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Students' Perceptions of and Experience With Online Test Preparation (Rehearsal) and Testing

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ABSTRACT

This study investigates students' perceptions of rehearsal (test preparation) and testing after the pandemic forced increased online teaching use and experimentation. Data was gathered from information and decision sciences (IDS) students in an underrepresented minority (URM) serving university. Responses from 136 participants were analyzed and revealed four major findings. The single most interesting finding was that students, on average, preferred graded rehearsal activities over optional activities. Second, rehearsal activities were more important in online than face-to-face settings. Third, students overwhelmingly prefer online exams, on which they feel they perform better and which they find less anxiety-producing. Finally, despite research showing the importance of online proctoring for major defined-answer testing, instructor use of proctoring and monitoring is split between those who do and do not use concrete methods, with lockdown browser being common and live webcam less common. These interconnected findings are discussed.

KEYWORDS

Online Education, IDS Online Education, Online Testing, Online Rehearsal Strategies, Online STEM Education

INTRODUCTION

The landscape of education has undergone profound changes in the wake of the COVID-19 pandemic, particularly in the realm of online learning and assessment. As institutions adapted to remote instruction, the methods employed for testing and student preparation became pivotal to understanding student success. This exploratory study aims to fill a critical gap in the literature by examining students' perceptions of rehearsal and testing in an online educational environment, specifically among students in information and decision sciences (IDS) at an underrepresented minority (URM) serving university.

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Effective test preparation is essential for optimizing student performance and engagement, and the unique dynamics of online learning introduce new challenges and opportunities. The dual processes of input—where learners acquire knowledge through readings and lectures—and practice—where they engage actively with the material—are crucial to achieving academic success. However, reliance on passive learning methods can hinder performance, making it vital to explore more interactive and supportive rehearsal strategies.

In this study, we investigate students' preferences for various test preparation methods, including the effectiveness of instructor-designed materials and the impact of online exam formats. We also examine students' views on proctoring practices, an area that has become increasingly relevant as educational institutions seek to maintain integrity in online assessments. By gathering and analyzing data from 136 IDS students, our research seeks to illuminate the complex interplay between preparation methods, testing modalities, and student anxiety, ultimately contributing valuable insights to the ongoing discourse on online education in a post-pandemic world.

The methods of testing as well as the support students get from instructors for test preparation opportunities are important in any setting. Since online settings affect the nature of testing so substantially and supportive virtual techniques significantly impact students' success, it is critical to investigate students' perceptions of online practices in this regard. However, careful investigation of online test preparation in the post-COVID period is disjointed and incomplete and testing patterns research is scarce.

As a brief overview and identification of the focus of this study, education can be viewed as a process of (a) inputs, (b) practice, and (c) testing (Van Wart et al., 1993). In the input stage, learners are exposed to facts, concepts, and knowledge of skills primarily through various types of readings and face-to-face or virtual lectures. While the input stage has critical importance overall, educators' overreliance on what is generally considered "passive" learning during this stage has long been a standard theme in higher education teaching for decades (e.g., Bligh, 2000; Chickering & Gamson, 1987; Al Shloul et al., 2024). Researchers have noted many students—after their initial exposure to readings and lectures—also tend to rely too heavily on passive review of readings, lecture notes, recorded lectures, and so forth. (Karpicke et al., 2009; McNulty et al., 2012; Rohrer & Pashler, 2010; Børte, Nesje & Lillejord, 2020). While passive input is useful initially, its utility declines dramatically in comparison to practice-based (aka "active learning") techniques or even becomes dysfunctional if it replaces practice altogether (Rickard & Pan, 2018; Roediger & Bulter, 2011; Rowland, 2014).

Practice itself can be divided into different stages (Salisbury, 1988). Earlier in the learning process, practice is variously called drill work, recitation (e.g., in small groups), homework, and so on. It is most useful for learning key concepts and terms, clarifying basic understanding, and providing simple application problems. Later in the learning process, practice is sometimes called test preparation or rehearsal (Flippo et al., 2018). It includes methods like the use of instructor-designed study guides, practice quizzes and tests, automatically scored problems, and synchronous review sessions. In terms of practice, this study is interested only in instructor-designed test preparation which we will call either rehearsal or instructor-guided review-and-study assistance.

The bulk of testing and assessment normally occurs at or toward the end of the learning process after the input and practice phases. However, testing and assessment can include not only the standard, end-of-module and end-of-term exams but also low-stakes, graded, formative practice and major assignments such as presentations, term papers, and performance reviews that occur during the learning process (Kubiszyn & Borich, 2000). This study focuses on student perceptions of the comparison between face-to-face versus testing modalities, as well as the associated proctoring and monitoring methods that students experience.

LITERATURE REVIEW

Rehearsal Activities

In a meta-analysis of self-directed learning, Doo and Zhu (2023) found that not only is self-directed learning critical for student success, but that instructors play a major role in assisting effective self-directed learning. Quality rehearsal opportunities provide feedback leading to self-efficacy, competence, and autonomy, which in turn results in higher satisfaction (Merhi & Meisami, 2022). This is sometimes called "deliberative practice" (Giraud-Carrier et al., 2021). As previously noted, rehearsal strategies are those that are commonly thought of as test preparation strategies. Four are discussed below.

Research regarding practice quizzes and practice exams has found them to be highly effective in enhancing the learning achievement (e.g., Butler, 2010; Cohen & Sassen, 2016; Dunlosky et al., 2013; Gray & Bunte 2021; Lee & Ahn, 2018). They are particularly helpful in giving students a more realistic view (Bälter et al., 2013; Karpicke & Roediger, 2008). This has been confirmed in science, technology, engineering, and mathematics (STEM) settings as well (Feudel & Unger, 2022; Gong et al., 2024; Larsen et al., 2008; Lavallard et al., 2023; Wenger et al., 2009). While agreeing with their overall effectiveness, researchers have observed that students who substitute quiz taking for original study do not have good overall achievement (Brothen & Wambach, 2001), and some students try to "game the system" when taking quizzes and therefore do not improve overall performance (Kibble, 2007, 2011).

There are numerous types of study guides and their effectiveness is grounded in many factors that are situation specific (Wood et al., 1992). For example, a study based on requiring textbook guides found that they were effective in improving multiple-choice test taking (Dickson et al., 2005). However, Hackathorn et al. (2017) questioned the efficacy of instructor-created study guides and hypothesized that their popularity with students was in narrowing the pool of information to be studied. A follow-up study used a concept-based, instructor-designed study guide finding that they encouraged "studying to the test" and actually reduced performance (Cushen et al., 2019). Other researchers have found that while students were very eager for instructor-designed study guides, students who created their own individually or in groups frequently performed better (Contreras et al., 2021).

Automatically scored activities can be graded or provided for optional practice or as a part of class participation. The use of online homework in online classes is nearly ubiquitous but it is not necessarily automatically scored (Xu, 2022). Studies generally find homework of some type improves performance because it aids students in error detection and self-regulation (e.g., Hattie & Timberley, 2007: Messer et al., 2024). Some studies have shown online homework to be superior to traditional homework methods (Angus & Watson, 2009), but other researchers find that the technique used to deliver homework makes minor or little difference in student success (e.g., Magalhães et al., 2020; Palocsay & Steven, 2008). Relatedly, researchers have found that gamification is effective in general and popular format for automatically scored activities in lieu of traditional homework (Lumsden et al., 2016; Metwally et al., 2021); others have found gamification to have limited impact on performance and satisfaction (e.g., Butler & Bodnar, 2017).

There are a few studies situated in face-to-face environments, but we could not locate any literature focused specifically on the usefulness of online synchronous exam review sessions. Hackathorne et al. (2012) found students' exam scores were significantly higher for the exams following both a traditional review and a trivia review than for the exam following the practice test review. Zhang et al. (2024) found STEM students significantly enhanced performance after exam review sessions with embedded micro and metacognition strategies. However, contrary to expectations, Levant and Paolo (2017) did not find that between-exam review affected re-test performance of medical students in a two-test system.

In sum, two of the methods—practice quizzes and automatically scored activities—were found to be consistently effective in general, and two were found to be of mixed effectiveness

depending on sample and situation. In none of the studies was the student perspective the focus, nor was a comparative methodology regarding effectiveness used. However, an understanding of comparative student preferences is useful for faculty to know in selecting strategies to employ. Furthermore, it stands to reason that if students do not use certain methods, or do not think they are important if required to use them, their motivation will be lessened, and their effectiveness will be limited. Therefore, these issues led us to ask the following question in the contemporary IDS and information systems and technology (IST) context:

- Research question 1: How important are instructor-designed rehearsal activities in online IDS/IST courses and which activities do students perceive to be the most helpful?

Required Versus Optional Review and Study Activities

The debate about whether or not to make review and study activities optional or mandatory is frequently framed in terms of the purposes of formative assessment. Should formative assessment be about unmonitored assessment, monitored but ungraded assessment, or low-stakes practice in which opportunities for improvement may or may not be embedded in the activities? Philosophically, some education theorists strongly believe in encouraging ungraded trial and error, discovery learning and constructivism (Balim, 2009; Bruner, 1966), and learner-centered approaches that deemphasize evaluation and emphasize learner development (Weimer, 2013; Brookhart, 2017) and learning as a community (Siemens, 2005). In this regard, some researchers have found optional formative quizzes useful (e.g., Feudel & Unger, 2022) and others have found mandatory formative assessments helpful (e.g., Lavallard et al., 2023). In an interesting case study, it was found that students required to use notetaking as a part of the learning process did in fact do better when taking a summative test, but they also took longer to process the online lecture materials (Armel & Shrock, 1996).

While the literature seems to find both optional and mandatory (graded) strategies useful for formative activities (e.g., practice quizzes), the question remains concerning what students think about the comparative helpfulness of the two approaches in the online context since the online context frequently relies on a flipped classroom approach, which in turn tends to be activity based (Chikeme, 2024; Sein-Echaluce, 2024). On one hand students like flexibility which optional formative strategies provide, but on the other hand, they do not like busywork (Dyment, Stone & Milthorpe, 2020), which ungraded activities likely to be perceived as (Cook, & Babon, 2017).

- Research question 2: Is there a significant difference between student perceptions of the helpfulness of required versus optional study and review activities?

Exams in Online Courses

Online exams have evolved alongside the rise of online education. The adoption of online exams has been driven by several factors, including technological advancements, increased access to the Internet, and the need for more flexible assessment methods. However, despite their advantages, such as offering convenience and flexibility for both educators and students, there are issues surrounding online exams (Al-Mashaqbeh, & Al Hamad, 2010). The benefits can include accessibility, more flexibility, and quick feedback. The challenges of online exams can include technical issues, increased stress and anxiety, cheating concerns (discussed in the next section), and diminished learning achievement.

Quick feedback helps students identify areas where they need improvement and adjust their study strategies accordingly (Kuo & Wu 2013). Online exams that utilize an automated grading system can evaluate and generate grades for students immediately upon submission of their test (Al-Qdah & Ababneh, 2017). Yet, students frequently mentioned potential technical problems during online testing created stress and anxiety (Arslan, 2022; Mutalik & Mutalik, 2022). Stowell and Bennett (2010) found that students with low classroom anxiety experienced increased test anxiety when taking tests online. Another study found that test anxiety in an e-proctored exam negatively related to students'

performance in STEM subjects (Prakasha et al., 2021). However, some studies report moderate to high student comfort with online exams (Ilgaz & Afacan Adanır, 2020), especially when the online proctoring system is well supported (Milone et al., 2017). In another study comparing students who opt to take the organic chemistry course exam online and those who opt to take it face-to-face, results found that students who chose to take face-to-face exams outperformed students who took online exams, and they also found chemistry more valuable than the students who preferred online exams (Beatty et al., 2022). One experimental study also found that students achieved lower grades taking the exam online compared to taking it in a proctored environment (Fask et al., 2014). However, other studies found either no difference between students taking online or face-to-face exams (Anakwe, 2008; Elmehdi & Ibrahem, 2019; Spivey & McMillan, 2014; Stack, 2015) or found better performance from students taking online exams compared to students who take exams in person (Adanır et al., 2020; Angus & Watson, 2009). While faculty concerns about cheating are extensive (e.g., Gribbins & Bonk, 2023), student concerns are minimal (Van Wart et al., 2020).

Overall, then, the preferences students have for face-to-face versus virtual testing modalities, and the reasons for those preferences have varied extensively according to different studies. The evidence does show that when student anxiety is reduced, students' preference for online testing increases. Because of our focus on the student perspective, we also wanted to investigate their perceptions of comparative: performance, reflection of their learning, assessment difficulty, fairness, and preparation time in the post-COVID era.

- Research question 3: What type of testing modalities do IDS/IST students prefer in their courses and why?

Proctoring and Monitoring of Exams in Online Courses

Cheating is widely reported as a problem in colleges and universities (Janke et al., 2021; Kedem-Yemini & Katz, 2021; Alessio & Messinger, 021). For example, McCabe et al. (2012) found that in institutions without an academic honor code, 71% of students admitted to serious cheating. In studies investigating cheating in which defined answers were prevalent and course grades were primarily dependent on major tests, various types of online proctoring made a substantial difference in reducing academic dishonesty. Most studies have reported 10%–20% higher score averages on unproctored online exams than those which have proctored online tests (Alessio et al., 2017; Daffin & Jones, 2018; Dendir & Maxwell, 2020). Studies reporting the differences between proctored and unproctored exam settings also noted that students took longer on unproctored exams on average, suggesting that they needed more time to answer questions, and lower performing students were more likely to see greater differences in their test scores in proctored exams (Akaaboune et al., 2022; Vazquez et al., 2021;). Some studies have indicated that the type of online proctoring or even the difference between in-person and online proctoring is far less important than the presence or absence of proctoring (Lee, 2020; Vazquez et al., 2021)

It should be noted, however, that proctoring is not the only way to reduce academic dishonesty (Dadashzadeh, 2021; Patael et al., 2022). The ability and motivation to cheat can be reduced by placing more weight on small, graded formative assessments; using time limits and simultaneous testing windows; utilizing large question banks to provide unique exams for all students; and reducing defined answer questions in major assessments when possible, moving to complex problems, essays, or performance activities (Valızadeh, 2022).

One of the fundamental ways that online proctoring occurs is through programs that secure various aspects of a test taker's computer to reduce the likelihood of looking up or receiving answers to questions. So-called "lockdown browser" technology has improved greatly and includes features such as authentication, disabling capturing and print functions, and disabling most toolbar and split-screen functions (Mistry et al., 2022). Even without auxiliary webcam monitoring programs, lockdown browsers have been found to be nearly as effective in a home setting as when used in an in-person setting

(Marín-García et al., 2021). Lockdown browser technology does increase test anxiety in some cases, especially when used in conjunction with other features such as only allowing students to see one question at a time and not allowing them to use the back button (Ruzgar & Chua-Chow, 2023).

When webcams are used in conjunction with lockdown browser technology, the reduction in academic dishonesty is "significantly reduced" to the point that it is roughly equivalent to a well-proctored, in-person environment (Alessio & Maurer, 2018). Technology improvements include automatic movement activated cheating detection (Gupta & Bhat, 2022) and 360-degree security cameras (Turani et al., 2020). However, since most students are taking exams at home, webcams raise questions about invasiveness (Mahon et al., 2023).

Because of the evolution of technology, the changing perceptions of students and faculty, and alternate ways of mitigating academic dishonesty, we seek to get a sense of how pervasive proctoring technology has become in the post-COVID IDS/IST discipline. The following research question aims to answer those issues:

- Research question 4: What types of proctoring or monitoring have IDS/IST students experienced?

METHODOLOGY

Data for the study was gathered from IDS students in an URM serving university. Responses from 136 participants were received and then analyzed. Students were included in the sample if they had experience taking multiple online courses within IDS. On average, participants reported having taken 5.5 online IDS courses at the time of the survey (median = 4, range = 2 to 20 courses). IDS courses are offered to undergraduate and graduate students at the school through its Bachelor of Arts (BA) in Information Security, BA in IST, BA in Supply Chain Management, Bachelor of Science (BS) in Business Intelligence and Analytics, BS in Cyber Security, BS in National Security and Master of Science in Cyber Security, and Master of Science in Business Intelligence and Analytics programs. Both face-to-face and online courses covering the same subjects are available to students. The programs in question do not have faculty policies regarding the use of proctoring methods, and the university has warned faculty about the prospective intrusiveness of webcams in student homes.

To begin our investigation, we surveyed students in IDS majors in order to capture the key factors which they perceive affect online exams and rehearsal. Two sections of the questionnaire were of primary interest for this project. The testing section included 15 questions that address difficulty, performance, anxiety, preparation time, perceived fairness, and other characteristics of online versus in-person exams. The rehearsal strategies section included 12 items that address study and review activities in online courses, including required versus optional rehearsal, availability of material, and usefulness of specific tools (e.g., study guides, review sessions, practice quizzes). Responses were collected in spring 2023 by inviting students in IDS courses to complete the survey. Demographic information is summarized in Table 1.

Table 1. Demographic composition of sample

	Count	Percentage (Count/N = 136)
Race / Ethnicity		
Hispanic/Latino/Latina	69	50.7%
White/Caucasian	26	19.1%
Asian/Pacific Islander	20	14.7%
Black/African American	3	2.2%

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Table 1. Continued

	Count	Percentage (Count/N = 136)
Middle Eastern/Indian	3	2.2%
Native American	2	1.5%
Multi-ethnic/Mixed	8	5.9%
Age (Average = 27.1; Median = 23.5)		
18–19	9	6.6%
20–24	64	47.%
25–29	25	18.4%
30–34	17	12.5%
35–39	7	5.1%
40+	12	8.8%
Gender Identity		
Woman	55	40.4%
Man	76	55.9%
Non-binary, agender, or multiple genders	2	1.4%
Year		
Sophomore	19	14.0%
Junior	34	25.0%
Senior	59	43.4%
Graduate Level	23	16.9%

FINDINGS AND RESULTS

Our first research question was: How important are instructor-designed activities in IDS/IST courses, and which activities do students perceive to be the most helpful? Two questions were designed to gauge the overall perceived importance. Only 14% of the students indicated that they did not use instructor-designed optional study and review materials much or at all. Over one third indicated that they use optional materials a lot. See Table 2 for details.

Table 2. Usage of optional study and review material for online information and decision sciences (IDS)/information systems and technology (IST) courses

	Frequency	Percent	Valid Percent
Strongly disagree	6	4.4	4.4
Slightly disagree	13	9.6	9.6
Neutral	15	11	11.1
Slightly agree	52	38.2	38.5
Strongly agree	49	36	36.3
Valid Total	135	99.3	100

A second dimensional question was the degree to which students think instructor-provided study and review materials are more important than in face-to-face classes (if at all). On average (mean = 3.72), students find study and review materials to be more important in online courses. Only 11% found them to be less important than in face-to-face courses. See Table 3 for details. So, students find study and review materials to be more important and report using them extensively when provided. See Table 3 for details.

Table 3. Importance of instructor-provided study and review materials for course learning

	Frequency	Percent	Valid Percent
Much more important in face-to-face	7	5.1	5.4
Slightly more important in face-to-face	8	5.9	6.2
Same importance	46	33.8	35.4
Slightly more important online	23	16.9	17.7
Much more important online	46	33.8	35.4
Valid Total	130	95.6	100

This leads to the question, comparatively speaking, which methods do students think are most helpful? In the first tier of importance for students are instructor-designed study guides, practice or review quizzes, and automatically graded practice problems in which the mode was five in all three cases. In the next tier was synchronous review sessions with the instructor with that a mode of four. See Table 4 for details.

Table 4. Comparative helpfulness of rehearsal strategies

In general, _____ help me learn in online information and decision sciences (IDS)/information systems and technology (IST) courses.		
Rehearsal Activity	**Mean**	**Mode**
Instructor-designed study guides	4.62	5
Practice or review quizzes	4.46	5
Automatically graded practice problems	4.40	5
Synchronous review sessions	3.93	4

There is a significant difference among the rehearsal strategies in that some are rarely directly linked to formative assessment (e.g., instructor-designed study guides and synchronous review sessions), and others frequently are a part of the formative grade structure (e.g., practice of review quizzes and automatically graded practice problems). Investigating this distinction is our second research question. Although students claimed their most helpful strategy to be instructor-designed study guides, they are cognizant of the importance of employing study and review activities and the positive role requiring them can play in the learning process. In fact, required study and review activities were significantly more helpful, according to students, than optional ones. See Table 5 for details.

Table 5. Comparative helpfulness of optional versus required rehearsal strategies

In general, required (graded)/optional (ungraded) study and review activities help me learn in online information and decision sciences (IDS)/information systems and technology (IST) courses.		
Voluntariness of Rehearsal Strategies	**Mean**	**Mode**
Required study and review activities	3.93	4
Optional study and review activities	3.56	4

Our third research question was essentially: What type of testing modalities do IDS/IST students prefer in their courses, and why? When students were asked about their preference, it was overwhelmingly in favor of online exams. Over half of the respondents chose the top category "strongly prefer online." Less than 9% preferred face-to-face exams. See Table 6 for details.

Table 6. Students' preference in online exams

	Frequency	**Percent**	**Valid Percent**
Strongly prefer in-person	8	5.9	5.9
Slightly prefer in-person	4	2.9	3.0
No preference	19	14	14.1
Slightly prefer online	33	24.3	24.4
Strongly prefer online	71	52.2	52.6
Valid Total	135	99.3	100

One major reason for the preference for online testing was that students reported that they felt that they performed better on average in online testing (mean=3.70). Ironically, there was a substantial bimodal distribution between those that felt their performance was equivalent in the two modes and those who reported doing much better online. See Table 7 for details.

Table 7. Performance in exams

	Frequency	**Percent**	**Valid Percent**
Much better in-person	6	4.4	4.4
Slightly better in-person	4	2.9	3.0
About the same	56	41.2	41.5
Slightly better online	27	19.9	20.0
Much better online	42	30.9	31.1
Valid Total	135	99.3	100

Students also reported online tests to be much less anxiety-producing (reversed, mean of 1.93 and mode of 1), a better reflection of their learning (mean = 3.38), and slightly fairer (mean = 3.16) with no more time

constraints than face-to-face exams. However, it should be noted that students found face-to-face exams significantly more difficult on average (mean = 3.46). Also, while the overwhelming majority of students stated that their prep time was equal for both, there was a slight lean on average to responding that they prepared less for online exams (mean = 3.18). See Tables 8 and 9 for details.

Table 8. Difficulty in online exams

	Frequency	Percent	Valid Percent
Much more difficult online	2	1.5	1.5
Slightly more difficult online	9	6.6	6.7
About the same	67	49.3	49.6
Slightly more difficult in-person	39	28.7	28.9
Much more difficult in-person	18	13.2	13.3
Valid Total	135	99.3	100

Table 9. Preparation time for exams

	Frequency	Percent	Valid Percent
Much longer online	13	9.6	9.6
Slightly longer online	10	7.4	7.4
About the same	69	50.7	51.1
Slightly longer in-person	26	19.1	19.3
Much longer in-person	17	12.5	12.6
Valid Total	135	99.3	100

Proctoring and monitoring can affect students' experience and indirectly affect preferences. For example, more proctoring and monitoring might affect students' perceptions of fairness positively but also cause more anxiety. Further, there was interest in obtaining a snapshot post-COVID of the utilization of proctoring and monitoring strategies. Students were asked in online IDS/IST courses, which type(s) of proctoring or monitoring they have experienced. Only 23.1% of respondents report no proctoring/monitoring experience. The mode was "some classes" at 40.0%. Experience with a lockdown browser was the most common proctoring technique with at least 60% reporting some experience (the mode was "some classes"). Live webcam monitoring was substantially less common, with over half the students reporting no experience with the technique at all. See Table 10 for a breakdown of the students' experience.

Table 10. Students' experience with proctoring and monitoring methods

	No exam proctoring or monitoring	Lockdown browser	Live webcam monitoring
Not experienced	23.1	39.6	54.6
Some classes	40.0	47.0	36.2

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Table 10. Continued

	No exam proctoring or monitoring	Lockdown browser	Live webcam monitoring
Most classes	24.6	11.2	8.5
All classes	12.3	2.2	0.8
Valid total	100%[a]	100%[b]	100%[a]

[a]N=130. [b]N=134.

DISCUSSION, CONCLUSION, AND LIMITATIONS

In this exploratory study, we focus on investigating and revealing students' perceptions of rehearsal and testing in an online education setting. We gathered evidence from IDS students in an URM serving university.

Our first research question was: How important are instructor-designed rehearsal activities in online IDS/IST courses and which activities do students perceive to be the most helpful? Overall, the literature suggests that instructor-designed rehearsal activities are perceived helpful and generally effective in raising performance. The overall answer in this study is resounding: instructor-designed rehearsal activities are very important to students. In alignment with the literature, instructor-created study guides, practice quizzes, and automatically graded practice problems are highlighted by students as particularly beneficial. Importantly, there was also a strong sentiment, on average, that instructor-designed rehearsal activities are more important in online courses than face-to-face courses.

Our second research question was: Is there a significant difference between student perceptions of the helpfulness of required versus optional rehearsal activities? This question has not been directly investigated in the literature. In a novel finding with enormous practical implications, results reveal that while both required and optional study activities are reported as being helpful, required review and study activities were reported to be more helpful than optional ones. So, while students appreciate the autonomy provided by optional activities, they are appreciative of required activities that provide a more distributed testing environment, more continuous feedback, and a determent to procrastination.

Our third research question was: What type of testing modalities do IDS/IST students prefer in their courses and why? The literature provides mixed results. Compared with in-person exams, the vast majority of students prefer taking exams online in this study. Furthermore, most believe online exams maintain the same level of fairness and difficulty, require similar preparation time, and can provide similar reflections of their learning. Research indicates that exam-related stress is common among college students, particularly attributing stress and anxiety to potential technology issues in online exam-taking (Prakasha et al., 2021; Stowell & Bennett, 2010). However, most of the students in this study claim they feel significantly less anxious and less pressure when taking exams online.

Our fourth research question was: What types of proctoring or monitoring have IDS/IST students experienced? The literature notes that cheating is common, and may be more common in online settings. While proctoring and monitoring technologies are not the only way to reduce cheating, they are important tools for instructors, especially in contexts requiring defined answer exams. In this study, most students have experienced at least some online proctoring, but nonetheless, less than a quarter of the students have not. Lockdown browser was a common method, but webcam technology was only reported as experienced by a little over a third of the students. Given the literature about the importance of online proctoring of exams that have defined answers in order to stem widespread academic dishonesty, as well as the anticipated competence of students and faculty in computer technology, this finding was quite surprising and warrants further investigation. Among the contributing reasons can be the use of non-defined answer assignments and the use of extensive formative assessment as mitigating strategies, the lack of departmental/university support

for online proctoring, and/or the lack of faculty conviction that online proctoring is worth their time and effort—especially for adjunct faculty.

The meta-analysis by Doo and Zhu (2023) emphasizes that instructors play a pivotal role in fostering effective self-directed learning. Our study reinforces this by exploring specific strategies like practice quizzes, study guides, and online homework, showing how instructors can directly influence students' learning outcomes. This aligns with the broader notion that instructor engagement and support, such as providing quality feedback and practice opportunities, can significantly boost student motivation, competence, and self-efficacy.

Our study contributes to the growing body of research on rehearsal strategies, such as practice quizzes and exams. This study reinforces previous findings (Butler, 2010; Cohen & Sassen, 2016; Dunlosky et al., 2013) regarding the positive impact of these strategies on student performance. In addition, this study addresses a gap in the literature by pointing out that little research exists on the effectiveness of online synchronous exam review sessions. This is a critical contribution, especially as online learning environments become increasingly common. By contrasting findings from traditional settings (Hackathorne et al., 2012) with emerging studies on STEM-focused review sessions (Zhang et al., 2024), our study sheds light on the potential benefits of synchronous reviews in online courses.

Moreover, our findings contribute to understanding the complex role of automatically scored activities (like online homework) and gamification in enhancing student learning. While these techniques are generally found to improve performance through self-regulation and error detection, we highlight the mixed results on their effectiveness, especially regarding gamification. This adds a layer of complexity to the literature by showing that the impact of these strategies can depend on context, format, and student engagement, a nuance that has been underexplored in prior studies.

Instructor-designed online learning rehearsal is very helpful according to both the literature and students. The question is not whether or not faculty should provide rehearsal activities for students in online courses, but how much they should provide. In terms of rehearsal practice, providing either quizzes, review exams, or automatically graded practice problems should be the rule rather than the exception in most online classes. In terms of a cognitive overview of the test, instructor-designed study guides are the most popular with students, but primarily as a mechanism to know what material is most important, which material can be ignored, and the nature of the test itself. Synchronous review sessions, in synchronous classes, may have some overlap with the provision of a study guide (which conserves class time). Logically, it would seem good practice to have one or the other as well. Successful students want a variety of methods to instill and deepen their understanding of the course content (Simsek & Balaban, 2010).

Second, the evidence for the use of extensive graded activities in addition to major tests in most standard undergraduate online courses is weighty. As indicated by this study, on average it is a student preference. It is also shown to distribute deliberative practice, to increase the effort necessary to cheat, and reduce the anxiety associated with major tests. This is especially true when lecturing is either less potent and more easily distracted in synchronous classes, or highly condensed in online recorded lectures.

Finally, while the importance of online proctoring is well documented, our study indicates that relatively viable and reliable online proctoring methods may be underutilized if policy and support are lacking. Of course, there may be cases where online proctoring is less effective or necessary; however, in an age of artificial intelligence, when even essays can be instantly generated, the importance of online proctoring as an important tool in safeguarding academic integrity cannot be seriously questioned.

The limitations of our study include the following: The exploratory findings are limited to statistical and descriptive statistics. The sample population comes from a single university, which is a Hispanic-serving institution with a specific demographic. It also targets IDS/IST students. While these factors tailor the findings to this group—such as the conclusion that required rather than optional rehearsal activities are most helpful—they limit broader generalizability. Future research should test our findings about the preference of students for required rehearsal activities over optional ones in

different settings and with different samples. Additionally, complementary faculty perceptions were not included in the study, nor were corresponding objective data, such as grades. Finally, this study did not investigate to see if there were significant differences by level of study; that is, do students opinions vary by whether they are being asked questions about introductory courses versus upper division courses.

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DISCLAIMER

"Any opinions, findings, and conclusions in the material are the author's and do not necessarily reflect the views of NSF."

CONFLICTS OF INTEREST

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

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Dr. Montgomery (Monty) Van Wart has worked in higher education in various capacities for over 35 years, nearly always with administrative roles. He served as the Interim Dean of the College of Business and Public Administration at California State University San Bernardino where he was also a longtime chair of the Department of Public Administration. Prior to that he was the Chair of the Department of Public Administration at the University of Central Florida. He was also a Senior Research Fellow at KU Leuven (formerly Catholic University) in Belgium (2012-13), a visiting professor at Rutgers (2013), and a visiting professor at the University of Hong Kong and the National University of Ireland, Galway. He is the recipient of the 2023-2024 Outstanding Faculty Award for CSUSB. As an instructor, Dr. Van Wart has won the Chancellor's award for teaching (Faculty Innovation and Leadership Award) and many other teaching awards. As a champion of online teaching, he was the first at CSUSB to provide Quality Matters certified classes. He has done extensive pedagogical research and has worked hard to ensure that he applies those insights to his own teaching. As a scholar, Dr. Van Wart has over 150 publications and received the University Outstanding Research Award in 2015. His primary research frequently appears in the best journals in the field; for example he has ten refereed articles in Public Administration Review. His eleven books include Dynamics of Leadership (2nd edition, Choice Award for Outstanding Academic Title), Leadership in Public Organizations (3rd edition), Human Resource Management in Public Service (with others, 7th edition, Best Public Sector HR Book by ASPA), Leadership and Culture (with Hondeghem and Schwella), Business-Government Relations (with Ni), Leadership Across the Globe (with Gupta), and Changing Public Sector Values. He has nearly 10,000 Google Scholar citations. His research areas are administrative and business leadership, human resource management, training and development, administrative values and ethics, organization behavior, and general management. He helped redesign the Code of Ethics for the American Society for Public Administration (ASPA), is the Associate Editor for Public Performance and Management Review and also serves on numerous editorial boards. He has received numerous awards for research. As the Director of Faculty Development.. Professor Van Wart is currently the Director of Faculty Development for the College of Business and Public Administration, and in that role he provides research support services to all faculty in the college. Those services include research seminars, copy-editing (including for grants), manuscript critique, revise-and-resubmit assistance, journal selection, research agenda advice, and mentoring/coaching expertise in research areas. As a student advocate. Van Wart is an advocate for maximum student "voice" in the university. For example, long before the COVID pandemic he advocated for "more and better" online classes and for the systematic improvement of online education (support, training, and teaching). As a social activist. As a gay man, Professor Van Wart has personally felt the oppression of repressive laws, attitudes, and discrimination his entire life. He grew up in an era in which it was a criminal offense to be gay and was unable to legally marry is long-term partner and be federally recognized as late as 2015. He has had a lifetime of listening to offensive and derogatory comments about his sexual orientation. He has engaged in civic marches for over 45 years, and more recently has been highly active marches related to immigrants, women, LGBT+,

and even the efforts aimed at dismantling the Post Office. Because of his front-line activism, he has been pictured in the LA Times, Press Enterprise, and other local papers. Within academe, he is a strong believer that diversity and quality can and should go hand-in-hand as a mutually supportive relationship. His most recent publication on social activism is "Social Inclusion, Social Exclusion, and the Role of Leaders in Avoiding—or Promoting—Societal Collapse" in Public Administration Review. Wikipedia page at: https://en.wikipedia.org/wiki/Montgomery_Van_Wart