

Research Trends in the Implementation of eModeration Systems: A Systematic Literature Review



Vanitha Rajamany , J. A. van Biljon , and C. J. van Staden 

Abstract The 2020 COVID-19 health pandemic has accelerated the trend towards digitizing education. Increased digitization necessitates a robust and regulatory framework for monitoring standards in a knowledge society, which requires adaptivity to the continuous changes in the quality assurance processes (moderation). This provides the rationale for an investigation into the literature trends in eModeration processes. This study draws on a systematic literature review as methodology to examine the extant literature on trends in eModeration research including the purpose of the research, methodologies and limitations regarding existing eModeration systems. The findings reveal that there is little, if any, empirical evidence of systems dedicated to online moderation of assessments specifically within the secondary school sector and that eModeration is mainly an emergent phenomenon with numerous adoption challenges, especially in resource constrained contexts.

Keywords eModeration · eAssessment · Quality assurance · eSubmission · eMarking

1 Introduction

Education is tasked with preparing students for economies that are experiencing turbulent changes [1]. The Fourth Industrial Revolution (4IR) has demanded an inevitable transformation in education, making Education 4.0 the buzzword within the educational fraternity [2]. Education 4.0, enabling new possibilities by aligning humans and technology, is a response to the needs of 4IR. A prediction of 4IR is

V. Rajamany (✉) · J. A. van Biljon · C. J. van Staden
School of Computing, UNISA, Pretoria, South Africa
e-mail: 7232969@mylife.unisa.ac.za

J. A. van Biljon
e-mail: vbiljja@unisa.ac.za

C. J. van Staden
e-mail: vstadcj1@unisa.ac.za

that, traditional methods and platforms for assessments may become irrelevant or insufficient [2]. Additionally, the global COVID-19 pandemic has accelerated 4IR predictions towards innovation and growth in digital solutions. The pandemic has refocused attention on eLearning and has necessitated a radical change in assessment processes. Tertiary institutions are increasingly adopting ICTs for online submission (e-submission) and electronic marking (e-marking). Increasing questions about the performance of eLearning systems have driven Higher Education Institutions (HEIs) to try different approaches to address the quality problems posed by the use of eLearning [3]. Moderation is a quality assurance process through which teachers share their knowledge and expectations concerning standards to improve the consistency of the judgement of assessments [4]. The moderator comments on the marking of a colleague and provides feedback on the consistency of the marking [5].

eAssessment needs innovative solutions to optimize the new moderation processes necessitated by the transformation from traditional paper-based moderation methods to electronic moderation [6]. A number of international studies claim generalizability in driving efforts at reforming moderation processes and increasing quality standards in education [7–9]. Prevailing research is generally supportive of a standards-based model, to develop moderation as a practical process in an attempt to raise standards [8, 10–12].

In contrast to online assessment and automated marking, which have been studied in depth and successfully applied in HEIs, the electronic moderation of school-based assessments is a relatively new phenomenon [13]. Based on the dynamic growth of online assessments, a usable, credible eModeration system is, therefore, critical. The research question can thus be stated as: *What are the research trends regarding the implementation of eModeration systems?*

Assessment has traditionally been a process of written submissions [14]. Developments in access to, and advances in, ICT services have facilitated the area of digital assessment (eAssessment) [15] which is described as the use of technology to support and manage the assessment process life cycle [16]. eSubmission and eMarking technologies are gradually becoming the norm in UK Higher Education resulting in an increased interest in the electronic management of assessments [5].

This paper is structured as follows: Section 1 provides an introduction presenting the background, context and rationale for this paper. Section 2 indicates the literature review process. Section 3 outlines the findings and summarizes existing technological solutions for conducting moderation processes online. Section 4 concludes this paper.

2 Systematic Literature Review

A Systematic Literature Review (SLR) is a rigorous, standardized methodology for the systematic, meticulous review of research results in a specific field [17]. The SLR is based on a detailed, well-articulated question. Furthermore, it isolates relevant studies, evaluates their quality and condenses the evidence by the use of an explicit

methodology [18]. The search terms included, were: eModeration, digital moderation, digital moderation of assessments and digital platform for external moderation. Only English peer reviewed journal articles and articles published at conference proceedings from 2012 to 2020 were included. Given the dynamic nature of technology, there is a time lapse between the implementation of a system and when the system is, in fact, reported in academic literature. Restricting the search to a certain period of time is thus a limitation of this study as a system which has not yet been reported on, but could, in fact, exist. Literature focusing on studies in domains other than education were excluded. Within this group of papers, only papers that described implemented eModeration systems were included since this study focused on practical, evidence-based findings regarding the implementation of moderation systems. These exclusion criteria limited the number of papers retrieved. A further limitation arises from the search strategy focusing only on information system specific databases such as Scopus and Inspec. Specialized education databases such as ERIC were not specifically consulted. The search strategy followed is depicted in Fig. 1.

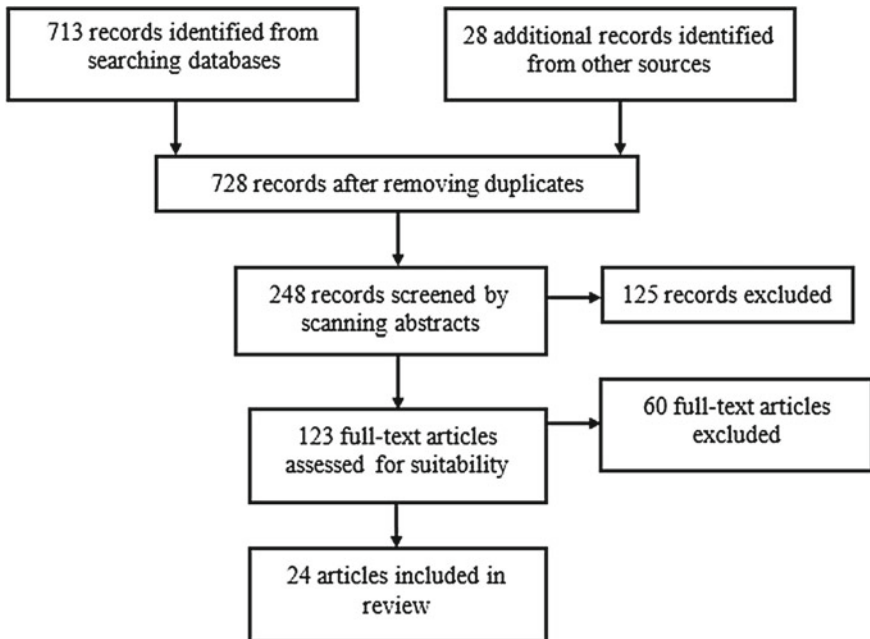


Fig. 1 Search strategy

3 Results and Findings

In this section, five systems/studies investigating eModeration will firstly be described individually. Secondly, the key focus of four of these five systems are summarized (cf. Table 1). The Digital Moderation Project [19] focused on teacher requirements prior to the creation of an actual eModeration system. Hence, the

Table 1 Key focus of existing moderation systems

System	Purpose	Context	Findings
Proof of concept trial (SPARK) [10]	Improving peer review processes of assessments in HEIs using technology to address quality assurance	HEI	An online tool should be context-sensitive; streamlined, efficient, cost-effective, sustainable and fit for purpose
Digital moderation project [19]	To determine teacher requirements for submitting assessments via an online digital platform	Secondary schools	Inconclusive, no existing eModeration system could be found
User experience evaluation framework [21]	A framework for evaluating the user experience of an eModeration system	HEI	An eModeration system should enable moderators to upload marked scripts, download scripts, track the moderation process, provide security and notifications when moderation is complete
Adaptive Comparative Judgement System (ACJS) [20]	ICT system for social online moderation using comparative judgement of digital portfolios. Pairs of digital portfolios are dynamically generated for each assessor to judge. Area provided for assessors to record individual notes about each portfolio	HEI	It is feasible to use ICTs to support comparative judgements. An important finding is that the reliability of the final scores was not high
Computer assisted evaluation system [11]	Machine learning techniques for solving problems of variances in evaluation	HEI	Machine learning can accurately predict scores of a second evaluator based on scores allocated by the first evaluator

Digital Moderation Project was not included in the discussion. Based on the literature reviewed, preliminary findings are presented in Table 1.

Newhouse and Tarricone [20] describe a system for pairwise comparison used in social online moderation to assist teachers with understanding of standards. A custom-made tool is used to store digital samples of assessments. The focus is on supporting social online moderation by generating groups of portfolios for each assessor to judge (cf. Table 1). The system calculates individual assessor scores to establish their reliability. System use is preceded and followed by standardization discussions using an online platform. Moderation takes the form of online scoring so that consensus is reached in awarding a grade rather than using the system to moderate assessments.

The New Zealand Qualification's Authority [19] conducted a survey to determine teacher requirements for an online platform for the submission of assessments. However, there is no further indication of the development of such a system (cf. Table 1).

Van Staden [21] describes an eModerate system used and tested at two private Higher Education Institutions in SA. Assessors upload marked assessments and a moderator downloads these assessments for moderation. Stakeholders receive notification when moderation is completed. This study focused on a framework for evaluating the user experience of the eModerate system (cf. Table 1).

Kamat and Dessai [11] present a system implementing machine language to establish the quality of the assessment and to validate consistency in evaluation. The system predicts a mark for each examiner to control variations in appraisals. Artificial Neural Network (ANN) modelling is then used on evaluations carried out by different examiners to predict the marks that would be obtained as though one examiner had performed all evaluations in the course (cf. Table 1).

Durcheva et al. [14] describe the TeSLA system integrated into the Moodle platform and implemented in specialized courses. The emphasis in the TeSLA system is on the task design specifically focusing on ensuring academic integrity and eliminating opportunities for cheating by using photos, videos or audio recordings of registered students.

The literature reviewed indicates that there are a limited number of studies applicable to the eModeration context. The findings indicate a focus on proof of concept systems and teacher requirements for using a digital platform to conduct moderation. Based on these findings, an online tool should be context-sensitive, streamlined, efficient, cost-effective, sustainable and fit for purpose.

Only one of the five studies considered, i.e. the User Experience Evaluation Framework [21] provides comprehensive functionality which enables a moderator to access assessed scripts, annotate these scripts and upload them together with a report for the initial assessor to retrieve. The proof of concept (SPARK) system [10] only outlines the requirements for an eModeration system while Booth and Rennie [10] report only on the first phase of a seven-phase project.

Van Staden [21] mentions a web-based eModerate System specifically designed for use at a HEI, but the actual moderation process is not necessarily an inherent function afforded by the eModerate System. Moderators are able to complete the

moderation either using tools provided by a word processor or the sticky note functionality provided by Adobe products. Noteworthy amongst the findings is that the institution hosting the eModerate System should have adequate Internet connectivity and infrastructure, which is also a necessary prerequisite for 4IR. Additionally, technology limitations can hamper the digital moderation process [21].

The other systems namely (ACJS) and the Computer Assisted Evaluation System (cf. Table 1) focus on comparing the judgements provided by two evaluators either by generating a pair of portfolios or by using machine language to predict the accuracy of the judgements. However, the reliability of the final scores is dependent on teacher experience.

4 Conclusion

This paper outlines a literature review investigating current trends on the use of technology in implementing moderation processes. The findings highlighted the importance of improving peer review processes using technology and machine learning techniques to determine variances in assessments. Notably, only two of the five studies focused on the implementation of technology in completing moderation processes. The five studies examined make use of qualitative and quantitative analyses of technological solutions, where the focus seems to be on quality assurance and the context predominantly that of HEIs. The lack of literature on the implementation of eModeration systems is the most pertinent finding of this paper, pointing to a knowledge gap on eModeration systems. It is, therefore, necessary for more research to be conducted on digital solutions for conducting moderation processes and, especially so in other educational contexts like the secondary school environment. Another important new direction is the improvement of peer review processes by using machine learning techniques to determine variances in assessments.

References

1. Motala S, Menon K (2020) In search of the “new normal”: reflections on teaching and learning during Covid-19 in a South African university. *Southern African Rev Educ* 26(1):80–99
2. Hussin AA (2018) ‘Education 4.0 made simple: ideas for teaching’, *Int J Educ Lit Stud* 6(3) 92. available at: <https://journals.aiac.org.au/index.php/IJELS/article/view/4616>
3. Farhan MK, Talib HA, Mohammed MS (2019) Key factors for defining the conceptual framework for quality assurance in e-learning. *J Inf Technol Manag* 11(3):16–28. <https://doi.org/10.22059/jitm.2019.74292>
4. Handa M (2018) Challenges of moderation practices in private training establishments in New Zealand. Masters Dissertation, Unitec Institute of Technology
5. Vergés Bausili A (2018) From piloting e-submission to electronic management of assessment (EMA): mapping grading journeys. *Br J Edu Technol* 49(3):463–478. <https://doi.org/10.1111/bjet.12547>

6. Volante L (2020) 'What will happen to school grades during the coronavirus pandemic?' the conversation Africa, april. https://theconversation.com/what-will-happen-to-school-grades-during-the-coronavirus-pandemic-135632?utm_medium=email&utm_campaign=Latest from the conversation for april 8 2020&utm_content=Latest from the conversation for april 8 2020+CID_1cd271e3ef246a59
7. Colbert P, Wyatt-Smith C, Klenowski V (2012) A systems-level approach to building sustainable assessment cultures: Moderation, quality task design and dependability of judgement. *Policy Futur Educ* 10(4):386–401. <https://doi.org/10.2304/pfie.2012.10.4.386>
8. Connolly S, Klenowski V, Wyatt-Smith CM (2012) Moderation and consistency of teacher judgement: teacher's views. *Br Edu Res J* 38(4):593–614. <https://doi.org/10.1080/01411926.2011.569006>
9. Wyatt-Smith C, et al (2017) 'Standards of practice to standards of evidence: developing assessment capable teachers', *Assessment in Education: Principles Policy and Practice*. Routledge, 24(2), 250–270. <https://doi.org/10.1080/0969594X.2016.1228603>
10. Booth S, Rennie M (2015) 'A technology solution for the he sector on benchmarking for quality improvement purpose's, In: *Proceedings of the 2015 AAIR annual forum*. Australasian association for institutional research Inc 22–32. <https://doi.org/10.1145/3132847.3132886>
11. Kamat VV, Dessai KG (2018) 'e-moderation of answer-scripts evaluation for controlling intra/inter examiner heterogeneity'. In: *IEEE 9th international conference on technology for education*. T4E IEEE 130–133. <https://doi.org/10.1109/T4E.2018.00035>
12. Krause K et al (2013) Assuring final year subject and program achievement standards through inter-university peer review and moderation. <http://www.uws.edu.au/latstandards>
13. Van Staden C, Kroeze J, Van Biljon J (2019) Digital transformation for a sustainable society in the 21st century, *IFIP international federatin for information processing 2019*. Ed by IO pappas et al Cham: Springer International Publishing (Lecture Notes in Computer Science). <https://doi.org/10.1007/978-3-030-29374-1>
14. Durcheva M, Pandiev I, Halova E, Kojuharova N, Rozeva, A (2019) Innovations in teaching and assessment of engineering courses, Supported by authentication and authorship analysis system. In: *AIP conference proceedings*, 1–9. <https://doi.org/10.1063/1.5133514>
15. Chia SP (2016) An investigation into student and teacher perceptions of, and attitudes towards, the use of information communication technologies to support digital forms of summative performance assessment in the applied information technology and engineering studies c. Doctor of Philosophy, School of Education, Edith Cowan University. https://doi.org/10.1057/978-1-349-95943-3_324
16. Moccozet L, Benkacem O, Tardy C, Berisha, E, Trindade RT, Burgi PY (2018) 'A versatile and flexible framework for e-assessment in Higher-Education'. in 2018 17th International conference on information technology based higher education and training, *ITHET 2018*, 1–6. <https://doi.org/10.1109/ITHET.2018.8424764>
17. Kitchenham B, Pearl Brereton O, Budgen D, Turner M, Bailey J, Linkman S (2009) Systematic literature reviews in software engineering—a systematic literature review. *Inf Softw Technol Elsevier BV*, 51(1):7–15. <https://doi.org/10.1016/j.infsof.2008.09.009>
18. Boell K, Cecez-Kecmanovic D (2015) On being 'systematic' in literature reviews in IS. *J Inf Technol* 30(2):161–173
19. New-Zealand–Qualifications Authority (2016) *Digital Moderation Discussion Paper* Wellington
20. Newhouse CP, Tarricone P (2016) Online moderation of external assessment using pairwise judgements. In: *Australian council for computers in education 2016 conference refereed proceedings*. Brisbane, 132–129
21. Van Staden C (2017) User experience evaluation of electronic moderation systems: a case study at a private higher education institution in South Africa. doctoral dissertation, school of computing, University of South Africa