Journal of Applied Technical and Educational Sciences jATES

ISSN 2560-5429

http://jates.org

Proctoring as a journey to quality education? A critical review of the literature

Michal Cerny [1], Dominika Solcova [2]

[1] *Masaryk University, Faculty of Arts, Arne Novaka 1, Brno, 602 00, Czech Republic, mcerny@phil.muni.cz*

[2] *Masaryk University, Faculty of Arts, Arne Novaka 1, Brno, 602 00, Czech Republic, solcovadominika@phil.muni.cz*

Abstract: *The paper aims to analyse the current professional discourse and to map the current views and attitudes of proctoring online exam formats across the globe. The entire theoretical delineation focuses mainly on college or university formats. We introduce the international context in the first part and then discuss the analysis of the texts found in the review study at Scopus and Web of Science databases. The study results in a comprehensive summary of the positive and negative implementation aspects of proctoring. We also reach a new categorisation of the different methods used to control proctoring online exams. The study should provide synthesising findings with easy applicability. Our results may be valuable for educational institutions or others interested in online learning and online proctoring processes, not only when considering implementation.*

Keywords: *online proctoring; online exams; exam security; online student authentication; distance education; online learning*

1. Introduction

Proctoring is not new, but it is associated with extraordinary dynamics. The first studies in the Web of Science database on this topic date back to 1972. In it, Farmer et al. (1972) analysed the academic performance of psychology students who were proctored and those who were not. This study brings to the forefront of its interest the fundamental question associated with this phenomenon - does proctor increase the quality of education? Studies over time have answered this question differently. Looking at the Web of Science, since the early 1990s, proctoring has been the subject of an order of magnitude of studies per year until 2009, when the topic became topical.

After a drop in interest in 2019 (from 66 to 29 studies), we can see a renewed interest logically accelerated by the COVID-19 pandemic, which brought not only the topic of e-learning as a basic form of education but also the question of monitoring quality and fairness. Universities and other actors in the educational process have begun to think intensively again about how to

make distance education secure and associated with the same level of credibility as regular f2f. This demand has offered, on the one hand, a naive implementation of proctoring into different systems; on the other hand, it has opened up a new deeper field of reflection on what role proctoring has in the educational process and what effects it is associated with.

2. Background

Fenu et al. (2018) point out that proctoring cannot just focus on monitoring students in exams but should be concerned with monitoring students' presence in the classroom. The goal should be more than authenticating the examinee but monitoring and controlling their education process. This is to be done by working with biometric data that can be collected and analysed online. Also, Grande de Prado et al. (2021) consider proctoring as a biometric identification of the learner, even if only during exams, and consider this process as one of the central themes of the discussions on e-learning, stressing the importance of planning such a measure.

Raje and Stitzel (2020) see proctoring as part of preventing copying and cheating on tests. They work with the example of chemistry tests, which involve, among other things, rote learning that can be easily circumvented by reinforcing correct answers. Knowledge of these concepts is essential for further study of chemistry, so the authors analyse various options - from watermarking to time-limited windows for completing tests - to prevent cheating.

Lee (2020) returns to a question by Farmer et al. (1972) about educational effectiveness and proctoring. He concludes (using a sample of 1762 students) that online and offline proctoring is unlikely to have any measurable effect on the quality of knowledge. Therefore, the mindset of educational institutions needs to be changed to focus more on significant and practical concepts of education.

Wuthisatian (2020) points out that the issue of proctoring can be complex - the choice of a particular proctoring environment and method has many psychological and technical dimensions that must be considered. In his view, protecting academic integrity alone cannot be a full-fledged reason for introducing proctoring - students' poorer performance on a test does not automatically mean they are copying. Instead, it points to other problems such as time and technical demands, stress, reluctance to take the test, scrutiny, etc. Labayen et al. (2021) discuss the ideal of proctoring as a completely passive solution for the student that will be technologically reliable, simple and scalable. On the one hand, the discourse reducing proctoring to a purely technological problem responds to Wuthisatian's (2020) findings but, at the same time, fails to reflect the psychological, social and ethical dimensions of proctoring.

Saunders and Weible (1999) offer two interesting considerations in their essayistic text about proctoring. Firstly, proctoring may not only be promoted by an educational institution seeking to ensure its academic integrity but may also originate from students' needs. These needs are based on the requirement to confirm the quality of one's education. A crucial factor is how online education is viewed in general - according to the authors, where it has the character of a distinct educational form, the students' need for proctoring is fundamentally less than for those who view online education only as a correspondence course.

The above studies clearly show that proctoring is - as they mention - a controversial and debated topic. However, at the same time, we need more data, a thorough overview, and a sufficiently robust empirical base for its critical analysis. Therefore, this study focuses on analysing available recent studies on the topic of proctoring in university settings to offer a comprehensive and plastic view of the issue, which could then be used, for example, for sociological or ethical analyses and discussions.

3. Methodology

We acquired information by creating a short review study conducted through the Web of Science and Scopus databases to understand the current research discourse. The search was conducted in July and August 2022 in two iterative processes to increase the relevance of the results, as proctoring is a highly diversified topic in terms of concept and meaning. We only looked at texts written in English with publication dates between 2020 and 2022. Later results were discarded due to the global pandemic situation, as the diversity of these texts would have been too high within the topic under study. A final limitation of the query was restricting the type of publications to journal articles and conference papers with a free open license.

3.1. Phase 1

The primary phase of the search queries focused on using the keyword phrases online learning, security, and covid-19, which yielded the results of the status or necessary changes in security at a distance education cause of the pandemic situation. The search query's key term was security, at the centre of which the technology-security component of proctoring is stated. Thus, the resulting search query looked as follows:

> TITLE-ABS-KEY ("online learning" AND security AND covid-19) AND (LIMIT-TO (OA , "all")) AND (LIMIT-TO (PUBYEAR , 2022) OR LIMIT-TO (

PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2020)) AND (LIMIT-TO (DOCTYPE , "ar") OR LIMIT-TO (DOCTYPE , "cp")) AND (LIMIT-TO (LANGUAGE , "English"))

The search query yielded 20 results, and in the process, three texts were excluded for not fulfilling the thematic requirements after a deeper study. The first one (Lam Lam & Dongol, 2020) described the security of blockchain-based e-learning platforms. The second one dealt with blockchain in the context of online student assessment (Alshahrani, 2022), and the last one (Rahmani et al., 2021) again provided insights into the general scope of e-learning development through artificial intelligence and blockchain. Thus, proctoring topics have been discussed here only marginally or not at all. The initial phase keyed 17 papers.

3.2. Phase 2

The secondary part of the search strings went into more detail about direct proctoring terminology, including the related aspect of test security, which, in contrast to the first search cycle, symbolises the psychological-security facet of guarded test quality. The chain displayed 21 additional results due to this fact. Our form of the chosen methodology thus encompasses different approaches and states of mind that equally interpret the problematic phenomenon. The wording of the second query is as follows:

TITLE-ABS-KEY ("test security" AND "online proctoring") AND (LIMIT-TO (OA , "all")) AND (LIMIT-TO (PUBYEAR , 2022) OR LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2020)) AND (LIMIT-TO (DOCTYPE , "ar") OR LIMIT-TO (DOCTYPE , "cp")) AND (LIMIT-TO (LANGUAGE , "English"))

3.3. Summary

In a short enumeration table, we provided a complete overview of the number of publications in both phases, including dependence on the relevant Web of Science and Scopus databases.

Table 1. A proportional number of publications in phases

	WoS	Scopus	Overall
Phase 1	9	8	17
Phase 2	12	9	21
Overall	21	17	38

The complete list of all the documents considered comprises 38 publications. It is included in the following parts of the text as a tabular statement. In the table, we provided basic bibliographic information about each paper; the authors, the year of publication, or the type of paper, which informs about the nature of the text. Furthermore, we have chosen to reflect in the table the proctoring statements that are important to us, which we will comment on in more detail in the results of the literature search. These metrics were; relationships to proctoring, geographic scope, and preferred review methods. As an associated part of the table used to assess the quality of the retrieved articles, we also include parameters in the number of citations in the Web of Science database as of 12 November 2022. The texts are typically arranged alphabetically and were all freely available in the full text within the database at the time of the review study.

4. Results

The results presented below show that proctoring is discussed across various continents, except for Africa and South America, which will be influenced mainly by developing countries, which face more elementary problems in the field of education, usually beyond the level of the security sector. Of the 38 documents, the most significant number of publications are associated with Asia, 17; then Europe, 10; North America, 8; and lastly, Australia, where we reflected three publications. The Turkish state became a problematic concept in terms of the breakdown because it is located at the level of the Asian and European continents in terms of area. Still, considering the geographical location of the institution of the written publications, we decided to include Turkey in the Asian continent for most of this analysis.

In the table below, the relatively high diversity of the topics discussed is also visible through the titles, marking both the novelty and the controversy of the concept because we find differentiated views on implementing proctoring even within a single national border. The most

frequent selection studies proposing a new secure proctoring framework 7; studies considering the advantages or disadvantages of proctoring 6; articles comparing the effectiveness of specific proctoring systems; five or comparing proctored and unproctored exams 4. The studies resorted to an analysis of the literature in three cases and obtained student opinions on the concept in another three points. The positively commenting studies mainly discussed reducing or minimising cheating, while opponents of proctoring often referred to secure test settings that effectively reduce cheating techniques.

Thus, our selection focuses on 38 recent papers that, without depending on the number of citations, can adequately demonstrate the current state of the proctoring in published studies and responses. We present the single items crucial to our understanding by attaching a summary table. A detailed analysis of the findings will be discussed in a forthcoming chapter.

Table 2. A complete list of the reflected literature

Authors + year of study	Type of Study	Quotations	State	Relationship to proctoring	Control methods
Ahmad, I., AlQurashi, F., Abozinadah, E., & Mehmood, R. (2021)	application	0	Saudi Arabia	positive	identification
Alshammari, M. T. (2020)	application	0	Saudi Arabia	positive	identification locking
Arnò, S., Galassi, A., Tommasi, M., Saggino, A., & Vittorini, P. (2021)	theoretical	8	Italy	negative	identification locking monitoring
Balash, D. G., Kim, D., Shaibekova, D., Fainchtein, R. A., Sherr, M., & Aviv, A. J. (2021)	empirical	4	USA	neutral	locking monitoring
Becker, B., van Rijn, P., Molenaar, D., & Debeer, D. (2022)	empirical	2	Germany/ Netherlands	neutral	xxx
Bergmans, L.,	empirical	0	Netherlands	negative	locking

Bouali, N., Luttikhuis, M., & Rensink, A. (2021)					monitoring
Butler-Henderson, K., & Crawford, J. (2020)	theoretical	37	Australia	positive	identification locking
ÇELİKBAĞ, M. A., & Delialioğlu, Ö. (2021)	empirical	0	Turkey	neutral	xxx
Conijn, R., Kleingeld, A., Matzat, U., & Snijders, C. (2022)	empirical	2	Netherlands	negative	xxx
Farland, M. Z., & Childs-Kean, L. M. (2021)	theoretical	1	USA	neutral	xxx
Fiano, K. S., Medina, M. S., & Whalen, K. (2021)	theoretical	4	Oklahoma (USA)	positive	xxx
Garg, M., & Goel, A. (2022)	theoretical	1	Indie	positive	identification locking
González, G. CS; Infante Moro, A.; Infante Moro, JC (2020)	empirical	37	Spain	positive	xxx
Hébert, C. (2021)	theoretical	0	Canada	negative	xxx
Howard, D. (2020)	empirical	3	Idaho (USA)	neutral	xxx
Humbert, M., Lambin, X., & Villard, E. (2022)	empirical-application	0	France	positive	xxx
Hussein, M. J., Yusuf, J., Deb, A. S., Fong, L., & Naidu, S. (2020)	empirical	14	Fiji	positive	identification locking monitoring
Indi, C. S., Pritham, K. C. S. V., Acharya, V., & Prakasha,	application	5	Indie	positive	monitoring

K. (2021)					
Infante Moro, A., Infante Moro, J. C., Gallardo Pérez, J., & Martínez López, F. J. (2022)	empirical	3	Spain	positive	xxx
Jadi, A. (2021)	application	3	Saudi Arabia	positive	identification locking monitoring
Khalil, M., Prinsloo, P., & Slade, S. (2022)	theoretical	0	Norway	neutral	xxx
Kilinc, H., Okur, M. R., & İlker, U. S. T. A. (2021)	empirical	0	Turkey	positive	identification locking
Labayen, M., Vea, R., Florez, J., Aginako, N., & Sierra, B. (2021)	application	6	Spain	positive	identification locking monitoring
Langenfeld, T. (2020)	theoretical	16	Iowa (USA)	neutral	locking
Lee, J. W. (2020)	empirical	7	China	neutral	identification
Lee, K., & Fanguy, M. (2022)	empirical	6	England/ South Korea	negative	locking monitoring
Li, M., Luo, L., Sikdar, S., Nizam, N. I., Gao, S., Shan, H., ... & Wang, G. (2021)	application	13	USA	neutral	xxx
Long, D. T. (2021)	application	0	Vietnam	positive	identification
Masud, M. M., Hayawi, K., Mathew, S. S., Michael, T., & El Barachi, M. (2022)	application	1	United Arab Emirates	positive	identification monitoring
Middleton, K. V. (2022)	theoretical	0	Washington (USA)	neutral	xxx
Muzaffar, A.	theoretical	16	Pakistan/Sa	neutral	identification

W., Tahir, M., Anwar, M. W., Chaudry, Q., Mir, S. R., & Rasheed, Y. (2021)			udi Arabia		
Nguyen, J. G., Keuseman, K. J., & Humston, J. J. (2020)	theoretical	31	Iowa (USA)	neutral	xxx
Nigam, A., Pasricha, R., Singh, T., & Churi, P. (2021)	theoretical	10	Indie	neutral	identification locking monitoring
Raman, R., Vachharajani, H., & Nedungadi, P. (2021)	empirical	19	Indie	positive	identification locking monitoring
Selwyn, N., O'Neill, C., Smith, G., Andrejevic, M., & Gu, X. (2021)	empirical	10	Australia	negative	identification monitoring
Shaushenova, A., Zulpykhar, Z., Zhumasseitova, S., Ongarbayeva, M., Akhmetzhanova, S., Mutalova, Z.,…& Zueva, A. (2021)	empirical	1	Kazakhstan	positive	xxx
Topuz, A. C., Saka, E., Fatsa, Ö. F., & Kurşun, E. (2022)	theoretical	1	Turkey	neutral	identification locking monitoring
Valizadeh, M. (2022)	empirical	1	Turkey	neutral	xxx

5. Analysis

The literature search results identified principal differences in perceptions of the relationship with proctoring depending on geographic location. A generalisation of the results is provided in the adjacent graph, which visualises an increased positive aspect predominantly in Asian countries; research from American universities tends not to show their opinion in their

investigations and considers both aspects equally, while Europe demonstrates the most fragmented views of both positive and negative aspects of implementation within the selected literature sample. This could also symbolise the attitudes of the countries in question in prioritising educational strategies with an emphasis on the level of security or social/psychological components.

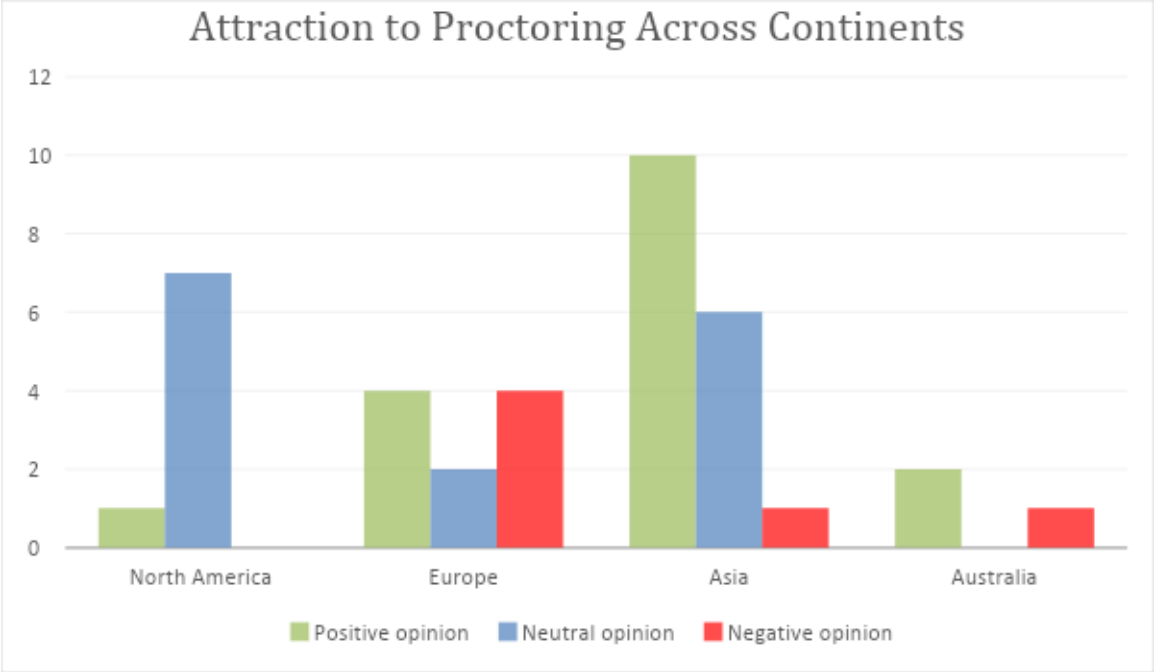

Fig. 1. Attraction to Proctoring Across Continents

5.1. Positive aspects of proctoring

Within the solid sample, it can be said that texts with affirmative colouring, representing proctoring as a necessary prevention against cheating, predominate. Butler-Henderson & Crawford (2020) define proctoring as the most dominant topic area, noting that students enjoy and also quickly adopt online formats that reduce various forms of anxiety compared to traditional instruction. Garg & Goel (2022) support preventing the detection of dishonesty. Their reviews identified diverse types of dishonest student behaviour across online education, from collaborating with others to looking up topics online. They also identified the causes of increased academic dishonesty in the online environment, summarising the main factors as the lust for good grades, parental pressure, lack of time, or simple personality. Valizadeh (2022) investigated students' attitudes toward the perception of cheating in online education, where more than half of the respondents stated that affair is more straightforward in the online

environment. According to his results, the most common cheating techniques were through Google, so avoiding the copy-and-paste function was one of the common suggestions.

Proctoring is also presented in positive texts as a reductionist tool to achieve a greater degree of educational quality and a level of safety against copying and other unethical behaviour across the university. Shaushenova et al. (2021) show significant differences between proctored and unproctored examinations, with the number of offences in proctored solutions found to be significantly lower. Similarly, Humbert et al. (2022) support the idea of protected online exams. Their study investigated the effectiveness of intervention methods in the form of warning messages when cheating was detected to encourage a perception of sophistication among students.

Other texts within the security framework appeal more to the emphasis of the notion of academic integrity, which is representative of the character of the university through a well-set teaching environment. Hébert (2021) argues that online proctoring is a defence against the devaluation of university degrees in the marketplace, as cheating can significantly tarnish a university's brand. However, he does not notably support the concept of proctoring, instead advocating the need for a revolution in online assessment practices that do not monitor the student but rather support value. Some universities, however, take the concept of proctoring and academic integrity as an advantage, where a student pays for a proctored exam to prove the high credibility of the authenticity of the certifications (Scheduling a proctored exam, c2022). However, Khalil et al. (2022) argue that there is little evidence that academic integrity plays a vital role in the adoption of proctoring solutions, but rather that it is a matter of maintaining professional standards and minimising cheating, as mentioned earlier.

Most studies supporting proctoring have sought to present empirical designs or directly tested application models of their trial safety frameworks that they consider highly reliable and potentially successful based on their analyses or pre-tests. Each of these frameworks applied different authentication methods. Labayen et al. (2021) proposed a system based on continuous authentication processes, using passive monitoring capabilities via webcam, microphone, and keystroke. In his model, Jadi (2021) prohibits the operation of other applications besides the allowed auxiliary components. At the same time, students underwent facial checkpoint scanning - eyes, nose, chin, mouth, eyebrows - throughout the trial. Long (2021) bases his model on taking a picture of the face, extracting features, and classifying them. The model considers basic expressive features, neutral expressions of people, and differences in lighting or poses. Masud et al. (2022) mention the effectiveness of video capture based on eye tracking,

head movement, mouth opening, and identity tracking. The average efficiency of these frameworks varies from 90-100 %.

Topuz et al. (2022) write about semi-automated monitoring methods, video and voice analysis, screen recording, and copy/paste blocking as the most effective security proctoring features. In contrast, Indi et al. (2021) say that a highly reliable proctoring system can have even minimal requirements by simply sensing eye gaze and head position. So, in principle, retrospective or simultaneous tracking of the student's image is the most commonly used phenomenon done through proctoring or automated AI formats. In some of the cases mentioned above, we can also notice more widespread constraining formats that interfere with the compositions of the computer settings.

5.2. Negative aspects of proctoring

Our study identified four key points that capture the negative differentiation of proctoring implementations. At the same time, proctoring raises concerns for many authors due to its lack of privacy protection and interference with human psychological factors. Furthermore, there are doubts about the relevance and effectiveness of the systems and doubts about the appropriateness of the technical radicalisation of the examiners' processes.

Nigam et al. (2021) categorised the problems of proctoring into two parts, technological and human, with the latter group respecting humans' psychological and socio-cultural aspects. The psychological safety of the student appeared to be a widely consulted topic in general, as we found many references to increasing stress hormones due to proctoring online exams. In Australia, for example, proctoring has caused controversy and media alarm. Selwyn et al. (2021) state that proctoring was generally only deployed there because of "technological appropriateness," and now it appears that proctoring is an underdeveloped technology causing much student stress or digital resignation. The same view is taken in a Dutch study where the authors Conijn et al. (2022) highlight that proctored exams increase test anxiety and stress levels. Balash et al. (2021) investigated students' attitudes toward online proctoring, finding that a significant intrusion on privacy and comfort mostly exacerbates students' psychological states. Students often cited webcam and microphone recording concerns because the device monitored their room.

From a statistical point of view, it is also crucial that many studies expressed an opposing sight to the study mentioned above (Shaushenova et al., 2021), demonstrating a difference between supervised and unsupervised exams. Çelikbağ & Delialioğlu (2021) show that no statistically

significant differences were found between the exams, with only one case of an unproctoring exam having a higher pass rate. Lee (2020) comments on the equal idea of no difference between exam environments. He also says that proctoring is unlikely to be related to student performance. Questioning of results also occurred because students were usually informed in advance of the proctoring format and, therefore, could prepare better for the exam and did not have to resort to copying (Howard, 2020). Thus, these results provide evidence that proctoring is unlikely to significantly impact students' scores, although the effects of divergent research are mixed. Also, these findings cannot be much related within the framework of intercultural ethical practices, as all the studies mentioned above reflect research from Asian countries.

Proctoring denial has also often been resorted to by studies that have inquired about the effectiveness of individual systems, the likelihood of errors, and the correct detection of cheating techniques. Bergmans et al. (2021) say that proctoring systems work more like some placebo effect because the sensitivity of the Proctoria system is very low. The system could not detect cheating students, so the study evaluated online proctoring as a questionable tool to ensure reliability.

The last and significant fourth identification point detected was the shift away from technology implementation of safety depending on the student's oriented needs. Lee & Fanguy (2022) describe online proctoring as teacher-centred, diminishing the values of social equity and deteriorating student-teacher relationships. The common thread among these concepts is that teachers should respect student privacy and provide well-secured test exams that naturally, without technical solutions, reduce opportunities for cheating and, therefore, false test pass rates. Nguyen et al. (2020) show that cheating can be minimised by thoughtfully composing the course or test operation. In their work, they recommend creating tests through essay questions. Other recommendations arise in a study by Becker et al. (2022), where it was reported that ordering items in a test by difficulty dramatically affects students' final scores. Students with more complex questions at the beginning and more straightforward questions at the end performed significantly worse than when the test was organised the other way around - so they consider it relevant to keep the order of questions fixed to reduce the variance in scores. These findings can be explained primarily by a relatively secure testing design that respects a strict time limit, appropriate question design, and other test settings (Langenfeld, 2020).

In the category of student-centred needs, we can also include efforts to reduce student anxiety, which was reduced in the American study by Farland & Childs-Kean (2021) by transferring classified assessments to non-classified activities. However, these solutions, we believe,

already go beyond proctoring, as it is a general definition of psychological safety in online educational formats.

5.3. Identification of different proctoring formats

In addition to the positive and negative phenomena of proctoring discussed above, mainly due to the proctoring models described in detail, we were able to identify different ways of achieving safety based on differentiated emphases in constraint prioritisation. We refer to these distinct proctoring control methods as identification, monitoring, and locking. All types of proctoring can be used synergistically.

The identification methods of proctoring solutions are limited to human verification features, which can occur at any time during the test, before or after the examination. The most common authentication methods are biometrics through face recognition using a webcam or voice analysis using a microphone (Labayen et al., 2021). However, fingerprint identification can also be classified as this type.

The monitoring functions use identical restriction means, such as webcam or microphone monitoring. However, monitoring methods are already focused only on minimising cheating techniques. Thus, student monitoring occurs not to verify the identity of the correct person but because of the potential threat of exam cheating and resorting to cheating methods. Thus, the goal is usually to monitor various metrics, such as eye, mouth, and head movement or the intensity of sounds in the home or other testing environment (Nigam et al., 2021).

The last type of technical restriction is called locking devices, which temporarily block a user's device, features, or software to prevent collusion. These include prohibiting certain keyboard buttons, such as the print screen or the copy and paste function. Blocking the browser or new browser windows is also another ordinary method used (Lee & Fanguy, 2022)

Our studies show that proctoring is a highly controversial topic which institutions have approached differently—positive views on implementing proctoring consider academic integrity, minimising cheating, and creating new security frameworks. The negative side of the concept is written mainly through an emphasis on respecting the principles of privacy and most students' psychological moods or feelings. A substitute for technical proctoring concepts may be to address the complete change of grading procedures of online assessments by converting them to non-classified actions or by emphasising test-taking designed according to value-based

social principles for students. We conclude our analysis by providing one possible breakdown of proctoring methods into identification, monitoring, and locking.

6. Conclusion

The review study shows that proctoring is a question of technological security and a complex socio-pedagogical-technical-ethical problem. On the social level, questioning approaches emphasise the loss of trust. On the other hand, we can identify an unambiguous effort to gain surveillance in a sense already contemplated by Foucault (1975). Depilation here is not only linked to the educational content (Deacon, 2006) but also to the form of education used (Nicoll, 2008; Fawns & Schaepkens, 2022) as a process of surveillance (Venter & Van Niekerk, 2011).

At the pedagogical level, the question of whether the presence of proctoring increases the quality of educational outcomes prevails. There are many studies on this topic, but they do not offer a clear-cut answer. If positive effects exist, they are associated with other factors. However, the studies conducted are currently unable to capture and can be referred to as environmental, probably related to specific educational cultures and practices. At the same time, however, we can observe a debate about the appropriateness of using other forms of testing where cheating has no effect, such as open-book formats (Gharib et al., 2012; Brightwell et al., 2004; Eurboonyanun et al., 2021; Jaap et al., 2021).

A significant number of studies have focused on the technical side of the issue (Selwyn et al., 2021; Kharbat & Abu Daabes, 2021), although they are aware that this is only one aspect. There are views that the ideal technical solution will make proctoring a universal educational tool, as well as sceptical remarks directed towards the dysfunctionality or unreliability of particular solutions or approaches. The development of quality proctoring tools is a crucial issue, but at the same time, we must bear in mind the necessity of anchoring it in a broader context. The goal of development is to provide a system that is non-disruptive to users, secure and stable.

The ethical question (Coghlan et al., 2021; Shaikh et al., 2021) poses the fundamental dilemma of the relationship between the student and the teacher, or more broadly, the person (student and teacher) and the institution. Proctoring can be seen as a tool of control, discipline, and breach of trust. The institution, in its implementation, places the teacher in the role of a clerk in a bureaucratic apparatus, as Arendt describes it, against which it is impossible to rebel, but which at the same time destroys a very fundamental dimension of relationality, trust and freedom.

We believe that the above comments and analyses show that proctoring, in the current social climate and technological maturity of the solution, cannot be considered an ideal and fully functional solution but instead can be seen as an emergency solution where it is not possible to choose another course of action.

Acknowledgements

The article was created thanks to the financial support of the Ministry of Education of the Czech Republic within the project MUNI 3.2.1 in the specific objective: SC C2 Safety of distance learning, project number NPO_MUNI_MSMT-16606/2022.

References

Ahmad, I., AlQurashi, F., Abozinadah, E., & Mehmood, R. (2021). A Novel Deep Learning-based Online Proctoring System using Face Recognition, Eye Blinking, and Object Detection Techniques. *International Journal of Advanced Computer Science and Applications*, 12(10).

Alshammari, M. T. (2020). An Adaptive Framework for Designing Secure e-Exam Systems. *International Journal Of Computer Science And Network Security*, 20(5), 189-196. https://www.webofscience.com/wos/woscc/full-record/WOS:000577876400024

Arnò, S., Galassi, A., Tommasi, M., Saggino, A., & Vittorini, P. (2021). State-of-the-Art of Commercial Proctoring Systems and Their Use in Academic Online Exams. *International Journal Of Distance Education Technologies*, 19(2), 41-62.

Balash, D. G., Kim, D., & Shaibekova, D. (2021). Examining the Examiners: Students' Privacy and Security Perceptions of Online Proctoring Services. In S*eventeenth Symposium on Usable Privacy and Security* (pp. 633-652). USENIX Association. https://www.usenix.org/conference/soups2021/presentation/balash

Becker, B., van Rijn, P., Molenaar, D., & Debeer, D. (2021). Item order and speededness: implications for test fairness in higher educational high-stakes testing. Assessment & *Evaluation in Higher Education*, 47(7), 1-13. https://doi.org/10.1080/02602938.2021.1991273

Bergmans, L., Bouali, N., Luttikhuis, M., & Rensink, A. (2021). On the Efficacy of Online Proctoring using Proctorio. In *Proceedings of the 13th International Conference on Computer Supported Education* (1) (pp. 279-290). SCITEPRESS – Science and Technology Publications. https://doi.org/DOI: 10.5220/0010399602790290

Brightwell, R., Daniel, J. H., & Stewart, A. (2004). Evaluation: Is an open book examination easier?. *Bioscience Education*, *3*(1), 1-10.

Butler-Henderson, K., & Crawford, J. (2020). A systematic review of online examinations: A pedagogical innovation for scalable authentication and integrity. *Computers & Education*, 159. https://doi.org/https://doi.org/10.1016/j.compedu.2020.104024

ÇELİKBAĞ, M. A., & Delialioğlu, Ö. (2021). Proctored vs Unproctored Online Exams in Language Courses: A Comparative Study.

Coghlan, S., Miller, T., & Paterson, J. (2021). Good proctor or "big brother"? Ethics of online exam supervision technologies. *Philosophy & Technology*, *34*(4), 1581-1606.

Conijn, R., Kleingeld, A., Matzat, U., & Snijders, C. (2022). The fear of big brother: The potential negative side-effects of proctored exams. *Journal Of Computer Assisted Learning*, 1-14. https://doi.org/DOI: 10.1111/jcal.12651

Deacon, R. (2006). Michel Foucault on education: a preliminary theoretical overview. *South African Journal of Education*, *26*(2), 177-187.

Eurboonyanun, C., Wittayapairoch, J., Aphinives, P., Petrusa, E., Gee, D. W., & Phitayakorn, R. (2021). Adaptation to open-book online examination during the COVID-19 pandemic. *Journal of surgical education*, *78*(3), 737-739.

Farland, M. Z., & Childs-kean, L. M. (2021). Stop tempting your students to cheat. *Currents In Pharmacy Teaching*, 13(6), 588-590. https://doi.org/10.1016/j.cptl.2021.01.035

Farmer, J., Lachter, G. D., Blaustein, J. J., & Cole, B. K. (1972). The role of proctoring in personalised instruction1. *Journal of Applied Behavior Analysis*, *5*(4), 401–404. https://doi.org/10.1901/jaba.1972.5-401

Fawns, T., & Schaepkens, S. (2022). A matter of trust: Online proctored exams and the integration of technologies of assessment in medical education. *Teaching and Learning in Medicine*, 1-10.

Fenu, G., Marras, M., & Boratto, L. (2018). A multi-biometric system for continuous student authentication in e-learning platforms. *Pattern Recognition Letters*, *113*, 83–92. https://doi.org/10.1016/j.patrec.2017.03.027

Fiano, K. S., Medina, M. S., & Whalen, K. (2021). The Need for New Guidelines and Training for Remote/Online Testing and Proctoring. A*merican Journal Of Pharmaceutical Education*, 85(8), 805-808.

Foucoult, M. (1975). Discipline and punish. *A. Sheridan, Tr., Paris, FR, Gallimard*.

Garg, M., & Goel, A. (2022). Systematic literature review on online assessment security: Current challenges and integrity strategies. *Computers & Security*, 113, 2-13. https://doi.org/10.1016/j.cose.2021.102544

Gharib, A., Phillips, W., & Mathew, N. (2012). Cheat Sheet or Open-Book? A Comparison of the Effects of Exam Types on Performance, Retention, and Anxiety. *Online Submission*, *2*(8), 469-478.

González González, C., Infante Moro, A., & Infante Moro, J. C. (2020). Implementation of E-Proctoring in Online Teaching: A Study about Motivational Factors. *Sustainability*, 12(8) https://doi.org/10.3390/su12083488

Grande de Prado, M., García-Peñalvo, F. J., Corell, A., & Abella García, V. (2021). Evaluación en Educación Superior durante la pandemia de la COVID-19. *Campus Virtuales*, *1*(10), 49-58.

Hébert, C. (2021). Online Remote Proctoring Software in the Neoliberal Institution: Measurement, Accountability, and Testing Culture. *Education*, 27(1), 23-40.

Howard, D. (2020). Comparison of Exam Scores and Time Taken on Exams Between Proctored On-Campus and Unproctored Online Students. *Online Learning*, 24(4), 204-228. https://doi.org/10.24059/olj.v24i4.2148

Humbert, M., Lambin, X., & Villard, E. (2021). The role of prior warnings when cheating is easy and punishment is credible. *Information Economics And Policy*, 2022(58). https://doi.org/https://doi.org/10.1016/j.infoecopol.2021.100959

Hussein, M. J., Yusuf, J., Deb, A. S., Fong, L., & Naidu, S. (2020). An Evaluation of Online Proctoring Tool. *Open Praxis*, 12(4), 509-525. https://search.informit.org/doi/abs/10.3316/informit.620366163696963

Indi, C. S., Pritham, K. C. S. V., Acharya, V., & Prakasha, K. (2021). Detection of Malpractice in E-exams by Head Pose and Gaze Estimation. *International Journal Of Emerging Technologies In Learning*, 16(8), 47-60. https://doi.org/10.3991/ijet.v16i08.15995

Infante Moro, A., Infante Moro, J. C., Gallardo Pérez, J., & Martínez López, F. J. (2022). Key Factors in the Implementation of E-Proctoring in the Spanish University System. *Sustainability*, 14(13), 8112. https://doi.org/10.3390/su14138112

Jaap, A., Dewar, A., Duncan, C., Fairhurst, K., Hope, D., & Kluth, D. (2021). Effect of remote online exam delivery on student experience and performance in applied knowledge tests. *BMC Medical Education*, *21*(1), 1-7.

Jadi, A. (2021). New Detection Cheating Method of Online-Exams during COVID-19 Pandemic. *International Journal Of Computer Science And Network Security*, 2(4), 123-130

Khalil, M., Prinsloo, P., & Slade, S. (2022). In the nexus of integrity and surveillance: Proctoring (re) considered. *Journal Of Computer Assisted Learning*, 1-14. https://doi.org/DOI: 10.1111/jcal.12713

Kharbat, F. F., & Abu Daabes, A. S. (2021). E-proctored exams during the COVID-19 pandemic: A close understanding. *Education and Information Technologies*, *26*(6), 6589-6605.

Kilinc, H., Okur, M. R., & Usta, I. (2021). The Opinions of Field Experts on Online Test Applications and Test Security During the COVID-19 Pandemic. *International Journal Of Assessment Tools In Education*, 8(4), 975–990. https://doi.org/10.21449/ijate.875293

Labayen, M., Vea, R., Florez, J., Aginako, N., & Sierra, B. (2021). Online Student Authentication and Proctoring System Based on Multimodal Biometrics Technology. *IEEE Access, 9*, 72398–72411. https://doi.org/10.1109/ACCESS.2021.3079375

Langenfeld, T. (2020). Internet-Based Proctored Assessment: Security and Fairness Issues. *Journal Of Educational Measurement*, 39(3), 24-27. https://doi.org/10.1111/emip.12359

Lee, J. W. (2020). Impact of proctoring environments on student performance: Online vs offline proctored exams. *Journal Of Asian Finance, Economics And Business*, 7(8), 653-660. https://doi.org/10.13106/jafeb.2020.vol7.no8.653

Lee, K., & Fanguy, M. (2022). Online exam proctoring technologies: Educational innovation or deterioration?. *British Journal Of Educational Technology*, 53, 475-490. https://doi.org/DOI: 10.1111/bjet.13182

Li, M., Luo, L., Sikdar, S., Gao, S., Shan, H., Kruger, M., Kruger, U., Mohamed, H., Xia, L., & Wang, G. (2021). Optimised collusion prevention for online exams during social distancing. *Npj Science Of Learning*, 6(1), 1-9. https://doi.org/10.1038/s41539-020-00083-3

Long, D. T. (2021). A Facial Expressions Recognition Method Using Residual Network Architecture for Online Learning Evaluation. J*ournal of Advanced Computational Intelligence and Intelligent Informatics*, 25(6), 953-962. https://doi.org/10.20965/jaciii.2021.p0953

Masud, M. M., Hayawi, K., Mathew, S. S., Michael, T., & El Barachi, M. (2022, February). Smart Online Exam Proctoring Assist for Cheating Detection. In *International Conference on Advanced Data Mining and Applications* (pp. 118-132). Springer, Cham.

Middleton, K. V. (2022). Considerations for future online testing and assessment in colleges and universities. *Educational Measurement: Issues And Practice*, 41(1), 51-53. https://doi.org/10.1111/emip.12497

Muzaffar AW et al. (2021).Systematic Review of Online Exams Solutions in E-Learning: Techniques, Tools, and Global Adoption. *IEEE Acces*s , 9, pp. 32689-32712, doi: 10.1109/ACCESS.2021.3060192.

Nguyen, J. G., Keuseman, K. J., & Humston, J. J. (2020). Minimise Online Cheating for Online Assessments During COVID-19 Pandemic. *Journal of Chemical Education*, 97, 3429-3435. https://doi.org/10.1021/acs.jchemed.0c00790

Nicoll, K. (2008). Discipline and e-learning. In *Foucault and lifelong learning* (pp. 184-197). Routledge.

Nigam, A., Pasricha, R., Singh, T., & Churi, P. (2021). A Systematic Review on AI-Based Proctoring Systems: Past, Present and Future. *Education And Information Technologies*, 26(5), 6421-6445.

Raje, S., & Stitzel, S. (2020). Strategies for Effective Assessments while Ensuring Academic Integrity in General Chemistry Courses during COVID-19. *Journal of Chemical Education*, *97*(9), 3436–3440. https://doi.org/10.1021/acs.jchemed.0c00797

Raman, R., B, S., G, V., Vachharajani, H., & Nedungadi, P. (2021). Adoption of online proctored examinations by university students during COVID-19: Innovation diffusion study. *Education And Information Technologies*, 26(6), 7339-7358. https://doi.org/10.1007/s10639-021-10581-5

Saunders, G., & Weible, R. (1999). Electronic courses: Old wine in new bottles? *Internet Research*, *9*(5), 339–347. https://doi.org/10.1108/10662249910297741

Scheduling a proctored exam. (c2022). Acadia University: Ranked One Of The Top Undergraduate Universities In Nova Scotia. Dostupné 30 November 2022, in: https://www2.acadiau.ca/online/current-students/exams.html

Selwyn, N., O'Neill, C., Smith, G., Andrejevic, M., & Gu, X. (2021). A necessary evil? The rise of online exam proctoring in Australian universities. *Media International Australia*, 1-16. https://doi.org/DOI: 10.1177/1329878X211005862

Shaikh, S., Shahid, M., Ali, M., & Ali, A. (2021). Ethical consideration of Online Exam Supervision. *Pakistan Journal of Ethics*, *1*(1), 9-13.

Shaushenova, A., Zulpykhar, Z., Zhumasseitova, S., Ongarbayeva, M., Akhmetzhanova, S., Mutalova, Z., Niyazbekova, S., & Zueva, A. (2021). The influence of the proctoring system on

the results of online tests in the conditions of distance learning. Ad Alta: *Journal Of Interdisciplinary Research*, 11(2), 250-256.

Topuz, A. C., Saka, E., Fatsa, Ö. F., & Kurşun, E. (2022). Emerging trends of online assessment systems in the emergency remote teaching period. *Smart Learning Environments*, *9*(1), 1-21.

Valizadeh, M. (2022). Cheating in online learning programs: learners'perceptions and solutions. *Turkish Online Journal Of Distance Education* (Tojde), 23(1), 195-209. https://doi.org/10.17718/tojde.1050394

Venter, E., & Van Niekerk, L. J. (2011). Reconsidering the role of power, punishment and discipline in South African schools. *Koers*, *76*(2), 243-260.

Wuthisatian, R. (2020). Student exam performance in different proctored environments: Evidence from an online economics course. *International Review of Economics Education*, *35*, 100196. https://doi.org/10.1016/j.iree.2020.100196

About Authors

Michal CERNY is an assistant professor in the Department of Information Studies and Library Science, where his research focuses on technology in education and its philosophical and sociological reflection. As a senior researcher, he led a project on information literacy and now works as a researcher in projects on personal learning environments and immersive virtual reality learning. He received his PhD in Social Pedagogy when his work focused on the changing philosophy of education in the context of technological change.

Dominika SOLCOVA works as a researcher at the Department of Information Studies and Librarianship, Faculty of Arts, Masaryk University in Brno. She has been involved in the project National Recovery Plan for restoring the safety of distance education in the Czech Republic, where she informs about security aspects abroad. She specialises in the topics of distance education, online courses, online tutoring, cyber security, psychological safety, and proctoring.

