Scaling Secure Digital Examinations in Higher Education: A Four-Year Case Study Using Chromebook-Based Assessment.

Experience of Students & Teachers

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***Abstract*— The rapid emergence of generative artificial intelligence (GenAI) is reshaping higher education by transforming how students produce knowledge and complete assessment tasks, creating both new opportunities for learning, feedback, and problem solving, and significant challenges related to academic integrity, authorship, and the validity of assessment. Within this context, educational institutions are required to design assessment systems that both safeguard the reliable measurement of learning outcomes and support the development of AI-related competencies. This article situates the implementation of on-campus digital examinations using Chromebooks within the Two-Lane assessment framework, which distinguishes between secure, controlled environments for summative assessment (Lane 1) and development-oriented contexts in which AI can be integrated to support learning (Lane 2). It presents a longitudinal analysis of the institutional rollout of Chromebook-based digital examinations between 2022 and 2026 at a European university of applied sciences, drawing on institutional data, student surveys, and teacher feedback to examine both the scaling of the infrastructure and its influence on assessment practices. The results show a substantial increase in adoption, with the number of on-campus digital exams rising from 295 during the pilot phase to 4,822 in 2025–2026, accompanied by positive teacher perceptions regarding exam logistics, technical reliability, and safeguards against academic misconduct through kiosk-mode devices, as well as generally high student ratings and a gradual shift in preference toward digital formats. Overall, the findings suggest that a secure digital examination infrastructure can contribute to safeguarding the integrity of high-stakes assessment by reducing opportunities for unauthorized resource use and by standardizing testing conditions.**

Keywords—digital examinations, two-lane assessment framework, on-campus Chromebook-based assessment

I. Introduction

The emergence of generative artificial intelligence (GenAI) is profoundly transforming the educational landscape. GenAI technologies can generate text, software code, images, and complex analytical outputs through advanced computational models [6], and are increasingly integrated into everyday academic and professional practice. As these technologies become more widespread, educational institutions face a dual responsibility. They must prepare students to understand, critically evaluate, and responsibly use AI systems, while simultaneously reconsidering existing teaching and assessment practices to ensure that learning remains meaningful, valid, and aligned with professional expectations in an environment where AI tools are easily accessible [1].

AI also creates important opportunities for education. Contemporary AI systems allow users to draft essays, generate code, analyse data, design visual content, and receive rapid feedback [8]. These capabilities can enrich learning processes by enabling exploration, iterative refinement, and timely feedback. At the same time, the widespread availability of AI raises significant concerns. Easy access to such technologies introduces challenges related to academic integrity, authorship, and the authenticity of student work [7]. Students may rely on AI to produce essays, solve assignments, or complete assessment tasks with limited personal involvement. Such practices complicate the reliable evaluation of learning outcomes and may weaken the development of essential knowledge and skills if students become overly dependent on automated systems during the learning process [2].

The integration of AI therefore affects not only how students learn, but also what they learn, why learning takes place, and how learning outcomes become visible. Understanding learning in AI-supported environments requires new insights into knowledge development, student interaction with AI systems, and ways to monitor and support these processes effectively [5, 9, 14]. Despite the growing capabilities of AI, foundational knowledge remains essential, particularly for interpreting AI outputs critically and integrating them meaningfully into problem-solving activities [10]. Within this context, assessment design becomes particularly important. Constructive alignment remains a central principle: learning objectives, instructional activities, and assessment methods should be coherently aligned to ensure valid evaluation of student learning [4]. At the same time, institutions must develop assessment systems that allow innovation while safeguarding academic standards and the credibility of educational qualifications.

One framework that helps address this challenge is the Two-Lane approach. Based on international educational practice and research [11]-[13], as well as established assessment theory [3], this model distinguishes between two complementary assessment contexts. The first lane focuses on the secure and reliable measurement of learning outcomes,

where assessments take place under controlled conditions and AI use is restricted or carefully managed. The second lane emphasises development-oriented assessment, where AI may be deliberately integrated to support learning processes and the development of AI-related competencies.

This distinction enables institutions to incorporate AI into education without undermining the reliability of high-stakes assessment. Secure and supervised assessment environments allow valid measurement of individual performance, while other assessment contexts can encourage students to engage with AI in reflective and responsible ways.

The present paper situates the implementation of on-campus digital examinations using Chromebooks within the Two-Lane framework. The described infrastructure represents a Lane 1 strategy designed to safeguard the integrity and reliability of summative assessment in an AI-rich environment by creating a controlled digital testing context through kiosk-mode devices and dedicated assessment platforms. At the same time, the implementation highlights the limitations of strictly controlled assessment environments and underscores the need for complementary Lane 2 approaches, in which AI is deliberately integrated into learning activities and formative assessment. The paper examines the implementation and development of this system between 2022 and 2026, drawing on institutional data and stakeholder experiences to explore how it has strengthened secure summative assessment while also revealing the need for further innovation in AI-integrated assessment.

Beyond describing an institutional implementation, this paper contributes to the field in three ways. First, it offers a longitudinal perspective on the scaling of secure digital examinations, showing how such infrastructures evolve from pilot initiatives to institution-wide practices. Second, it demonstrates how Chromebook-based examination environments can function as a concrete realization of Lane 1 within the Two-Lane framework. Third, it identifies emerging design considerations and implementation conditions that may inform other institutions seeking to develop secure and scalable digital assessment practices in the age of AI

II. Methodology

This study adopts a longitudinal institutional case study design, examining the implementation and scaling of Chromebook-based digital examinations between 2022 and 2026. The research combines multiple data sources to provide a triangulated perspective on the development and impact of the initiative.

First, institutional data were collected on the number of digital examinations conducted each academic year, providing an objective indicator of adoption and scaling. Second, student perceptions were gathered through annual post-exam surveys using a structured questionnaire administered after examination sessions. The survey included Likert-scale items (e.g., usability ratings on a 0–10 scale), multiple-choice preference questions, and optional open-ended feedback. While the core constructs of the survey (e.g., usability, stress, and device preference) remained stable across years to enable year-to-year comparison, minor adjustments to item wording were made to reflect evolving use contexts. Survey responses were analysed using descriptive statistics, including averages and percentages, to identify trends over time.

Third, teacher experiences were collected through a combination of structured and informal feedback mechanisms during implementation phases, including debrief sessions after exam periods, internal consultations with instructional support teams, and iterative improvement meetings. Although this feedback was not captured through a single standardized instrument, recurring themes were systematically identified and synthesized to inform both practice and analysis.

The study is primarily descriptive and exploratory in nature. Its aim is not to test causal relationships but to document and analyse institutional practices, stakeholder perceptions, and scaling processes in a real-world educational context. As such, the findings contribute to understanding how secure digital examination infrastructures can be implemented and sustained in higher education.

III. General Findings

The implementation of on-campus digital examinations has seen steady and substantial growth over four academic years. In the first pilot year (2022-2023), 295 exams were conducted using Chromebooks. By the end of 2023-2024, the number of digital on-campus exams had risen to over 1450. This trend continued in subsequent years, with 3,272 in 2024-2025, and reaching 4,822 in 2025-2026. This sharp increase reflects both growing institutional trust in the system and rising demand from faculties to leverage digital assessment. The initiative has spanned a broad range of disciplines, including business, health sciences, and teacher education, thus confirming the approach's versatility across different fields.

To support the scaling, physical and technical infrastructure was enhanced. The fleet of Chromebooks dedicated to exams expanded from an initial 110 devices to 220 devices by early 2025, enabling larger cohorts to be examined simultaneously and reducing scheduling bottlenecks. Each device operates in kiosk mode to ensure a secure, locked-down exam environment, a feature that has been instrumental in preserving academic integrity.

Assessment platforms have played a pivotal role in the evolution of the digital examination system. During the rollout, software such as assessmentQ, Ans, and the university's Toledo environment were integrated, often in combination to meet different assessment needs. Platform selection was mainly relevant for teachers responsible for configuration and administration, while the student experience remained largely consistent across systems; survey data indicate that many students were unaware of the specific tool used, suggesting that platform choice is not a critical factor when exams are properly configured. All platforms supported a wide range of question types, including multiple-choice, essay, and practical tasks, demonstrating the versatility and adaptability of the digital examination approach.

Quantitative indicators underline the increasing confidence in and normalization of on-campus digital exams. Over four years, not only did exam counts surge, but stakeholder familiarity improved and process kinks were gradually ironed out. Initial results highlighted the value of the Chromebook's kiosk mode in preventing academic misconduct, which has been a foundation for broader acceptance. At the same time, early limitations such as the inability to access external resources and some device

usability issues (e.g., with touchpads) were documented. These findings guided iterative refinements in subsequent years, ensuring that the digital examination system became more robust and user-friendly as it scaled. By 2025-2026, the on-campus digital exams were not a novelty but rather an established component of the institution's assessment regime, with ongoing data collection to drive further improvements.

Taken together, these findings suggest that successful scaling of secure digital examinations depends not only on technical infrastructure, but also on iterative refinement, stakeholder engagement. These elements appear to be critical conditions for sustainable adoption beyond the pilot phase.

IV. Experience of Teachers

Throughout the rollout from 2022 to 2026, teachers have generally reported positive experiences with the on-campus digital examination system. Many educators found that the use of Chromebooks simplified exam logistics significantly. The devices are easy to deploy in exam halls and, thanks to the kiosk mode, they automatically restrict students to the approved test environment, which streamlines the administration by minimising the need for manual proctoring of digital tools. Indeed, faculty feedback frequently highlights that the kiosk setup reduced opportunities for academic dishonesty and technical distractions, thereby allowing teachers and students to focus on the exam content. The reliability of the hardware and network during exams in these four years has been high; only isolated minor technical issues were reported, which gave teachers confidence that digital exams can run smoothly without disrupting the assessment process.

Moreover, teachers appreciated the seamless integration of Chromebooks with the chosen e-assessment platforms. By 2025, most technical teething problems (such as compatibility issues or performance bottlenecks) had been resolved, and platforms like assessmentQ and Ans were running stably under the institution's configuration. This meant that instructors could design a variety of question types (e.g., quizzes, case analyses, coding exercises, audio/video components) knowing that students would all have a uniform and controlled interface to work with. In turn, grading could be more efficient, especially for objective question types that are auto-gradable, thus closing the feedback loop faster. Nevertheless, teachers have also pointed out certain challenges that persisted through the implementation. One issue is the limited flexibility of the kiosk-mode environment: because students cannot open external websites or applications, exam designs that in a traditional setting might allow use of specific software, data sets, or online resources have to be adjusted.

Some instructors noted that this constraint can restrict the scope of open-book or resource-intensive exams, requiring them to find alternative ways to provide necessary information within the locked-down system. Another concern relates to accommodating diverse student needs. For instance, a few teachers observed that students less adept with typing might be disadvantaged in an all-digital exam, or that certain hands-on skills are harder to assess without physical interaction (though these concerns are not unique to Chromebooks and pertain to digital testing in general). Additionally, while the devices are largely hassle-free, there was feedback regarding the lack of precision of the touchpad for tasks like drawing diagrams or navigating through long texts, which some faculty worry could affect student performance for specific question types.

Despite these caveats, the overall sentiment among lecturers is that the benefits outweigh the drawbacks. By the 2025-2026 academic year, many instructors had either adopted or observed digital exams in various courses and were increasingly confident in the format. They reported that students, too, seemed well-prepared and less prone to technical issues as the years went on, which in turn made the teachers' experience less stressful compared to the early pilots. The faculty has also been actively involved in providing feedback and suggestions. This collaborative approach, where instructors relay their experiences to the project team, has been crucial in refining guidelines (for example, how to write exam questions suitable for on-screen display) and in identifying where additional technical support or training might be needed. In summary, teachers see the on-campus digital examination initiative as a positive advancement in assessment methodology, appreciating the security, clarity (no illegible handwriting issues, for instance), and potential for innovation it brings, while remaining mindful of the areas that require ongoing attention.

V. Experience of Students

Student perspectives over the four-year rollout offer encouraging evidence of growing acceptance and adaptation to digital exams, along with insights into what students value or find challenging. Familiarity with the system increased over time, albeit not in a strictly linear fashion. In the initial year (2022-2023), most students were encountering the Chromebook-based exam for the first time, only about 23% had any prior exposure. As more exams were held, a larger pool of students gained experience; by the end of 2023-2024, roughly 37% of students sitting digital exams had used the system before, reflecting the return of students who participated in the pilots. Interestingly, in 2024-2025, the influx of newcomers (particularly first-year students or others new to digital exams) meant the proportion with prior experience fell to around 19%. However, as those students went through the process and the ones from earlier years continued, the familiarity level rose again to about 31% in 2025-2026. This indicates that while each academic year brings in a fresh cohort initially unfamiliar with the system, the overall student population is gradually building a base of experience year on year.

Despite varying levels of experience, student satisfaction with the digital exam interface has remained high. Across all survey years, students rated key usability aspects of the Chromebook exam setup positively. On average, scores for general user-friendliness of the device and platform hovered around 8 out of 10. Notably, the login process, a potential stress point if slow or complicated, was consistently rated well (for instance, it scored 8.6/10 in 2022-2023 and still around 7.6/10 in 2025-2026, indicating that even as the scale increased, the process remained efficient). Students also gave high marks to the clarity of the Chromebook's screen (often 8.3-8.5) and the comfort of the keyboard (roughly 8.0 or above in all years). These factors are important for reducing fatigue during lengthy exams. By contrast, the touchpad was the one component that received more lukewarm feedback: its average rating ranged in the mid-7s, dipping as low as 7.4/10 in some surveys. Complaints about the touchpad typically involved mentions of it being "not as precise as a mouse" or a preference for using a touchscreen or an external mouse

(though the latter is not an option in the exam setting). It's worth noting that an external USB mouse was considered early on but was eventually ruled out for logistical reasons.

Student preferences show a gradual but clear shift toward digital exams. In 2022–2023, opinions were evenly split between paper-based and Chromebook exams, but by 2023–2024 around 60% preferred digital formats. This majority remained in subsequent years, though slightly decreasing (57% in 2024–2025 and 54% in 2025–2026). Students favour digital exams mainly for faster typing, easier editing, and improved readability, while those preferring paper cite comfort factors such as reduced eye strain and familiarity.

A similar trend appears in device preference. Initially, most students preferred institution-provided Chromebooks (73% in 2022–2023, rising to 79% in 2023–2024) due to reliability and fairness. By 2025–2026, this preference declined to 59%, with 41% favouring personal devices, likely reflecting increased confidence in digital exams and preference for familiar personal setups.

Importantly, Chromebook use did not substantially increase exam anxiety. Reported additional stress remained relatively low (from 4.25 in 2022–2023 to around 3.5 in mid-years, and 4.12 in 2025–2026), indicating that the device is a minor stress factor compared to exam content. Anxiety related to technology also decreased with familiarity, supported by reliable system performance and effective on-site support.

Students particularly valued features such as automatic saving and reduced risk of losing work, while some initial stress persisted due to unfamiliarity or the perceived formality of digital exams. Overall, findings indicate increasing comfort and preference for digital examinations, with ongoing feedback mainly focused on improving interface elements such as touchpad usability. Stable survey response rates (131 in 2022–2023; 183 in 2023–2024; 194 in 2024–2025; 193 in 2025–2026) further support the reliability of these trends despite the strong growth in exam numbers.

VI. Limitations

Several limitations must be noted. First, survey participation was voluntary, which may introduce self-selection bias. Second, it is not possible to determine whether respondents participated in multiple years, limiting the ability to track individual longitudinal trajectories.

Third, the study does not include control groups or comparative experimental conditions, which restricts conclusions about causality or relative effectiveness. Lastly, the present study provides primarily indirect evidence of impact, based on adoption data and stakeholder perceptions. Further research is needed to examine more direct indicators such as misconduct incidents, assessment validity, and learning outcomes in comparison with alternative assessment models.

VII. Critical Reflections

While the implementation of Chromebook-based digital examinations has shown clear benefits, several critical reflections must be considered. First, the controlled kiosk-mode environment inherently limits access to external tools and resources. This may restrict the suitability of the approach for assessment formats that rely on authentic tool use, open-resource problem solving, or complex software environments. As a result, certain competencies may be more difficult to assess within this model. Second, the approach may have differential impacts across disciplines. Courses requiring drawing, modelling, or extensive use of specialized software may encounter more friction compared to text-based or structured assessments. Third, accessibility considerations require ongoing attention. Although accommodations can be provided, the standardized device environment may not fully align with all student needs, particularly for those who rely on assistive technologies or alternative input methods. Finally, the standardization that enables security may also introduce tensions with flexibility, particularly in discussions around bring-your-own-device models. These trade-offs highlight the need for institutions to carefully balance reliability, inclusivity, and pedagogical richness when scaling digital assessment systems.

VIII. Implications for Practice

The findings of this study point toward several transferable insights for institutions seeking to implement secure digital examinations. First, standardization of the device environment (e.g., through managed Chromebook fleets in kiosk mode) appears to be a key factor in ensuring reliability and minimizing opportunities for misconduct. Second, successful scaling requires continuous stakeholder involvement, including structured feedback from both teachers and students to iteratively refine the system. Third, alignment between technical infrastructure and assessment design is critical, as constraints of secure environments directly influence the types of assessments that can be implemented. Finally, the case highlights the importance of embedding secure examination infrastructures within a broader assessment strategy. Positioning such systems explicitly as a Lane 1 component within the Two-Lane framework can provide conceptual clarity and support institutions in balancing assessment integrity with innovation in AI-integrated learning contexts.

IX. Future Directions

Future development of the Chromebook-based digital examination system will not only focus on further optimization at the institutional level, but also on refining its contribution to broader practices in higher education. A key direction is the further articulation of secure digital examination environments as a robust Lane 1 strategy within the Two-Lane assessment framework.

The present case demonstrates how controlled device ecosystems (e.g., kiosk-mode Chromebooks) can support reliable summative assessment in an AI-rich context. Future work should deepen this approach into a clearer set of design principles that can support both our institution and others, including the importance of device standardization, alignment with assessment platforms, and the integration of continuous stakeholder feedback mechanisms.

In addition, the longitudinal scaling observed in this study points toward the need for a more explicit maturity model for institutional adoption. The transition from pilot implementation to large-scale normalization suggests distinct phases in the development of secure digital assessment infrastructures. Future research could identify and characterize these stages, including enabling conditions, common barriers, and risk factors in scaling. A further

priority is to strengthen the connection between Lane 1 infrastructures and emerging Lane 2 practices. Future work should explore how institutions can coordinate both lanes strategically, ensuring that secure summative assessment and AI-integrated learning environments are developed in a complementary rather than fragmented way.

Finally, comparative and cross-institutional research will be essential to increase the transferability of findings. By examining variations across institutional contexts, disciplines, and technological configurations, future studies can contribute to a more robust and generalizable understanding of effective and sustainable models for secure digital assessment in the age of AI.

X. Conclusion

This study has presented a four-year longitudinal case of scaling Chromebook-based digital examinations within a European university of applied sciences, explicitly framed within the Two-Lane assessment model. The findings demonstrate how a controlled digital examination environment can evolve from a pilot into an established institutional practice, supported by strong growth in adoption, reliable technical performance, and increasing confidence among both teachers and students.

Teacher experiences underline improvements in logistics, standardization, and assessment efficiency, while also highlighting constraints in flexibility and assessment design. Student data show high usability, growing preference for digital formats, and limited impact on exam-related stress. At the same time, the findings reveal limitations of strictly controlled environments, including constraints on authentic task design, disciplinary differences, and ongoing challenges related to accessibility and flexibility, thereby reinforcing the need for complementary Lane 2 approaches.

Beyond the institutional context, this study contributes to a broader understanding of how secure digital examinations can be designed and scaled. It identifies key conditions for successful implementation, including device standardization, alignment between infrastructure and assessment design, and continuous stakeholder engagement. The longitudinal perspective further suggests that scaling involves distinct phases, from pilot experimentation to institutional normalization.

Overall, the paper moves beyond a single case to inform how institutions can develop robust and scalable Lane 1 strategies while recognising their limits and preparing for AI-integrated innovation. In doing so, it contributes to ongoing discussions on balancing reliability, integrity, and pedagogical innovation in AI-supported assessment.

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