Confirming the Identity of the Individual Using Remote Assessment in E-learning

Olaf Hallan Graven, and Lachlan MacKinnon

Abstract—One major issue that is regularly cited as a block to the widespread use of online assessments in eLearning, is that of the authentication of the student and the level of confidence that an assessor can have that the assessment was actually completed by that student. Currently, this issue is either ignored, in which case confidence in the assessment and any ensuing qualification is damaged, or else assessments are conducted at central, controlled locations at specified times, losing the benefits of the distributed nature of the learning programme. Particularly as we move towards constructivist models of learning, with intentions towards achieving heutagogic learning environments, the benefits of a properly managed online assessment system are clear. Here we discuss some of the approaches that could be adopted to address these issues, looking at the use of existing security and biometric techniques, combined with some novel behavioural elements. These approaches offer the opportunity to validate the student on accessing an assessment, on submission, and also during the actual production of the assessment. These techniques are currently under development in the DECADE project, and future work will evaluate and report their use..

Keywords—E-learning, remote identification, assessment.

I. INTRODUCTION

THE topic of this paper is remote assessment in e-learning, and the challenge of how to deal with the individual in such an situation, confirming the identity of the individual completing an assessment, control of the environment, books, friends and so on.

The current solution to the challenge of confirming the individual is either to:

- Ignore the challenge of identifying the individual and accept that whoever is login in to an account is the correct individual.

- Complete the assessment in a centralised location, i.e. the assessment cannot be completed at a distance. A variation of this is to set up multiple locations to cut down on travel cost and time.

- Webcams can be utilised in setting where oral exams are used.

Our proposed solution is to capture information about people while performing tasks and construct a form of digital signature in the form of a behaviour pattern that can then be used for user identification in eLearning assessment. The rest of the paper considers the form and nature of online assessments, establishing a clear relationship to constructivist pedagogy, then highlights the benefits of such assessments in the future development of eLearning, before discussing mechanisms and approaches to capturing behavioural metrics that can be combined to describe a behavioural profile, or digital signature, that could be used to authenticate students and their assessment submissions

II. ASSESSMENT

The traditional focus on assessment has been on the final exam. Students will naturally try to guess the exam questions and will make this the focus for the learning rather than the learning objectives. If the assessment is poorly focused the students will underestimate requirements and try to get by with low-level learning strategies. The most important factor in creating a good assessment system is that the assessment must be designed into the learning process, this is well documented [1,2]. Additionally it is important that the assessment must be used to test that the desired learning has taken place, and not check that the student has learned only the desired facts.

A. Assessment in Constructivist Pedagody

The theoretical argument for constructivism is that deep knowledge and long-lasting knowledge is more likely to arise from constructivist learning environments [3] and the use of multiple cognitive channels. The body of evidence for this is convincing, but only where sufficient periods of time is allowed to permit learning and reflection, and appropriate assessment is carried out timeously to embed and reinforce learning.

Expectations and outcomes are different in a constructivist learning environment than those found in the traditional classroom. Therefore, testing procedures must be redesigned to compensate for the expanded knowledge base that the students are developing. If not sufficient time is allowed to pass and we to quickly try to assess the knowledge the students have acquired, the results will be unsatisfactory and students dissatisfied with the results. Findings by McKenna and Leycook[4] show that for short learning periods with tests performed immediately after the learning period, instructivist models will provide better results and make for more satisfied students.

"Students using the instructivist resource improved most in relation to this previous class average mark. In terms of attitude, students also preferred to use the instructivist environment, or the mixture of instructivist and constructivist,

O. H. Graven is with Buskerud University College, Kongsberg Norway (phone: +47 32 86 95 00; e-mail: Olaf.Hallan.Graven@hibu.no).

L. M. Mackinnon is with Buskerud University College, Kongsberg NORWAY (phone: +47 32 86 95 00; e-mail: Lachlan.MacKinnon@hibu.no).

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rather than relying solely on the constructivist." [4]

They go on to note that:

"the instructivist artefact offered clear structure and instructions as well as familiarity, the constructivist environment almost certainly required the user to make more effort" [4]

However, they also note:

"those using the constructivist artefact coped with the more complex material (such as signal to noise ratio) slightly better." [4].

B. Narrative Based Assessment

Educators generally have been consistent in arguing that higher education should be about encouraging students to take a deep approach to their studies, i.e. they should learn the material and not just memorise it so they can retell in exams. One of the major challenges of this is that even if the teaching of the students does take a deep approach it does not necessarily lead to the desired learning outcomes. Assessment, as so clearly shown by [1, 5], drives the learning process and over-rides practically every other aspect of curriculum design, students will be guided by the assessment and not by what they are told. The general understanding is in order to get the best learning and most proper assessment, the assessment should be designed into the system and be an integral part of the learning process. The importance of having the assessment as an integral part and not something added just at the end is well documented.[1, 2]

Assessment has two goals, covered by formative and summative assessment. Formative assessment is designed to aid the learning process, it is a mechanism to encourage student reflection by the means of synthesis of their existing understanding and then reflection on the feedback they receive on that understanding. The summative assessment evaluates the student's knowledge in the area. It is important that summative assessment is included as part of the course, not solely at the end. From definition by The American Association for Higher Education, November 1995 "Assessment is an on-going process aimed at understanding and improving student learning." It is important to remember that learning material must contain both formative and summative assessment.

Traditional assessment is based on students producing essays on demand. Producing a well written text will for most people require several revisions and consequently the time to make them. In addition the added stress of an exam situation has an adverse effect on the student's ability to produce a well written text. The outcome of this is that the student will fall back on knowledge-telling strategies and will not demonstrate the full extent of their knowledge. Cho[6] in his paper "Assessing writing: Are we bound by only one method?" asks the question

"How realistic and fair is it, then, to expect somebody to draft a well-organized essay in less than an hour on a topic that the writer may or may not have thought about before?" [6].

According to Scardamalia and Bereiter[7], the most influential model of the cognitive processes in writing is the one proposed by Hayes and Flower in 1980. This model describes three cognitive processes: planning, translating, and reviewing. Their main contribution to this model was showing that these cognitive processes are not necessarily strictly sequential rather, these processes may interact recursively with one another. In addition to this Scardamalia and Bereiter divides the method selected by individual writers into two major categories: knowledge telling and knowledge transformation. The knowledge telling process is when the memory is searched for content relevant to the topic and whatever comes to mind is written down. Knowledge transforming process is a more complex process in which goals are incorporated into the planning process and only content relevant to both the topic and the goals is written down, this process does also include multiple revisions of the produced text. A more detailed description can be found in "Assessment of Planning, Translating, and Revising in Junior High Writers"[8]

Research by Powers and Fowler [9] has shown that even small increases of time at written tests can give significant improvements in test score. The same results have been reported by others, in addition to the results time constraint will also influence the writing style. The students need to be given ample time to prepare and their writing. This is important as the aim is not that the students resorts to knowledge-telling strategies as described by Bereiter and Scardamalias[7] model, the aim is for the students anchored in the constructivist model, transforming the knowledge and making it their own. The strategy of knowledge-telling is a low level strategy that is triggered by imminent deadlines and other stressful factors. The distinction between knowledge telling strategies and knowledge transformation strategies are similar to the distinction in learning between deep and shallow learning, described by Marton and Saljo [3].

III. CONFIRMATION OF INDIVIDUALS

A. Benefits of eLearning and Online Assessment

The move from instructivist to constructivist learning has been enhanced by the growth of eLearning and the widespread use of Virtual Learning Environments (VLEs), but this also increases the risk of personation, and other forms of cheating, in online assessments. It is therefore important to find mechanisms that can give confidence in verifying the identity of those undertaking online assessments, especially where those assessments contribute to academic or professional qualifications. As indicated earlier, current solutions predicate against the use of online assessment, either by ignoring the issue of validation of identity, making such assessments inappropriate for qualifications, or by insisting on centralised assessment locations. This, however, means that we lose several benefits that online assessments can offer students:

As indicated earlier, constructivist assessment is associated with giving the student the opportunity to demonstrate knowledge transformation capability in their subject.

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Accordingly, allowing greater flexibility in the timing of the assessment, easily managed in an online process, can have very beneficial effects [7].

The authors have been engaged for a number of years in researching the use of computer games in eLearning and online assessment. The benefits of this approach are reflected in a willingness by students to make multiple attempts to complete an assessment task, supporting both formative learning, and a summative evaluation of actual knowledge [10, 11].

The use of question-bank technology allows the creation of individualised assessments, even within large cohorts, which removes the concerns over the security of the assessment instrument [12], supporting anytime, anywhere assessment.

These technologies also allow the potential to offer Assessment when Ready, within relevant academic constraints, a construct fundamental to the principle of constructivist learning, supporting a move towards heutagogic learning environments [13].

B. Determining the Identity of the Individual

In order to confirm that an individual student has completed an online assessment in accordance with the rules set out for that assessment, we can envisage a number of steps:

- The student goes through some form of online registration process for the assessment, including a statement confirming their identity and their intention to complete the assessment according to those rules
- The student's identity is verified, potentially using password, webcam image or other ID element
- The assessment is made available to the student, and any environmental and/or time constraints are initiated
- The student undertakes the assessment, utilising as much of the time allowed as they wish, and then indicates they are ready to submit
- The student submits the assessment, again using their verified identity to validate the submission
- The student receives feedback on their assessment, within a specified time, and are then given the option to repeat or revise the assessment (dependent on type) or their grade is finalised.

There are clearly a number of points in this process that could be open to fraudulent activity, although the use of webcams and modern biometric technology could overcome a number of these. However, the weakest point in the process is when the student is actually completing the assessment, as even if we have successfully validated their identity, and have a webcam running showing them at the keyboard, it would still be possible for them to have someone else undertaking the assessment on their behalf, through a slave keyboard or uploading answers direct to the system. Current online assessment systems provide no answer to this issue, even if they do have online verification of student identity. Therefore, it is not enough to have effective biometric tools to verify the identity of the individual student, we also require to confirm that they have actually carried out the work on the assessment themselves, and that there is evidence that the work was completed during the time allocated for the assessment. To achieve this we need to capture information about their online behaviour during the assessment, and compare it with an existing user profile.

C. Capturing Information on Behaviour

Existing administration tools in digital environments allow us to capture a range of information about the way in which users interact with the tools provided for their use. In addition, a range of security tools have been developed that provide more detailed pictures of user behaviour in the tasks they undertake. For example, key loggers will not only provide information on the sequence of keys used in a session, but also the cadence of key striking, time between strikes, delays and pauses in typing, and a variety of other measures that can be used to characterise an individual user [14]. MacKinnon and Bacon, in considering the capture of domain expertise, highlighted the potential to build an individual digital signature of a user from their behaviour in digital environments [15], as a means of verifying not only their identity but also their activities within that environment. Whilst individual differences between users on single activities may be slight, the combinatorial effect of using a number of behavioural parameters, in combination with existing biometric and standard security authentication techniques, provides a significantly high level of confidence in the unique identification of a user, both at login and during the process of their completion of the assessment. Indeed, in much the same way that handwriting can uniquely identify an individual, especially when written hastily or under stress, so the way in which a user types, interacts within a digital environment, and sequences their actions, can provide a similar level of identification. Clearly, such behaviours can be mimicked, and a very determined attempt to produce a good facsimile of an individual user could be successful for a short period. However, in the process of an online assessment, under stress to concentrate on the responses required, and with some limit of time, it is extremely unlikely that a facsimile could be maintained, and the relative cost and effort of doing so would be prohibitive relative to the gain achieved.

So, we can argue that it is both possible and desirable to develop and provide effective authentication of students accessing, completing and submitting online assessments. However, whilst we might be confident, given our approach, that the student is the person completing the assessment, we also have to give consideration to issues of external support, coaching and the use of texts. At one level, the simplest answer with regard to the unauthorised use of notes or textbooks is to make assessments open book, and ask questions that require the student to engage in knowledge transformation, rather than simple repetition or knowledge-telling. However, we have already mentioned the potential for the use of webcams in supporting authentication activities, and it would clearly be possible to enable a webcam and microphone on the computer being used by the student, to record the assessment activity. This would eliminate the potential for a student to engage in conversation, or Q & A, with a coach or supporter out of sight of the webcam. It would also require that whenever the student wished to consult a

text, or converse with a coach, they would need to move away from the computer and out of range of the webcam and microphone. So, once again, we find a behavioural parameter that can be utilised to ensure the authenticity of student performance in online assessment, with students being advised that they are expected to remain at their computer for the duration of the assessment (with some small allowance for natural functions). The captured video and audio could be automatically analysed for the presence of the student, and for evidence of conversation, and suspicious activities highlighted to the assessor.

It should be stressed that none of the methods described here are failsafe, and individually each could be defeated, but in combination they become much more formidable, and the challenge to defeat them is far greater than any gain that could be achieved. In considering the approach to any secure system, the trade off between level of security and the risk appetite of the organisation becomes the predominant driver. In the case of online assessments, it is not possible to develop a fully secure, failsafe system, but the extent to which organisations improve their existing systems, or develop online assessment capabilities, will reflect the risk they feel it represents to the quality of their outcomes, and ultimately their qualifications.

IV. CONCLUSION

There is a considerable body of evidence now available to support the contention that constructivist models of learning are more beneficial for students in higher education, particularly in supporting the development of individual and creative knowledge use. As eLearning becomes more widespread, it is clearly important to support constructivist models within the learning environments and tools used to provide learning and assessment materials for online students. Unfortunately, the lack of effective authentication measures has resulted in online assessments being mistrusted or not used. In this paper, we have highlighted a number of existing security and biometric measures that can be used to validate and authenticate students, combined with some novel behavioural elements that an be used to model student behaviour, in the form of a digital signature. This work is currently under development in the DECADE (Domain Expertise Capture in Authoring and Development Environments) project. One output of that project will be a student authentication system for online assessments that will validate the student's identity on accessing and submitting the assessment, and also validate the work carried out on the assessment based on the student's digital signature. Future work will involve a structured evaluation of the use of the system with students, which will be reported in due course..

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