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Lebanese Secondary Students' Perceptions of Remote Assessment in Science and Mathematics

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Abstract

The rapid shift to remote assessment during educational disruptions has heightened scholarly interest in students' experiences with this format. This study investigates Lebanese secondary students' perceptions of remote assessment in science and mathematics in a crisis-affected context. Specifically, it examines students' perceptions of remote assessment, their level of satisfaction with this assessment format, and their willingness to continue using remote assessment once face-to-face education resumes. Using a quantitative research design, data were collected from 2,717 students in Grades 7–12 across 13 private secondary schools through a structured online questionnaire adapted from established e-assessment perception frameworks. Descriptive statistics were used to examine students' perceptions across six dimensions: affective responses, perceived validity and fairness, practical and technical feasibility, academic integrity and security, satisfaction, and willingness to continue remote assessment. Findings revealed largely neutral affective responses, while technical barriers emerged as the greatest challenge, with the strongest agreement recorded for the perception that poor technical capabilities contribute to late submissions (M = 2.05, SD = 1.21). Fairness concerns were also prominent, with students agreeing that online exams favor some students over others (M = 2.47, SD = 1.29). Integrity-related perceptions were mixed, with students acknowledging cheating risks while recognizing that appropriate safeguards can mitigate them. Overall, 49.4% of students reported satisfaction compared with 13.4% expressing dissatisfaction, and 53.8% indicated some willingness to continue remote assessment. The

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findings highlight the importance of strengthening infrastructure, improving assessment design for science and mathematics, and addressing fairness and integrity concerns in crisis-affected secondary education contexts.

Keywords: Remote assessment, Student perceptions, Science and mathematics education, Secondary education

Introduction

Since March 2020, educational systems worldwide have undergone significant transformations following the rapid shift to online learning and assessment. This shift initially emerged in response to the COVID-19 pandemic and has continued to shape assessment practices in contexts marked by prolonged disruption (Pozza et al., 2025). In Lebanon, this transition was compounded by multiple crises, including health emergencies, prolonged economic instability, and the October 2024 escalation. These conditions resulted in repeated school closures and increased reliance on remote assessment. Research on education under conditions of conflict in Lebanon highlights how crisis contexts can accelerate the adoption of digital assessment practices despite limited infrastructure and policy readiness (Rabih & Yammine, 2025). Recent evidence also indicates that online learning adoption in Lebanon followed a pattern of rapid expansion followed by decline, reflecting adaptation pressures and sustainability challenges in crisis conditions (Najjar et al., 2025).

Assessment occupies a central role in guiding instruction, measuring student achievement, and supporting learning outcomes. However, the rapid replacement of traditional paper-based examinations with online assessment formats raised concerns regarding assessment design, academic integrity, technological access, fairness, and student preparedness (Pozza et al., 2025; Terblanche et al., 2024). While online assessment offers flexibility and logistical advantages, post-pandemic studies report mixed student responses, with concerns regarding technical reliability, academic integrity, and perceived fairness remaining prominent (Kuluşaklı, 2024; Terblanche et al., 2024). A recent scoping review of 36 global studies confirms that, while remote online exams offer operational efficiency and instant feedback, they raise persistent questions about assessment effectiveness and academic integrity in higher education (Zhuang et al., 2026). Although the existing literature on remote assessment has expanded considerably, most studies have focused on higher education contexts, while research examining secondary students' perceptions remains comparatively limited. Such limitations in the existing evidence base appear particularly significant when remote assessment is implemented as an emergency response rather than as part of a planned digital transformation (Pozza et al., 2025).

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Academic integrity represents another major concern associated with remote assessment. Research indicates that teachers and university students frequently perceive online assessment as more vulnerable to cheating and unauthorized collaboration than traditional face-to-face examinations (Jalilzadeh et al., 2024; Rüth et al., 2024). Such perceptions may undermine trust in assessment outcomes and influence students' willingness to accept remote assessment practices.

Science and mathematics subjects present additional challenges for remote assessment because evaluation often requires procedural reasoning, symbolic notation, and step-by-step problem solving. Prior research reports increased skepticism regarding the fairness and suitability of online assessment in these disciplines, particularly concerning the demonstration of reasoning and the allocation of partial credit (Iannone et al., 2020; Zhan et al., 2022).

In crisis-affected contexts, remote assessment is further influenced by structural barriers such as limited technological infrastructure, unstable electricity supply, and unequal access to digital devices (UNESCO, 2020). Yet despite Lebanon's increasing reliance on remote assessment, secondary students' perceptions in science and mathematics remain underexplored (Rabih & Yammine, 2025).

This study is grounded in student perception frameworks of e-assessment (Dermo, 2009; Hillier, 2014), which conceptualize perceptions across affective, fairness, technical, and integrity dimensions. Against this background, the present study investigates Lebanese secondary school students' perceptions of remote assessment in science and mathematics. By focusing on a crisis-affected secondary education context, the study contributes large-scale evidence regarding factors influencing students' acceptance of remote assessment practices.

Research Questions

This study addresses the following research questions:

1. What are Lebanese secondary students' perceptions of remote assessment in science and mathematics subjects?
2. What are students' levels of satisfaction with remote assessment in science and mathematics?
3. To what extent are students willing to continue using remote assessment once face-to-face education resumes?

Literature Review

Students' perceptions of remote assessment have become an increasingly important area of educational research following the rapid transition to online learning environments during and after the COVID-19

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pandemic. Remote assessment refers to the evaluation of student learning through digital platforms without the physical presence of instructors and students, while e-assessment constitutes the broader technological framework supporting digital assessment practices (Dermo, 2009; García-Peñalvo et al., 2021). Although e-assessment existed prior to the pandemic, its rapid expansion during crisis conditions intensified pedagogical, technical, and ethical challenges associated with remote assessment (Terblanche et al., 2024; Wahas & Syed, 2024). Existing literature suggests that students' experiences with remote assessment are shaped by interconnected affective, technical, pedagogical, and contextual factors.

Effective remote assessment requires intentional redesign through formats such as online quizzes, open-book examinations, project-based tasks, and continuous assessment approaches (Redecker & Johannessen, 2013). However, emergency implementation during crisis conditions may limit adequate preparation to preserve fairness, validity, and alignment with learning objectives, particularly in structured disciplines such as science and mathematics (Pozza et al., 2025).

Research on students' affective responses to remote assessment has reported mixed findings. While some students appreciate the flexibility and reduced logistical pressures associated with online assessment, others report increased anxiety, uncertainty, and lower confidence in assessment reliability and examination conditions (Terblanche et al., 2024; Zhuang et al., 2026). Such affective responses may influence students' satisfaction and willingness to continue remote assessment practices.

Perceived fairness represents one of the most frequently discussed dimensions in remote assessment research. Students frequently express concerns about unequal access to technological resources, inconsistent internet connectivity, and disparate home learning environments, all of which may affect assessment performance (Pozza et al., 2025). Across studies, students consistently associate remote assessment with concerns regarding fairness and technological reliability, although the intensity of these concerns varies according to infrastructure quality, institutional support, and assessment design (Kuluşaklı, 2024; Zhuang et al., 2026). These concerns may become more pronounced in crisis-affected contexts where structural inequalities and technological limitations are more severe. Research conducted in higher education settings has likewise identified digital inequality as an important factor shaping students' perceptions of remote assessment, with concerns about fairness being more pronounced among students experiencing technological constraints (Kuluşaklı, 2024; Terblanche et al., 2024).

Academic integrity remains a central theme in the literature. Online assessments are frequently perceived as more susceptible to cheating, plagiarism, and unauthorized collaboration than traditional face-to-face

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assessment environments (Dendir & Maxwell, 2020; Jalilzadeh et al., 2024). However, perceptions regarding integrity remain inconsistent across studies. While some students report reduced trust in online examinations, others recognize that assessment security depends largely on assessment design, question structure, and monitoring strategies (Zhuang et al., 2026). These findings suggest that students' perceptions of integrity are shaped not only by the online format itself but also by the quality and intentionality of assessment implementation. In response to integrity concerns, previous research has emphasized the importance of technological safeguards such as student authentication systems and authorship verification mechanisms to mitigate cheating risks in e-assessment environments (Mellar et al., 2018).

Beyond concerns related to fairness and academic integrity, students' experiences with remote assessment are strongly influenced by technological and contextual factors that affect accessibility and assessment reliability. Technical problems such as unstable internet connections, electricity interruptions, device limitations, and unfamiliarity with digital platforms may negatively affect students' confidence and performance during online examinations (UNESCO, 2020). Recent synthesized evidence further underscores the importance of contextual and technological factors in shaping students' perceptions of remote assessment. Zhuang et al. (2026) reported that students' experiences with remote online exams varied considerably according to infrastructure quality, institutional support, assessment design, and digital preparedness. Technological barriers and concerns regarding assessment reliability appeared particularly prominent in contexts characterized by unequal technological access and emergency implementation conditions.

Science and mathematics assessments present additional challenges within remote environments because these disciplines frequently require procedural reasoning, symbolic notation, calculations, and step-by-step problem-solving processes. The procedural and symbolic nature of science and mathematics assessment may intensify students' concerns regarding fairness and accuracy in remote assessment environments, particularly when online formats limit opportunities to demonstrate intermediate reasoning steps or receive partial credit for problem-solving processes. Previous research reports increased skepticism regarding the suitability and fairness of online assessment in mathematics and science disciplines, especially in relation to demonstrating reasoning processes and validating authentic student performance (Iannone et al., 2020; Zhan et al., 2022).

In crisis-affected educational contexts, remote assessment is further complicated by structural and socioeconomic challenges. Research conducted in conflict-affected or economically unstable settings indicates that unequal technological access, infrastructure instability, and disruptions in educational continuity significantly influence students' learning experiences and

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perceptions of assessment fairness (Rabih & Yammine, 2025). In Lebanon specifically, prolonged economic and social crises have intensified digital divide challenges within secondary education, affecting students' access to stable internet, electricity, and digital learning resources (Najjar et al., 2025). Despite the increasing reliance on remote assessment in Lebanese schools, empirical research examining secondary students' perceptions of remote assessment in science and mathematics remains limited.

Students' perceptions are widely recognized as a central determinant of assessment effectiveness and acceptance. Frameworks such as the Student Perceptions of E-Assessment Questionnaire (SPEAQ) conceptualize students' perceptions across affective responses, fairness, technical feasibility, and integrity dimensions (Alsadoon, 2017; Hillier, 2014). These dimensions are particularly relevant in crisis-affected contexts where infrastructural instability and unequal technological access may intensify concerns regarding accessibility, reliability, and fairness (UNESCO, 2020). Despite growing evidence on remote assessment perceptions in higher education, secondary education contexts — particularly in crisis-affected settings — remain underrepresented in the literature.

Methodology

This study employed a quantitative research design to investigate Lebanese secondary school students' perceptions of remote assessment in science and mathematics during periods of educational disruption. A convenience sampling approach was used, with schools selected based on accessibility and willingness to participate under emergency schooling conditions. The sample consisted of 2,717 students enrolled in Grades 7 to 12 across 13 private secondary schools located in different Lebanese regions. These schools had implemented remote teaching and assessment during repeated school closures.

Data were collected using a structured questionnaire adapted from established e-assessment perception frameworks (Alsadoon, 2017; Hillier, 2014). The questionnaire was administered online via Google Forms in English and French, reflecting Lebanon's bilingual education system. Prior to large-scale distribution, the instrument was piloted with a small group of students to ensure clarity and content validity. Participation was voluntary, anonymous, and confidential, and the study adhered to established ethical principles for education research. The institutional context did not require formal ethical board approval; however, all ethical guidelines for educational research were strictly observed.

The questionnaire included two sections: demographic information and students' perceptions of remote assessment across four dimensions – affective responses, perceived validity and fairness, practical and technical

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feasibility, and academic integrity and security. A five-point Likert-type response scale was employed, ranging from 1 (strongly agree) to 5 (strongly disagree), consistent with the scaling used in the original SPEAQ instrument (Alsadoon, 2017; Hillier, 2014) and aligned with established practice in e-assessment perception research, thereby ensuring comparability with prior studies. Perceived validity and fairness are defined here as students' subjective views on the appropriateness of the format for their discipline and the equity of assessment conditions, rather than as psychometric measures of test validity. Two additional items examined students' satisfaction with remote assessment and their willingness to continue remote assessment after the resumption of face-to-face education. Data were analyzed using IBM SPSS Statistics. Descriptive statistics were computed to address the research questions, and Cronbach's alpha coefficients were calculated to assess internal consistency. Ninety-five percent confidence intervals were computed for all item means to provide additional precision in interpreting the descriptive findings.

Results

Overview of the sample

The sample (N= 2,717) was relatively balanced by gender (male = 1,315, female = 1,402). As shown in Table 1, the largest proportion of participants was from Grade 10 (20.6%), followed by Grade 7 (19.4%) and Grade 9 (18.9%). Students in Grades 11 (13.9%) and Grade 12 (9.8%) represented smaller proportions of the sample. Female students slightly outnumbered male students across most grade levels.

Table 1: Demographic Characteristics of Participants

Grade Level	Male	Female	Total	Percentage
Grade 7	245	281	526	19.4%
Grade 8	227	249	476	17.5%
Grade 9	238	275	513	18.9%
Grade 10	288	271	559	20.6%
Grade 11	189	189	378	13.9%
Grade 12	128	137	265	9.8%
Total	1,315	1,402	2,717	100%

Results for Research Question 1: Students' Perceptions of Remote Assessment

Internal consistency analysis showed acceptable reliability for the affective responses (α = .752), practical and technical feasibility (α = .652), and academic integrity and security (α = .781) dimensions. The perceived validity and fairness dimension yielded a low reliability coefficient (α = .419). Consequently, findings related to this dimension were interpreted cautiously at the item level rather than as a unified scale.

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To address Research Question 1, descriptive statistics were computed for items measuring students' affective responses, perceived validity and fairness, practical and technical feasibility, academic integrity and security, and willingness to continue remote assessment. Table 2 presents the means and standard deviations for all items. Lower means indicate stronger agreement because responses ranged from 1 (strongly agree) to 5 (strongly disagree). Items were not reverse-coded. To facilitate interpretation, mean scores were classified as indicative of agreement (1.00–2.49), neutral to moderate responses (2.50–3.49), or disagreement (3.50–5.00). Items were grouped into themes following Dermo's (2009) dimensions of students' perceptions of e-assessment and the adoption construct proposed by Hillier & Fluck (2013) adapted to reflect the emergency remote assessment context. Additional descriptive statistics, including 95% confidence intervals, medians, and interquartile ranges for all questionnaire items, are provided in Appendices A and B.

Table 2: Students' Perceptions of Remote Assessment

Statements	Mean	SD
Affective Responses		
I feel more comfortable if the exam was on paper, not online.	3.11	1.45
Using a computer for an exam is more stressful for students than a handwritten paper exam.	3.13	1.52
Students might be at a disadvantage when undertaking online exams.	2.95	1.31
Perceived validity and fairness		
Online exams are appropriate for my discipline/subject (sciences, mathematics...).	3.07	1.25
Online exams favor some students more than others.	2.47	1.29
Paper-based exams are fairer than online exams.	2.76	1.42
Practical and Technical Feasibility		
Technical problems make doing exams via computer impractical.	2.38	1.21
Many students do not submit assessments on time due to their poor technical capabilities.	2.05	1.21
I had technical problems in sending assignments/tests etc.	2.48	1.39
Academic Integrity and Security		
It is easier to cheat in online exams than with paper-based exams.	2.60	1.40
Many students copy each other's assessments.	2.76	1.16
There is a higher risk of students cheating in remote assessments.	2.92	1.31
Online exams are just as secure as paper-based exams.	2.56	1.32
Online exams allow students to cheat from each other.	3.16	1.33
Online exams allow students to cheat from online sources.	2.82	1.33
Many students always ask about postponing the submission of exams for various excuses.	2.82	1.31
Many students submit assessments that are copied from websites without modifying or paraphrasing.	3.20	1.21
Willingness to Continue		
Would you be interested in continuing remote assessment once face-to-face education resumes?	2.88	1.46

Note. 95% confidence intervals for all items are reported in Appendix A. Additional descriptive statistics (Median, Q1, Q3) are reported in Appendix B.

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Regarding affective factors, students' responses were largely neutral, indicating neither strong comfort nor strong discomfort with remote assessment formats. Students did not demonstrate a strong preference for paper-based examinations over online formats (M = 3.11), reflecting a largely neutral affective stance toward the assessment medium. Similarly, the statement that computer-based exams are more stressful than handwritten exams (M = 3.13) reflected near-neutral responses with a slight tendency toward disagreement. In contrast, the statement "Students might be at a disadvantage when undertaking online exams" averaged M = 2.95, representing the strongest concern among the affective items. While stress related to technology was not strongly reported, concern regarding potential disadvantage clearly emerged. This pattern mirrors Dermo's (2009) findings, where affective responses were slightly positive and stress was not perceived as substantially increased in e-assessment contexts.

With respect to perceived validity and fairness, students showed greater concern about fairness between students than about the suitability of online exams for science and mathematics subjects. They agreed that online exams favor some students more than others (M = 2.47) and indicated a moderate tendency to perceive paper-based exams as fairer than online exams (M = 2.76). Additionally, a slight tendency toward disagreement was noted regarding the appropriateness of online exams for science and mathematics subjects (M = 3.07). This mild skepticism aligns with prior findings suggesting that procedural disciplines such as mathematics and science present particular assessment difficulties in online environments, especially regarding demonstration of reasoning and allocation of partial credit (Iannone et al., 2020; Zhan et al., 2022). Similar to Dermo (2009), fairness concerns emerged as a central issue, suggesting that equity perceptions remain an important determinant of remote assessment acceptance across contexts.

Technical challenges emerged as the primary concern across all dimensions. The strongest agreement in the entire survey was recorded for the perception that poor technical capabilities contribute to late submissions (M = 2.05), followed by agreement that technical difficulties make online exams impractical (M = 2.38). Personal difficulties in submitting assessments were also frequently reported (M = 2.48).

Concerns about academic integrity and security were evident; however, students' responses were not uniform and revealed a balanced, sometimes contradictory pattern across items**.** Students demonstrated a moderate tendency toward agreement that online exams can be as secure as paper-based exams (M = 2.56), suggesting they do not view misconduct as unavoidable. At the same time, students also agreed that cheating is easier in online exams than in paper-based exams (M = 2.60) and that copying occurs (M = 2.76). A comparable tendency toward agreement emerged regarding the

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perception that the overall risk of cheating is higher in remote assessments (M = 2.92). However, students showed a slight tendency toward disagreement that online exams primarily allow students to cheat from each other (M = 3.16) or frequently submit plagiarized work from websites (M = 3.20). This pattern reflects recognition of cheating risks without perceiving them as excessive, uncontrollable, or fundamentally different from traditional assessment environments. The mixed responses may reflect acknowledgment that both online and paper-based assessments have vulnerabilities, or uncertainty regarding the effectiveness of security measures in remote contexts.

Willingness to continue remote assessment after the resumption of face-to-face education yielded M = 2.88, indicating cautious acceptance rather than strong endorsement or rejection. This finding is further clarified in Research Question 3 through categorical response analysis.

Overall, the findings revealed a pattern characterized by neutral affective reactions, moderate equity concerns, strong technical barriers**,** mixed security perceptions, and cautious acceptance of remote assessment**.**

To further illustrate the distribution of responses, Figure 1 presents boxplots for four representative questionnaire items selected from the technical feasibility, fairness, and academic integrity dimensions.

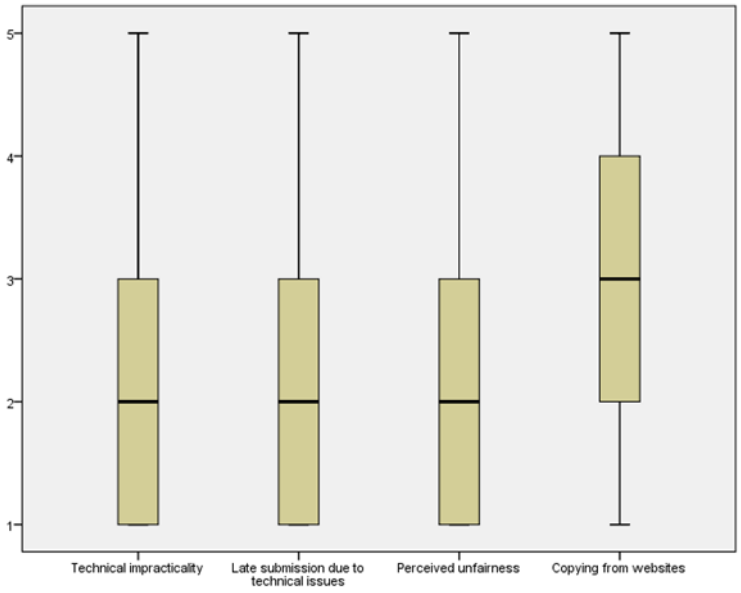

Figure 1: Boxplots illustrating the distribution of responses for four representative questionnaire items

Figure 1 complements the descriptive statistics presented in Table 2 by illustrating the median, interquartile range, and variability of responses for representative questionnaire items. As shown in Figure 1, the items related to technical feasibility ("Technical problems make doing exams via computer

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impractical" and "Many students do not submit assessments on time due to their poor technical capabilities") and perceived fairness ("Online exams favour some students more than others") had a median response of 2 (Agree), with the middle 50% of responses ranging from 1 to 3, indicating that a considerable proportion of students agreed with these statements. In contrast, the item "Many students submit assessments that are copied from websites without modifying or paraphrasing" had a median response of 3 (Neutral) and an interquartile range of 2 to 4, reflecting greater variability in students' perceptions regarding academic integrity. These graphical findings are consistent with the descriptive statistics presented in Table 2.

Results for Research Question 2: Students' Satisfaction with Remote Assessment

To address Research Question 2, descriptive statistics were computed to examine students' satisfaction with remote assessment. Table 3 presents the distribution of responses.

Table 3: Students' Level of Satisfaction with Remote Assessment

	Frequency	Percent (%)
Very Satisfied	433	16.0
Somewhat Satisfied	908	33.4
Neither satisfied nor dissatisfied	1,010	37.1
Somewhat Dissatisfied	202	7.4
Very Dissatisfied	164	6.0
Total	2,717	100

Unlike the largely neutral perceptions observed across the dimensions in Table 2, responses regarding satisfaction revealed a more positive distribution. The most frequent response was "Neither satisfied nor dissatisfied" (37.1%), indicating substantial neutrality. However, satisfaction clearly exceeded dissatisfaction: 49.4% of students reported some level of satisfaction compared to 13.4% expressing dissatisfaction (approximately 4:1 ratio)**.** Specifically, 16% were very satisfied and 33.4% somewhat satisfied, whereas 7.4% were somewhat dissatisfied and 6% very dissatisfied. These findings suggest that while strong enthusiasm for remote assessment was limited, most who held a definite opinion viewed their experience positively rather than negatively. The large neutral proportion (37.1%) may reflect mixed experiences, uncertainty about comparing online versus traditional assessment, or cautious evaluation during an ongoing transition.

Overall, satisfaction can be characterized as moderately positive but tempered by substantial reservation. Remote assessment appears to have been perceived as an acceptable emergency solution rather than a preferred long-term alternative to traditional face-to-face evaluation. This pattern of moderate satisfaction combined with high neutrality is consistent with neutral-to-

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cautious perceptions observed across dimensions in Table 2, particularly the neutral affective responses and concerns about technical feasibility and fairness.

Results for Research Question 3: Willingness to Continue Remote Assessment

To address Research Question 3, students were asked whether they would be interested in continuing remote assessment once face-to-face education resumes. Table 4 presents the distribution of categorical responses.

Table 4: Students' Willingness to Continue Remote Assessment

	Frequency	Percent (%)
No, definitely not	1,256	46.2
Yes, definitely	465	17.1
Yes, if I have the choice	996	36.7
Total	2,717	100.0

Students' willingness to continue remote assessment revealed a divided pattern rather than consensus. Nearly half of students (46.2%) indicated they would "definitely not" be interested in continuing remote assessment, representing clear rejection. However, a slight majority (53.8%) showed some level of openness toward continuation. Within this group, most expressed conditional rather than unconditional acceptance: 36.7% indicated willingness "if I have the choice," while only 17.1% reported definite interest.

This pattern reflects several important considerations regarding students' conditional acceptance of remote assessment. First, while remote assessment was not rejected in principle by most students, acceptance is contingent upon the fulfilment of specific conditions. Second, the large proportion favoring conditional acceptance (36.7%) suggests that students require agency and flexibility rather than mandatory imposition of remote assessment. Third, the small proportion expressing definite interest (17.1%) indicates that remote assessment, in its current implementation, is not perceived as superior to traditional formats by most students. When combined with the Likert-scale willingness item from Table 2 (M = 2.88, indicating cautious acceptance), these findings suggest that students view remote assessment as a conditional practice whose continued use requires addressing current concerns. The convergence between the Likert measure (indicating cautious acceptance) and the categorical measure (53.8% showing some openness) reinforces the interpretation that acceptance exists but is tempered by significant reservations regarding infrastructure, fairness, and design quality. This divided willingness aligns with Table 2 findings, where technical and fairness concerns moderated acceptance despite moderate satisfaction.

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Discussion

The findings of this study indicate that Lebanese secondary students' perceptions of remote assessment in science and mathematics were characterized by largely neutral affective responses, substantial technical concerns, moderate fairness reservations, mixed integrity perceptions, and cautious acceptance of continued remote assessment. These findings are consistent with international research suggesting that emergency implementation of remote assessment often generates concerns regarding infrastructure, fairness, and assessment reliability (Pozza et al., 2025; Zhuang et al., 2026).

Concerns about fairness and equity corroborate research indicating that students perceive traditional examinations as more equitable and less susceptible to dishonesty (Pozza et al., 2025). Students' agreement that online exams favor some students over others reflects awareness of the digital divide and differential access to reliable technology, stable internet connectivity, and conducive testing environments. This pattern likely reflects structural disparities in access to reliable technology and conducive learning environments – disparities characteristic of crisis-affected contexts like Lebanon, where electricity shortages, internet instability, and unequal device access create uneven conditions for remote assessment (UNESCO, 2020).

Practical barriers emerged as the most influential factor shaping students' perceptions of remote assessment in low-resource environments. Strong agreement regarding internet instability, submission difficulties, and limited technical capabilities highlights the extent to which infrastructural limitations affect assessment feasibility in crisis-affected educational settings. These findings indicate that infrastructural accessibility represents a more immediate concern for students than pedagogical or security-related issues.

An additional factor that may have influenced students' perceptions is their familiarity with the digital platforms used for remote assessment. Students with greater experience using online assessment systems may encounter fewer technical difficulties and demonstrate greater confidence in remote examinations than students with limited digital experience. Because this variable was not measured in the present study, its influence could not be examined and should be considered in future research.

Students' perceptions regarding academic integrity and security revealed a nuanced and sometimes contradictory pattern. Although students acknowledged that cheating and copying may occur more easily in online examinations, they did not perceive academic dishonesty as excessive or unavoidable. At the same time, many students agreed that remote assessments can achieve security levels comparable to traditional examinations when appropriate safeguards are implemented. These findings suggest that students distinguish between the existence of integrity risks and the effectiveness of

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assessment design in minimizing those risks. Similar findings were reported in previous research indicating that students' perceptions of integrity may be influenced not only by the online format itself but also by monitoring strategies, question structure, and institutional safeguards (Jalilzadeh et al., 2024; Zhuang et al., 2026).

Moderate satisfaction coupled with divided willingness to continue remote assessment aligns with findings that students and educators viewed remote assessment primarily as an emergency solution, with concerns about fairness and integrity limiting its acceptance for routine use (Pozza et al., 2025). With satisfaction exceeding dissatisfaction and a majority showing conditional openness, results suggest that remote assessment is not fundamentally rejected but requires substantial improvement to gain broader acceptance. The large conditional acceptance group indicates that students are willing to engage with remote assessment if given choice and control, but are resistant to its mandatory imposition in its current form.

Overall, the findings suggest that effective implementation of remote assessment in crisis-affected secondary education contexts requires more than digital delivery alone. Strengthening technological infrastructure, improving assessment design for procedural disciplines such as science and mathematics, and addressing fairness and accessibility concerns are therefore essential conditions for broadening students' acceptance of remote assessment. These findings highlight the need for assessment strategies that are adaptable to crisis conditions while remaining attentive to fairness, accessibility, and students' confidence in assessment processes.

Conclusions

This study examined Lebanese secondary students' perceptions of remote assessment in science and mathematics within a crisis-affected educational context. By analyzing affective responses, perceived validity and fairness, practical and technical feasibility, academic integrity and security, and willingness to continue remote assessment, the study provides a comprehensive understanding of students' assessment experiences during periods of disruption.

The findings reveal a nuanced pattern of perceptions characterized by cautious evaluation rather than outright rejection. While affective responses regarding comfort and stress were largely neutral, concerns regarding potential disadvantage remained evident. Technical and infrastructural limitations emerged as the dominant concern, highlighting the significant influence of internet instability, electricity interruptions, and technological accessibility on students' assessment experiences. Fairness concerns were also prominent, particularly regarding unequal assessment conditions and the suitability of remote assessment for science and mathematics subjects. Academic integrity

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perceptions were mixed, with students acknowledging cheating risks while simultaneously recognizing that remote assessments can achieve acceptable levels of security when appropriate safeguards are implemented. Although satisfaction with remote assessment was moderately positive overall, substantial neutrality persisted. Students' willingness to continue remote assessment after the return to face-to-face education remained divided, with many expressing conditional rather than unconditional acceptance. The findings highlight that students do not fundamentally reject remote assessment but view its continued use as dependent on improvements in infrastructure, fairness, reliability, and assessment design quality.

These findings carry important implications for educational policy and practice in crisis-affected contexts. Ultimately, improving remote assessment in crisis-affected secondary education requires stronger technological infrastructure, discipline-specific assessment design, and measures that promote fairness and academic integrity. The study further underscores the need for flexible and context-sensitive assessment approaches capable of balancing educational continuity with equity, reliability, and student trust.

Students' familiarity with online assessment platforms may also have influenced their perceptions. However, the present study did not directly measure students' prior experience or digital competence. Future research could expand the scope of investigation by including public schools, incorporating qualitative perspectives from students and teachers, and examining longitudinal changes in perceptions as remote assessment practices continue to evolve. These findings contribute to the growing evidence on remote assessment in crisis-affected secondary education and provide practical guidance for designing more equitable and resilient assessment systems.

Conflict of Interest: The author reported no conflict of interest.

Data Availability: All data are included in the content of the paper.

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Appendix A: Ninety-five Percent Confidence Intervals for the Questionnaire Items

Statements	Mean	SD	95% CI
Affective Responses			
I feel more comfortable if the exam was on paper, not online.	3.11	1.45	3.06-3.17
Using a computer for an exam is more stressful for students than a handwritten paper exam.	3.13	1.52	3.07-3.18
Students might be at a disadvantage when undertaking online exams.	2.95	1.31	2.90-3.00
Perceived validity and fairness			
Online exams are appropriate for my discipline/subject (sciences, mathematics...).	3.07	1.25	3.02-3.11
Online exams favor some students more than others.	2.47	1.29	2.42-2.51
Paper-based exams are fairer than online exams.	2.76	1.42	2.70-2.81
Practical and Technical Feasibility			
Technical problems make doing exams via computer impractical.	2.38	1.21	2.33-2.42
Many students do not submit assessments on time due to their poor technical capabilities.	2.05	1.21	2.00-2.09
I had technical problems in sending assignments/tests etc.	2.48	1.39	2.43-2.54
Academic Integrity and Security			
It is easier to cheat in online exams than with paper-based exams.	2.60	1.40	2.55-2.65
Many students copy each other's assessments.	2.76	1.16	2.72-2.80
There is a higher risk of students cheating in remote assessments.	2.92	1.31	2.87-2.97
Online exams are just as secure as paper-based exams.	2.56	1.32	2.51-2.61
Online exams allow students to cheat from each other.	3.16	1.33	3.11-3.21
Online exams allow students to cheat from online sources.	2.82	1.33	2.77-2.87
Many students always ask about postponing the submission of exams for various excuses.	2.82	1.31	2.78-2.87
Many students submit assessments that are copied from websites without modifying or paraphrasing.	3.20	1.21	3.16-3.25

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Appendix B: Additional Descriptive Statistics for the Questionnaire Items

Statements	Median	25th Percentile (Q1)	75th Percentile (Q3)
Affective Responses			
I feel more comfortable if the exam was on paper, not online.	3	2	5
Using a computer for an exam is more stressful for students than a handwritten paper exam.	3	2	5
Students might be at a disadvantage when undertaking online exams.	3	2	4
Perceived validity and fairness			
Online exams are appropriate for my discipline/subject (sciences, mathematics...).	3	2	4
Online exams favor some students more than others.	2	1	3
Paper-based exams are fairer than online exams.	3	1	4
Practical and Technical Feasibility			
Technical problems make doing exams via computer impractical.	2	1	3
Many students do not submit assessments on time due to their poor technical capabilities.	2	1	3
I had technical problems in sending assignments/tests etc.	2	1	3
Academic Integrity and Security			
It is easier to cheat in online exams than with paper-based exams.	3	1	4
Many students copy each other's assessments.	3	2	3
There is a higher risk of students cheating in remote assessments.	3	2	4
Online exams are just as secure as paper-based exams.	2	1	3
Online exams allow students to cheat from each other.	3	2	4
Online exams allow students to cheat from online sources.	3	2	4
Many students always ask about postponing the submission of exams for various excuses.	3	2	4
Many students submit assessments that are copied from websites without modifying or paraphrasing.	3	2	4