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# Does the Shift to Cloud Delivery of Courses Compromise Quality Control

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# Does the shift to cloud delivery of courses compromise quality control

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## Abstract

*In the last few years' online cloud computing courses have become more common place providing the student the capability to attend courses from home, from anywhere in the world. As this new paradigm is being adopted by colleges and universities, the next associated potential wave of change is a cloud technology termed "online proctoring." This technology and method facilitates the online student taking tests and exams from a remote, off campus location. This technology could also potentially mean education institutions scale to larger student numbers than previously defined by the physical constraints of exam halls or lab facilities as well as reducing the remote students time and cost of travel to an exam invigilation centre. However the question is: How does online proctoring quality control standards measure up to the traditional exam room invigilation quality controls and if such a solution were implemented would there be compromises? On campus exam invigilation methods have evolved over a considerable period of time and the processes and quality control standards are well defined. This research firstly explores the types of online proctoring systems in existence. Secondly it investigates how these systems, offered by multiple cloud vendors, compare and what back end technologies they utilize. Lastly it investigates the potential gaps in the online proctoring quality control systems and how the verification and controls measure up to the traditional on campus exam hall invigilation methods.*

***Keywords:*** Online proctoring, Cloud delivery, quality control

***Abbreviations and acronyms:***
Online Proctoring (OP): Third party monitoring of an exam by a proctoring system, where the student and proctor or proctoring system are not in the same room but connected over the internet. All forms of communications and monitoring are via applications and devices that use internet protocols. Also sometimes referred to as cloud or remote proctoring.
Learning management system (LMS). Blackboard ® is an example of a LMS system.
Traditional methods: Traditional on campus exam invigilation methods.
Exams taken by the honour system: Running an exam based on trust and honesty, assuming that the student will not cheat.

## Does the shift to cloud delivery of courses compromise quality control?

Across the world universities and colleges online education strategies vary. Research by Allen, I and Seaman, J. (2013) indicated that 32 percent of higher education students in the United States now take at least one course online. Even though Hartman, K. (2015) predicts that online degree programs will grow modestly at 2% in 2015, those institutions that choose to offer an online course have further challenges around the assessment and exam strategy.

Schulson (2014) says Doug Winneg CEO of SoftwareSecure suggests that, not having a water tight online exam and testing strategy, has the potential to ruin your college reputation. This is very concerning when one considers that Eduventures, (2013) states that 95% of online exams offered are taken by the honour system. This research surveyed students who had taken an online exam using the honour system and 90% said they could have cheated if they wished. 85% of these students indicated there were huge gaps or just no invigilation when comparing this to the traditional on campus exams.

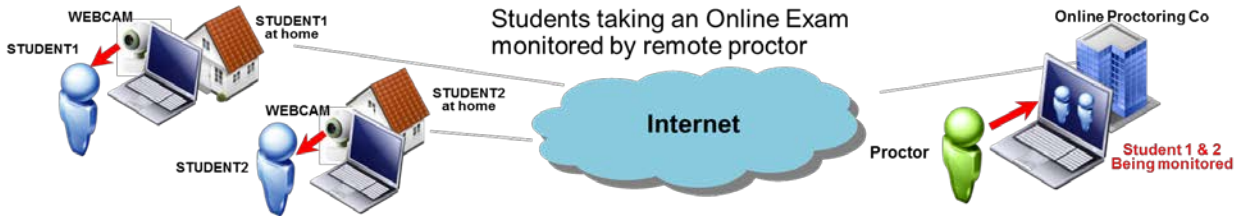
The challenges with online testing and the growing need to facilitate the off campus students to take the exams or tests in the environment they have studied and learned, is what is driving a number of new start-up companies offering what is called online proctoring.

Within this framework of online testing, Eduventures, (2013) say that there are two main drivers for online proctoring: student authentication and cheating. This research supports these statements. A lecturer of an online course may never have the opportunity to meet the students face to face and therefore they have no means of knowing that the remote student, authenticating with his or her student account, is indeed the person who registered for the course. Secondly, when using the honour based system, there have been times when the result of an online exam does not at all match the competency of the individual interviewed. The lecturer suspects the student cheated but has no means of proving this.

## Online Proctoring

Online proctoring (OP) is where a proctor system monitors a student or students over the internet through a computing device or devices such as a webcam and microphone. In Figure1 it shows a human proctor providing this service. However it should be noted that an automated system could also be used for proctoring.

**Figure1**




According to Foster & Layman, (2013), "It includes the processes for authenticating the examinee at a distance, verifying firstly, that this is the person that should take the exam. Adding to the definition, online proctoring includes any automated processes that aim to stop cheating in a test administration event." A few examples of online testing would be: an online multiple choice test; written tests (answered in electronic format in word or excel or in a LMS browser portal); virtual lab tests where students are expected to configure a physical or virtual lab environment, all done over an internet connection.

Research by Foster & Layman, (2013), indicates that "Online proctoring using human proctors in an effective way was first introduced and championed by Kryterion in 2006, and began large-scale operations in 2008." Several other organizations have followed Kryterion's lead." Rick Beaudry CEO of BVirtual Inc. has said in an interview, "Cloud proctoring is in its infancy and is evolving and changing very rapidly. Online proctoring, [in the case of BVirtual] is however growing rapidly from 100s of students per month in 2013 to 1000's in 2015."

## Current online proctoring models

This research has found that OP companies have adopted one of two approaches:

1) Human proctors aided by technology.
2) Fully automated OP using computing technology only.

Table 1 lists a number of vendors this research has investigated as of time of writing.

| OP Company | Website | Proctoring technique |
|---|---|---|
| Kryterion<br>ProctorU<br>Loyalist<br>Bvirtual Inc<br>SoftwareSecure | http://kryteriononline.com/<br>http://proctoru.com/<br>http://loyalistexamservices.com<br>http://bvirtualinc.com/<br>http://www.softwaresecure.com/ | Use of human for OP aided by computer technologies. |
| Proctorfree.com | http://proctorfree.com/ | Fully automated proctoring. No human intervention in the authentication and proctoring process. |
| ProctorCam | http://www.proctorcam.com/ | A toolkit for institutions that want to create their own integrated OP solution. |

Kryterion, ProctorU, BVirtual, Software Secure and Loyalist all have human proctors doing the initial validation and exam proctoring process. Proctorfree.com one of the newest companies who was part of the American start-up clash (start-up funding scheme) in September 2014 takes a different approach. (Rashidi, 2014) states “ProctorFree is an on-demand, automated online proctoring service that deters cheating in an online testing environment. Using biometric and machine learning technologies, ProctorFree has eliminated the need for a human proctor during testing.”

## Online proctoring using human proctors

This research has found that Kryterion, ProctorU, Bvirtual and SoftwareSecure all use a similar proctoring model. If the education institution utilizes an LMS like Blackboard ®, the choice can be made to have the proctoring service integrated with the LMS to aid validation.

This research investigated the LMS independent authentication model which is generic and allows for a wider variety of test types. The steps involved in this model are listed below.

1. The student connects to the website at the agreed time and connects to a link or portal that facilitates download and installation of the remote proctor application.
2. This notifies that the student is ready and allows the proctor connect to the student using video, voice and/or text chat over the internet connection. At a minimum the software will allow the proctor to view the student through the computers web camera and communicate with the student using text chat. If an issue with the student PC configuration

occurs then the proctor will assist in resolving webcam or PC microphone issues. At the very least the proctor has to have webcam and text chat functionality to perform the student identification. Having microphone functionality is key for the proctor to monitor changes in background noise.

3. The proctor goes through the authentication routine, asking the student to display a government issue ID (passport or driving licence) and verifies that the photograph and name matches the student registration. Once this validation is complete the student may start the test.
4. Generally the type of online test scenario the student takes after this step 3 does in most instances not change the proctor monitoring process. The proctor will monitor the students screen and actions via the web camera and listen for any changes in background noise via the microphone.

Table2 lists common features, techniques, technologies and processes that each company using human proctors use.

**Table2**

*The common features of companies that use human proctors*

| | |
|---|---|
| 1 | Human proctors who are trained technically to trouble shoot software and connectivity issues as well as situation management for suspected cheating scenarios. |
| 2 | An application installed by the student to allow the proctor to communicate via voice or text chat, monitor what the student has on the screen or screens and listen to changes in ambient sound levels. |
| 3 | Utilizing a webcam and microphone on the students PC to see the student, communicate with the student and monitor any activity in the room. |
| 4 | Student authentication and verification asking the student to display a government issue photo ID. |
| 5 | Either LMS integration for student authentication, or utilizing 2 above for LMS independent authentication processes. |
| 6 | Support for both Microsoft Windows and MAC operating systems on students PC's. |
| 7 | Use of webcam: Asking the student to scan the room with the webcam to identify any potential for cheating. |
| 8 | A web portal displaying technical requirements of students devices. |

| **Table3**<br><br>*The differences between vendors that use human proctors* | |
|---|---|
| 1 | Vendor diligence standards: For one vendor, every proctor asked the students to use a mirror to check behind the PC or laptop and scan the room using the webcam. They asked the student to remove any item in the room that looked suspicious. For another vendor, the proctors merely authenticated and then proceeded with the test. One student reported he had another laptop in the same room and could have used that. |
| 2 | Quality control diligence may vary between proctors in the same centre. |
| 3 | Proctor to student ratio. This can vary between OP vendors. 1 to 4 is the standard but it can increment to 1 to 8. It also depends on the type of agreement the education institution enters into. |
| 4 | For non LMS authentication the availability of a portal that the lecturer may use to track student test registration and completion progress. This feature was extremely useful to monitor student progress. |
| 5 | Type of software used for remote monitoring. Examples are JoinMe by LogMeIn. |
| 6 | Incidence tracking methods: Some vendors provide an incident report.<br>Example incident Summary: *During the testing session the proctor overheard the sounds of a phone in the testing area. The proctor had the test taker perform an additional camera pan of the work area and observed that the test taker had his phone, as well as papers and a calculator in the work area. The proctor reminded the test taker that those resources were prohibited and asked to have them removed from the testing area. The test taker changed locations and was able to proceed with his exam with no further issues observed.* |
| 7 | Some OP vendors keep the proctor's face visible in the remote application. They said this was was to act as a cheating deterrent. Others go into background mode when the authentication has completed and monitor the screen activity and student actions via the webcam without making themselves visible. |
| 8 | Some proctors, interrupt the student and check his actions if an anomoly is suspected. Others merely report the anomoly and the time it occurred. This is especially true if the session is being recorded, see 9. |
| 9 | Some proctoring companies record the whole exam session and provide that to the lecturer to view if required. |
| 10 | Costs of tests. These are reasonably competitive and depend on the number of students and proctoring agreement but average around $15 per student per hour as a starting point. |
| 11 | End device specifications. On the one hand some vendors rely solely on the students device provided this is within specifications stipulated. On the other hand SoftwareSecure's high end quality control hardware solution has hardware device which has to be purchased. This plugs into the student computer and has a built in web camera and microphone that the student has to plug into the test takers computer. The hardware provides a 360 degree view of the exam environment. It uses biometrics to authenticate and capture all voice and video data. |
| 12 | Type of proctoring agreement. Vendors provide different agreements to cater for different scenarios and the price point varies. |
| 13 | The number of screens allowed. Some OP vendors do not allow multiple screens. |
| 14 | Time limit. Some OP vendors were not willing to proctor exams over 2 hours. |

## Fully automated proctoring method

ProctorFree have taken a fully automated approach. After the student has installed the application that is downloaded from the portal, credentialing occurs. This involves the student taking a photograph using the software. The server side application compares the student against a reference image if this is setup in the student profile. It authenticates the student using facial

recognition software and maintains continuous identity verification throughout the exam. (ProctorFree, 2015). The app also stays open throughout the whole exam with the students image visible. It is a small popup that students can minimize and move if they wish.

ProctorFree records the entire session and provides this to the exam administrator afterwards to view through a portal. Throughout the exam ProctorFree also monitors for a variety of events, behaviour's, and patterns typically associated with cheating. These so called anomalies are logged and displayed when the exam is reviewed by the test administrator. Once the exam is complete, a detailed and optimized report of the proctor session is emailed to the test administrator for review. It includes levels and time of potential violation which are flagged allowing the test administrator to go directly to the anomaly and determine the severity.

Anomalies tracked:
Camera/Visual

- Additional persons in the room, Test taker moves out of screen, Irrational eye movements, books, lack of facial recognition, look lighting changes.

Behaviours

- Cutting/pasting, keystroke pattern changes, erratic movements, test response times.

Noise levels

- Printer, papers, talking/whispering/consistent detectable noises, camera noises.

Computer activities

- Web browser activities, internet connection lost, computer shuts down.

For larger classes or volumes of students, the administrator can log into ProctorFree's review dashboard to easily sort and view results. They highlight the specific minute and second where cheating-like behaviors occurred and allows the administrator to determine if the student cheated or not. This information can also be forwarded easily to other members of the administration with the proper privileges.

Proctorfree have no exam time limits set and charge a flat rate of $15 per student.

**Potential gaps in OP that affect quality control**

ID validation: All online proctoring solutions do the validation of government ID very well. But they cannot verify the authenticity of the government ID. Biometric checking and verification of the government ID is not common place and is not used besides in the high end solution that SoftwareSecure provide. (SoftwareSecure, 2015)

In both the traditional and online proctoring methods a student may present a fake ID. However with the traditional method the impostor is more likely to be exposed as the imposter is not known by the staff or fellow students.

Quality control in OP can be affected by the proctor to student ratio's. Proctor to student ratio's vary between 1:4 to 1: 8 and hence a variance exists in proctoring standards. The competitiveness of the market segment means that lower prices invariably mean higher student to proctor ratio's and the vendors indicate that lower proctor to student ratio's mean better quality control. This has a cost as vendors that provide a premium proctoring service, which stipulates the proctoring ratio of 1 to 4, has a higher price point.

The location of the web camera: This research found that students who have a laptop that has a camera embedded in the screen limits the view the proctor can take. Some proctors request a separate camera that allows a side view. However this research has found that students report there are ways to beat the camera. This also ties in with how the scanning of the room is done. Some online proctors do a very diligent job of scanning the room.

Remote control software: Many variants of remote control software that students can use means that a package may become available that is now known and detected. This is a constantly changing field and and OP companies have to continually adapt and update their monitoring routines. Use of virtual machines: Virtual machines that allow a student to present the proctor a monitoring interface different to what they are using. This means the student maybe using another device to browse, or communicate with another person.

Technical challenges to get the remote proctoring software working can delay the start of the exam and may mean that exam quality is compromised if the student has to sit the exam at another time. Dependencies on bandwidth and potential network outages is another factor that is out of the proctoring vendor's control and that can introduce inconsistencies.

## Conclusions and future study

OP is new and is still very much in development. OP has not been around as long as the traditional invigilation methods hence the explicit trust factor is not there yet. Students perceive it is easier to cheat in an online exam. According to a study done by King, Guyette & Piotrowski, (2009) 73.6% of the students in the sample held the perception that it is easier to cheat in an online versus traditional course. OP is a deterrent and is better than using the honour based system. The risk of being caught cheating, is a deterrent. The need to stringently define exactly the student's end device parameters to ensure proctoring software will operate as required is becoming the norm. If using only OP for testing of modules in a certification, diploma or degree, the potential exists that a student could obtain his certification entirely by cheating. The potential that the student devises a work around and this goes undetected for the duration of the course is a reality.

The risk and potential exposure of a student exploiting the system and this becomes public knowledge is far greater than in the traditional methods. Colleges are handing over their monitoring and management of examinations to external companies which may, in the long term, introduce a new series of risks to the exam process. Network and general security issues such as denial of service attacks may add to possibilities of exams being compromized. The authentication process is one that has gaps. Future technologies are bound to improve the quality control and validity of the student identification.

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# Experiments on curricular flexibility performed in different higher educational institutions in the network of technological education in Brazil

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## Abstract

*This article presents two similar experiments on curricular flexibility, each of them performed in different Higher Educational Institutions in the network of technological education in Brazil. Both experiments aimed to allow better training routes, specially directed to the idea of the entrepreneurial university, applicable to enrolled students. On the other hand, it intended to reach better management of the Institutes resources. We used in both experiments the same curricular format, where all the subjects that made up a particular course had a workload of 40 hours and lasted only a month. Each month, new students could be enrolled in courses offered by the Institutes instantaneously, allowing ten periods of enrolment of students over a year, instead of only one, two or three. Students who left the Institutes for extended periods could then complete missing subjects, instead of missing them as it would occur in the traditional model. After the conclusion of these experiments, the students completed a survey questionnaire, comparing the traditional curriculum model and the model proposed in this experiment. The survey focused on the following areas: adequacy of time to follow the activities, retain and process the acquired knowledge; facility to interrupt the course; lower losses in case of interruption; adequacy of weekly hours for required frequency and time volume for the courses. For all these variables, this more flexible model was better evaluated by the students, especially to the categories related to course interruption and sufficient time to follow the activities. The students' answers showed that a more flexible curriculum met the expectations of most of them and was favourable to consolidate the Institutes role as entrepreneurial universities.*

**Keywords**: Curricular flexibility; entrepreneurial university; instant classes

## Introduction

Innovation is presented as one of the great contemporary issues, including the development of science and technology, and also its interfaces with society. In this context, technical and technological educational institutes have become the locus *par excellence* for features such as universality and connectivity. These institutions also awaken new expectation in society and can be perceived as central agencies for the affirmation of new paradigms. Moreover, they also represent the place in which the greatest challenges (especially social ones) are located. One of them is the ability to overcome the traditional barriers that strongly impact the access of disadvantaged social groups, which necessarily implies rethinking the social function of the institutes confronted with the identity of these groups.