Exploring Strategies for Assuring the Integrity of Remote Online Assessments

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Abstract

Worldwide, universities have had to quickly transition teaching, learning and assessment to the online modality, given the widespread restrictions imposed by governments in response to COVID-19. Although some universities had embraced remote teaching and learning well before the COVID-19 pandemic, the integrity of remote assessments remains a significant concern for institutions and employers who demand competence in graduates. Prior to the pandemic, several tools were used, and different strategies explored for assessing students; however, the assessments done during the pandemic period revealed several anomalies across computing courses at The University of the West Indies. This paper explores the experiences and challenges with final assessment across computing courses, including suspected cheating. Discussion of experiences, analysis of anomalies and recommendations will provide generalisable assessment guidelines for assuring the integrity of assessments.

Keywords: online assessments, cheating, COVID-19 pandemic

Background and Introduction

The outbreak of the COVID-19 disease in December 2019, and its subsequent declaration as a global pandemic by the World Health Organization (WHO) in March 2020 (Coronavirus Disease [COVID-19] – Events as they Happen 2021), brought about much uncertainty. As the disease spread rapidly across the world

at the end of the first quarter of 2020, many governments began to restrict public gatherings and other social events in order to contain the spread. As a result, many institutions, including universities, significantly reduced face-to-face teaching and learning activities. Given the semester structure of many universities across the world, including The University of the West Indies (The UWI), quick action was required during the second half-of-semester months of academic year 2019/2020 to complete the semester without having face-to-face sessions.

Moving teaching and learning to online delivery mode had its challenges, more so with how assessments would be administered and how the integrity of these assessments may be preserved. The major challenge was how to minimise the student's use of unauthorised materials or external help, ensuring that what was done reflected their ability and was not based on help received during the assessment. Many higher education stakeholders expressed several concerns, including the state of technology infrastructure to support the transition to online mode, the need to preserve academic integrity, and student access to the appropriate technologies in order to continue engagement in the teaching-learning process.

As the transition to online began, significant planning to manage the end of semester assessments began. The UWI changed the dates for the administration of exams and extended the usual examination period. This allowed adjustments to be made to assessment methods and time for these adjustments to be approved under The UWI's regulations. Internal discussions among instructors revealed a major concern about how to maintain the integrity of remotely administered final examinations. The discussions sought to identify key measures to minimise the likelihood or incidence of academic dishonesty (cheating), and how to address any incidents, given the new reality of remotely administered assessments.

The fraud triangle espouses the view that three conditions are needed for someone to perpetrate dishonest behaviour: pressure/incentive to perpetrate, opportunity, and attitude/rationalisation to justify fraudulent action (Lou and Wang 2009). The remote administration of assessments, combined with the design of an assessment, may provide the opportunity to cheat. The desire to achieve good grades may provide incentive, as grades are seen as important to career success since more desirable jobs and prospects for further studies are more accessible to top performers. Students may therefore be inclined to achieve good grades by any means necessary, even by cheating in some cases (McCabe, Treviño, and Butterfield 2001). Students' attitudes may be the only missing link in this model. Nevertheless, the concerns of dishonesty remain.

Random variations in student performance on assessments may be attributed to changes in the design of assessments, methods of assessment, or random variations in students taking a course. Statistically significant variations in student performance, however, require more thorough investigation of factors that may have resulted in such variations. Given that remote administration of assessments provides opportunities for cheating, it is important to quantify the prevalence of cheating, especially where there are statistically significant changes in performance year over year. Further, since the objective of assessments is to determine if students have achieved defined competencies, the integrity of the assessment is challenged when students cheat. Conversely, the integrity of remote assessments may benefit from design and administration strategies that reduce cheating. As a starting point, it is useful to determine whether student performance changed for remotely administered assessments compared to other periods, and what factors may have contributed to any observed changes or lack thereof.

This study investigates and details the experiences with final assessment of courses in the Department of Computing at The UWI. The paper seeks to identify any differences in student performance over comparative periods of offer of the same courses. The initial offer of courses, which is the baseline, reflects face-to-face assessment, while the second offer is done using online modality. Experiences of instructors in specific courses where academic dishonesty is detected are discussed and synthesised to identify best practices from existing literature that may be applied.

In the ensuing section, contributions are presented from other scholars on the issues surrounding academic dishonesty and measures explored to detect and/or prevent cheating. Thereafter, the methodology for this study is given, followed by the results, discussion, and conclusions.

Related works

Virtual learning is defined as the use of software systems to support teaching and learning. It allows teachers and learners to interact in an integrated, online environment (Bri et al. 2009). These systems facilitate remote education through the worldwide web (Ubell 2000). An important component of the teaching and learning process is assessment. In virtual learning environments, assessments are usually administered remotely.

Remote assessments are typically provided via the internet to candidates who answer questions by uploading response files or inputs in customised webforms (Thomas et al. 2002). Synchronous assessments usually require candidates to stay connected to the online examination resource during the assessment and submit responses in a fixed time. Asynchronous assessments may provide longer periods for completion and do not usually require consistent connection to the assessment server.

One of the earliest applications of assessment in remote learning was a software tool that autocorrected subject specific activities and allowed instructors to assess the learning level and possible deficiencies of the students (Wong and Ng 2016). With increased use of remote learning technologies, many additional tools and approaches have been adapted for this mode of education delivery. Although administering assessments remotely enables cheaper and more consistent grading and greater ease of capturing and marking responses (Shermis et al. 2001), assessments used for summative purposes may more readily facilitate cheating (Thomas et al. 2002).

Academic dishonesty includes several variations of unacceptable student behaviours such as copying other students' answers, using prohibited materials or using materials without appropriate attribution (Alghamdi, Rajab, and Rashid 2016). Specifically, cheating is the use or attempt to use unauthorised materials, information or study aids in any academic exercise (Pavela 1997). This of course extends to human help in providing materials or support when otherwise not allowed. Ullah, Xiao, and Barker (2016) classify cheating activities into two discrete areas of collusion and non-collusion. Non-collusion includes copying from the internet, books, or other unauthorized sources and plagiarism. Collusion includes impersonation, credential sharing, abetting, and screen sharing.

The detection and prevention of academic dishonesty have received much attention in the last decade, especially given increases in online education options. These concerns would naturally become more widespread, given adjustments across institutions to curtail COVID-19 infections. Whilst cheating occurs in face-to-face proctored assessments, evidence suggests that more widespread cheating occurs in remotely administered assessments (Hollister and Berenson 2009; King, Guyette, and Piotrowski 2009).

Cheating detection has seen different approaches in the literature, including using simple descriptive statistics to identify patterns in performance over comparative assessments or periods. Other methods include surveys of

students with the hope that they admit to cheating (D'Souza and Siegfeldt 2017). De Leeuw, Hox, and Dillman (2008) note that surveys in general may suffer from underreporting. Therefore, studies that use surveys to assess how widespread cheating occurs in unproctored assessments should be carefully reported and interpreted (Fask, Englander, and Wang 2014). Underreporting may occur for several reasons including students' unwillingness to admit that they cheated, as well as whether the studies are representative of different disciplines or courses which may be more challenging to students, inducing them to seek unauthorised help. The problem may therefore not emerge extensively in these studies and the problem may be much larger than reported. Other studies report cheating in undergraduate courses ranging from 9% to 90%, with recent studies further confirming alarming rates of cheating in higher education (Hsiao 2015; Arnold 2016; Burgason, Sefiha, and Briggs 2019).

Given the problems identified with online assessments and the widespread cheating reported in several studies, options for reducing the likelihood of cheating have been studied and reported. D'Souza and Siegfeldt (2017) propose a framework that applies several quantitative techniques to detect cheating in different types of assessments. Chuang, Yuan, Craig, and Femiani (2017) suggest a method to detect cheating in online assessments based on time delays of the student combined with their head movement. This requires the use of a video recording device such as a webcam. Unfortunately, this may not always be practicable since students may not have the appropriate equipment or enough bandwidth to use video while completing an assessment synchronously. Further, some students may access the internet on metered connections where the data transfer is limited, making it likely to lose connectivity if the data transfer quota is exhausted.

Students' motivation for cheating has also been widely studied. In a cross-cultural study involving university students in the USA and Israel, researchers observed that students' propensity to engage in academic dishonesty was influenced by a few key variables. These include the students' motivational orientation, personality traits, students' perception of the opportunities to cheat, students' attitude towards punishment for acts of academic dishonesty, type of course enrolment (elective vs. required), and attitudes of instructors towards academic dishonesty (Peled et al. 2019).

Contract cheating (where someone else is hired to complete an assessment for the student) has also been studied, specific to computer science education. Computer science integrity violations account for 37 per cent of academic integrity

violations over a ten-year period (Graziano et al. 2019). Unfortunately, contract cheating cannot be easily detected by common plagiarism tools.

Academic dishonesty undermines the integrity of qualifications, particularly in higher educational institutions (Baron and Crooks 2005; Hemming 2010; Faurer 2013). It is therefore a major objective of higher educational institutions to conduct assessments in a way that ensures the grades students earn truly reflect their abilities (Cluskey, Ehlen, and Raiborn 2011).

The literature confirms that cheating in higher education is a major issue and remote assessments provide an even greater opportunity for cheating to be more widespread. Given the current situation where COVID-19 has forced many higher education institutions to conduct remote assessments, it is necessary to study whether student performance varies when compared to face-to-face mode, and whether this is attributable to the remote administration of these assessments.

Methodology

This study uses both quantitative and qualitative data collected using several techniques. All data collected relate to courses offered by the Department of Computing at The UWI. The key data relate to students' final scores for courses, assessment structure and administration of each course, instructor feedback on suspected cheating, and official reports of suspected cheating.

Given the adjustments imposed by COVID-19, the Department held several meetings to discuss strategies for administering remote examinations and to solicit feedback from instructors on the methods to be used for final assessments. Subsequent to the examination period, faculty members discussed experiences and outcomes from remote assessments. Three sets of meeting minutes and recordings were examined to elicit experiences with course assessments and to capture information on assessment structure used, types of assessment administered, student experiences with the assessment, and lessons learnt along with outcomes after the assessments were administered. Additionally, formal documentation prepared as feedback to the university, on final assessments for Semester 2 2019/2020, was reviewed. This feedback documented the actual suspected shortfalls of the assessments reported by instructors. Where the full information for a course was not available in the documents reviewed, a questionnaire requesting the additional information regarding assessment type and experience with administration of the assessment was circulated to instructors. A request for the documents

and details about the course assessments and experience in administering their assessments accompanied the questionnaire. Group chat messages exchanged by members of the department surrounding final assessments for Semester 2, 2019/2020 examination period were also examined. Over the period covered by this study, eighteen instructors were engaged in the delivery of courses. Courses for which all the information required could not be collected were excluded from the study. Table 1 shows the courses included in the study.

Quantitative data were collected from the mark sheets for courses offered over the two comparative semesters of academic years 2018/2019 and 2019/2020. The number of students achieving specific grades (A, B, C) and the number of failures in each course were recorded. Course enrolment numbers ranged from 15 to 230 students. Graduate level courses and streams that were not based at the Mona Campus were excluded from the collected data.

The mark sheet data were grouped by course and descriptive statistical analyses applied to determine whether there were differences in achievement levels between the periods under review, and to determine the significance of any changes in the achievement levels across the comparative period for each course. Further, outcomes from marking the assessments, the experiences with suspected cheating, and the viewpoint of instructors were captured. This included perspectives on how different assessment designs or methods of administering assessments may have prevented or were ineffective in safeguarding the integrity of assessments. These were grouped and analyzed to identify similarities, differences, weaknesses, and strengths in order to recommend best practices and avoid pitfalls.

Results

In Semester 2 of both 2018/2019 and 2019/2020, the department offered twenty-three courses that had a final written assessment and were therefore included in the data collection. At the end of the data collection, however, only seventeen courses (*see* table 1) had complete information to satisfy the analyses done in the study; six courses were excluded on the basis of incomplete data. The analyses proceeded with basic descriptive statistics of the performance differences between the two periods for each course. The results indicate that there was an overall improvement in performance across all courses in the 2019/2020 year over the previous year. Overall, there was an average of 15.4% increase in the number of students achieving grade 'A' across the courses, 6.7% and 2.7% reduction in grades 'B' and 'C' respectively, and 6.1% average reduction in failures across all courses.

Table 1. Courses included in the study

Course Code	Course Name
COMP1126	Introduction to Computing I
COMP1127	Introduction to Computing II
COMP1161	Object-Oriented Programming
COMP1210	Mathematics for Computing
COMP1220	Computing and Society
COMP2130	Systems Programming
COMP2211	Analysis of Algorithms
COMP2171	Object Oriented Design & Implementation
COMP2340	Computer Systems Organization
INFO2100	Mathematics and Statistics for IT
COMP3161	Database Management Systems
COMP3162	Data Science Principles
COMP3702	Theory of Computation
INFO3180	Dynamic Web Development II
INFO3435	Ecommerce
SWEN3165	Software Testing
SWEN3185	Formal Methods and Software Reliability

Figure 1 illustrates the percentage change in grades achieved by course over the two periods. As shown, differences in the achievement levels for some courses varied widely. At the extremes, one course recorded a 30% reduction in the number of students achieving grade 'C', another course shows 46% increase in the number of students achieving grade 'A'.

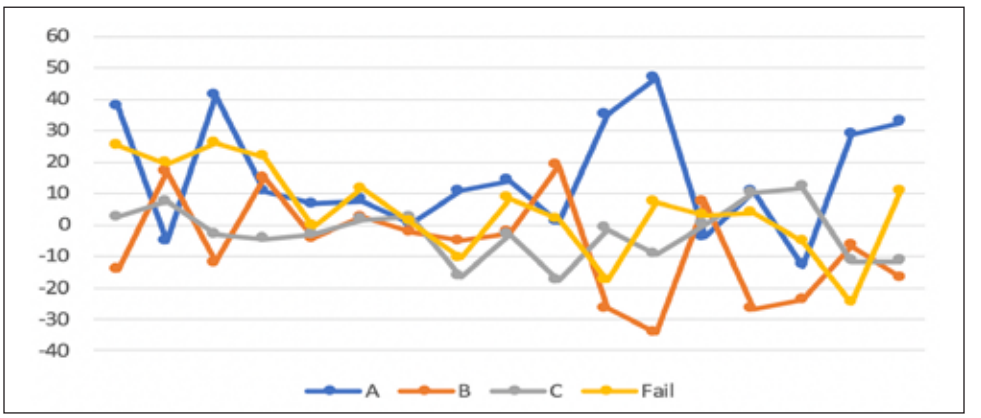

Figure 1. Percentage change in performance levels by course

Table 2. Percentage change in achievement of each grade by course

Course Code	% Change in A's	% Change in B's	% Change in C's	% Change in F's
COMP1126	37.5	-14.2	2.5	-25.2
COMP1127	-5.3	16.9	7.5	-19.4
COMP1161	41.3	-11.8	-3.1	-26.1
COMP1210	10.7	15.1	-4.4	-21.6
COMP1220	6.8	-4.2	-3.0	0.7
COMP2130	7.6	2.7	1.6	-11.7
COMP2211	0.6	-2.2	2.7	-0.8
COMP3161	11.0	-5.0	-16.6	10.5
COMP3702	13.9	-2.7	-2.8	-8.3
INFO2100	0.9	18.9	-17.7	-2.1
INFO3180	35.2	-26.4	-1.3	-7.4
INFO3435	46.8	-34.4	-9.3	-3.1
SWEN3165	-3.9	7.4	0.0	-3.8
SWEN3185	10.8	-26.6	10.1	5.4
COMP3162	-13.0	-23.7	11.9	24.9
COMP2171	28.8	-6.7	-11.5	-10.7
COMP2340	32.7	-16.7	-11.7	-4.2

Specifically, 35% of courses (six courses) recorded at least a 10% decrease in the number of failures in the 2019/2020 period when compared to the previous year, while only one course (COMP3162) recorded a more than 20% increase in the percentage of students who failed in 2019/2020 over the prior period.

Table 2 gives a breakdown of the percentage change in achievement of different grades by course over the periods 2018/2019 and 2019/2020. Values with the negative (-) sign indicate a percentage decrease in 2019/2020 when compared with 2018/2019, while values without a sign indicate a percentage increase over the same period.

The analysis of the recorded achievement levels over the two periods was carried out using two-sample t-test for each achievement level. The results related to achievement differences for percentage of students receiving grades 'A', 'B', 'C' and the percentage that failed are shown in table 3.

Based on the p-values from the t-tests on the percentage of students achieving different grades over the two periods (table 3), only the change in percentage for

Table 3. T-test result for each achievement level compared for Semester 2, 2018/2019 and 2019/2020

Achievement Levels	P-value
A	0.0463
B	0.1789
C	0.3781
Fail	0.3743

students achieving grade 'A' is statistically significant with a p-value of *0.0463*. Overall, the difference in the percentages of students who passed courses studied in both periods was not statistically significant, with the t-test returning a p-value of *0.3715*. This therefore indicates that, except in the case of the percentage of grade 'A' recorded, the other changes represent random variations which are not statistically significant.

Assessment Structure and Academic Dishonesty

Instructors generally maintained the format of their final assessment in the 2019/2020 examination period, although they adjusted the number of questions and the way questions were structured to compensate for the remote administration. Some instructors (such as those for COMP3162 and COMP1161), modified questions to require more explanations and examples, making it more difficult to have identical answers without indicating collusion. In other cases, instructors extended or created new question banks for multiple choice questions (MCQs). This had the effect of either introducing MCQs into the 2019/2020 assessment or increasing the number of MCQs used as a proportion of the overall assessment over the prior year. Overall, 88% of courses included in the study had at least one structured question on the final assessment paper in the 2019/2020 period, consistent with its structure in the previous academic year. Instructors also used randomised questions so that the question order, or specific groups of questions for one student would be different for another. These questions were carefully curated to ensure consistency in the number, topic coverage and difficulty level for all students alike, although the specific questions for each student would vary randomly for each topic assessed.

Instructors in at least four courses (23%) noted that as they marked structured questions types, student responses to questions in a number of cases raised sus-

picion of cheating. Further, in post-assessment discussions with students, it was noted that they had large course-specific WhatsApp groups used to share information; in some cases, assessment questions and suggested answers were shared openly. Hence, some of these groups served as channels of academic dishonesty.

Although the suspected cases of collusion, based on solutions submitted in many courses, were not collated and reported formally by some instructors, the post-assessment review provided evidence of concerning levels of collaboration among students, beyond what would be possible if assessments were face-to-face and proctored. Collusion was further enabled given that most assessments had a window of at least twenty-four hours (with some up to seventy-two hours) during which students were allowed to attempt the assessment, although they had a fixed time to finish once they started. Therefore, students could share their experiences and answers with others who attempted the examination later in the window of time. Two courses (COMP2211 and COMP3162) had official reports of 17% and 23% of suspected cheating. These cases included identical responses to specific questions from the assessments. Notably, the highest rate of suspected cheating was in a core course (COMP2211) that, if failed, would prove a major setback to students completing their degree in the required time. Additionally, the content covered in this course has been generally reported by students over the years as difficult to grasp. This assessment did not use randomised questions.

Discussion

The results confirm both the existence of academic dishonesty, found more extensively in specific courses, and relatively random variations in achievement except for the percentage of students achieving grade 'A'.

The statistically significant change in the percentage of students achieving grade 'A' can possibly be attributed to one of the following:

- Increased use of materials or help during assessments since they were not proctored to prevent such use or collusion of students. Collusion may have manifested in different forms ranging from sharing of ideas, giving guidance to improve answers, or sharing questions to allow more time to attempt before starting the assessment officially (in the case of timed assessments). These activities may not have resulted in students submitting comparably similar or identical responses, hence these submissions may not have been flagged as suspected cases of cheating, though they reflect academic dishonesty.

- The semester was extended due to a temporary closure for four weeks (after nine weeks of teaching). This provided additional time for students to review materials, explore content and prepare for final assessments, resulting in many students being better prepared for final assessments.

The level of cheating observed across computing courses based on lecturer reports in general was low. However, many submissions were identified as meeting the standard for review based on their similarity to other responses. This relatively low reporting of official cheating numbers is consistent with previous findings on underreporting of cheating (Fask, Englander, and Wang 2014). The informal discussions that ensued and some post-assessment hearings for students who were reported for suspected cheating, also provided insights into the use of WhatsApp and other tools to enable sharing and, in some cases, collaboration on assessments. These types of activities are examples of collusion as described by Ullah, Xiao, and Barker (2016). The existence of suspected cheating underscores the need for instructors to consider some key options for the preparation and administration of assessments.

The high percentage of suspected cases of cheating reported in two courses is cause for concern, especially given that one is a core requirement for students registered in the computer science major. This cohort of students therefore has a significant number of students (37) who are suspected of cheating in one course, although they may not have cheated in other courses. These students would represent approximately 23% of the cohort. Strategies are therefore needed to reduce the likelihood of cheating among students, for this and future cohorts across different courses. As Peled et al. (2019) note, opportunity to cheat, and type of course, are factors that influence students' decision to cheat.

Conversely, several courses reported no suspected cases of cheating. Among them are many that had assessments with questions that could easily provide evidence of collusion. Instructors across these assessments identified some strategies which were employed both in their design and administration of the assessments. These include

- **For Multiple Choice Questions**
  - Shuffling options randomly for each student. This made it less likely that if a student shared the letters of answers they would be correct for another student attempting the same question.
  - Randomly sequencing questions to ensure the order of questions, and

possibly topics, are not in the same order for different students attempting the assessment.
    - Increasing the number of questions for topics being assessed, to ensure that different students would get a more random set of questions. This increased the likelihood of students not doing the same questions, hence making answer sharing ineffective.

- **For structured questions**
    - Generating random changes to question sections so that the same question had different values, or different requirements for the responses. This also included, in some cases, the illustrations (models) used in the question.
    - Requiring more descriptive answers that incorporated specific examples. This provided a basis for identifying answers that may have been the result of collusion. In these cases, students were required to provide explanations from their perspectives.

- **In administering the assessments**
  Restricting the amount of time to complete the assessment. A time limit was set within which students had to complete the assessment once they started the attempt. This should have had the effect of forcing students to work on completing on time and may have provided fewer opportunities for recording and sharing questions and answers.

These and other strategies have been studied and documented with varying levels of effectiveness reported. Table 4 provides a summary and grouping of strategies for preventing or reducing the ability of students to cheat explored in several studies. D'Souza and Siegfeldt, (2017) provide a discussion of the strategies summarised in table 4.

Instructors across different course types and subject areas may have limited options based on the type of content delivered and the course objectives. However, varying the question types, carefully selecting timing, and randomising questions may be options available to many course types and disciplines. Even in cases where questions requiring more descriptive responses may not be incorporated into the assessment, generally, designing more assessment questions that require higher order thinking and analysis may be an option.

It is important that students be oriented to develop honest attitudes, and to view and approach assessments as a reflection of their own competence, not of others. It can be argued that students with the right attitudes towards honesty will

Table 4. Summary of strategies to reduce or prevent cheating

Question Design	Scramble multiple choice answers so that every student gets a different answer sequence presented. Provide multiple exams when possible without the knowledge of students. Both exams must have the same format with slight changes in wording and parameters.
Timing	Provide only the time that it would take an average student to complete the full exam. A student finishing an exam in an abnormally short time may be a cheating suspect. Compare each student's exam times with the average for the class. Check the clock time at which cheating students started and finished the exam, and compare this with the time span of other students to determine if they worked in groups.
Assessment Administration	Present questions one at a time and/in a random fashion with no backtracking. Check examination scripts with the same score to see if there is any distinctive similarity between the answers to questions.

not engage in dishonest behaviours. Additionally, clear and frequent reminders of the consequences and policies regarding cheating may deter cheating. Some students may also reconsider their actions if they are convinced that instructors will take steps to detect cheating in submissions and will take actions based on clearly defined rules. The threat of punitive action and knowledge that review and detection tools will be used are useful strategies, in addition to timing, question design, and assessment administration options.

Students across university campuses no doubt may continue to be tempted to find innovative ways to maximise their scores on assessments and, depending on their motivations and the opportunities, may engage in academic dishonesty. As has been demonstrated in this study and the literature, it is difficult to reliably determine the extent to which students cheat. However, especially in higher education institutions, the integrity of assessments is critical to maintaining their academic excellence ranking and the quality associated with the degrees they award. Further, employers depend on universities to provide competent graduates. Whenever a degree is awarded, this should give reasonable assurance

that the graduate has achieved a level of mastery and the reflected performance can be trusted as a true measure of the person's performance and abilities. This makes it critical for our institutions to provide strong controls and detection capabilities to prevent and detect cheating. Further, strong action is necessary in cases where students are proven to have cheated. By implementing and enforcing appropriate regulations, institutions can demonstrate intolerance for academic dishonesty.

Conclusion

This paper investigates changes in student performance in remote versus face-to-face assessments and the prevalence of cheating in the remotely administered assessments. With the advent of the COVID-19 pandemic and the forced transition to online teaching and learning, assessments have had to also be administered remotely. The study provides insight into the experiences with remote assessments conducted in the Computing Department at The UWI and highlights generalisable strategies that are useful in reducing academic dishonesty.

Although several authors have reported widespread cheating in higher education assessments generally, others have noted that there is general underreporting of cheating across the disciplines. This study was done to establish whether the transition from usually face-to-face assessments to remote assessments resulted in any significant change in student performance. Courses offered over Semester 2 of both 2018/2019 and 2019/2020 academic years were analyzed. The analysis showed a statistically significant increase in the percentage of students earning grade 'A' across courses. However, all other comparative scores had changes that were not statistically significant. The percentage of students suspected of cheating across all courses was not formally reported, though formal reports were made for two courses. The reports reflected 17% and 37% cheating respectively. Students involved were reported for disciplinary action.

The study advances our understanding of performance changes resulting from transition of assessments to remote administration. Additionally, important implementable strategies discussed in this study can provide important improvements in the design and administration of assessments for remote learning. Although some strategies may not be applicable to all disciplines, in general, the design and administration of assessments provide the most viable options to reduce cheating. In cases where cheating occurs, detecting and effectively applying punitive actions

outlined in institutional policies should be prioritised to secure the integrity of the assessment and hence, the degrees awarded by the institution.

One limitation of the study is that the performance and experiences relate only to computing courses. This could be expanded to include a broader range of courses across The UWI to get a more general and comprehensive assessment of performance changes and prevalence of cheating.

Administration of remote assessments requires developing and applying strategies that prevent and detect cheating. Some future directions may include more widespread exploration of changes in performance across disciplines at the university. These could include examining the methods used, whether collusive or non-collusive, and identifying specific strategies and regulations that may address the specific nuances of methods used by students across disciplines.

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