ABSTRACT

The primary drivers of online education in developing countries like Uganda have been identified as phenomenal growth in Internet and smartphone penetration, low online education costs, digitally friendly government policies, and rising demand for continuing education among working professionals and job seekers. High internet costs, lack of power in some areas, a lack of computer skills, and lack of tools and technologies to authenticate integrity in e-assessment are some of the existing challenges that have hampered e-learning in academic institutions in developing countries, particularly Uganda. E-assessments, are classified into three types: (i) *Formative assessment* (ii) *Summative assessment* (iii) *Diagnostic assessment*. Secure e-assessment is still a challenge, especially ensuring that the registered learners attempt the examination themselves without any form of academic dishonesty such as impersonation. Impersonation during e-assessment is still a major issue that leads to unfair assessment. Hence, students' grades are compromised, which eventually affects the quality of labour delivered to the market once grades are not matched with the right students as a result of impersonation. This research aimed to design an E-assessment Multifactor Authentication Framework (E-MuAF) to mitigate impersonation attacks on e-learning platforms.

Design science research method was used to guide the design and evaluation of E-MuAF and the study adopted a mixed-research approach (Key informant interviews and a literature study) were used for objective 1. For objective 2 UML (Unified Modeling Language), case studies, and business process modeling were used for designing the E-assessment Multifactor Authentication Framework. E-MuAF was evaluated using a structured walkthrough with experts and was instantiated with a prototype (EA-System) to determine its usefulness, usability and completeness.

The E-assessment Multifactor Authentication Framework was designed to address the shortcomings of single-factor authentication that included; failure to verify the true identity of the user; users selecting weak passwords that can easily be guessed at. This research's proposed solution of E-assessment Multifactor Authentication Framework was carried out and tested on Uganda student community at University level. Therefore, further research to validate the newly developed Framework on a wider student Community outside Uganda should be carried out to test and confirm if similar results can be obtained to involve more Schools, Colleges and Universities.

Keywords: E-assessment, Multifactor, Integrity, Authentication