructs in PLS-SEM. Australasian Marketing Journal, 27(3), 197–211. https://doi.org/10.1016/j.ausmj.2019.05.003
23. Sillat, L. H., Tammets, K., & Laanpere, M. (2021). Digital competence assessment methods in higher education: A systematic literature review. Education Sciences. https://doi.org/10.3390/educsci11080402
24. Soeselo, D. A., Kusanto, A., Handini, N. S., Setiawan, J., Stephanie, I., Lie, M., & Gitasaraswati, A. A. (2022). Virtual suturing skills learning: role of verbal versus written feedback in surgery rotation clerkship. Medical Education Online. https://doi.org/10.1080/10872981.2021.2023937
25. Topuz, A. C., & Kinshuk. (2021). A Review of Literature to Understand Student's Perceptions Regarding Online Assessments. In Lecture Notes in Educational Technology. https://doi.org/10.1007/978-981-15-7579-2_4
26. Udechukwu, J. (2020). Digital Proctoring:Challenges and Prospects in Computer-Based Assessment in Nigeria. European Academic Research Journal.
27. Wahyu Widodo, A., Solikhatun, I., Raharja, S., Abdun Salam, A., & Sri Wartini, F. (2021). A Utilization of Information Technology on Education in Indonesia (2017-2020): A Systematic Literature Review. Journal of Physics: Conference Series. https://doi.org/10.1088/1742-6596/1779/1/012024
28. Wijayanto, P. W., Thamrin, H., Haetami, A., Mustoip, S., & Oktiawati, U. Y. (2023). The Potential of Metaverse Technology in Education as a Transformation of Learning Media in Indonesia. Jurnal Kependidikan: Jurnal Hasil Penelitian Dan Kajian Kepustakaan Di Bidang Pendidikan, Pengajaran Dan Pembelajaran. https://doi.org/10.33394/jk.v9i2.7395
29. Zainuddin, Z. (2023). Integrating ease of use and affordable gamification-based instruction into a remote learning environment. Asia Pacific Education Review. https://doi.org/10.1007/s12564-023-09832-6