

GRANDON GILL

PROCTORFREE: DETERRING ONLINE CHEATING¹

Currently, no company uses biometric facial and voice recognition to address online identity verification in education. We want ProctorFree to become the premier resource for testing.

Mike Murphy, co-Founder of *ProctorFree*, was eager to get the message out. The company had just received a highly competitive grant from *NC Idea*, one of only 5 awarded out of 159 initial submissions and the only one from the Charlotte area. Now they needed to identify the most suitable business model for entering the marketplace. If they could get this right, the size of the potential market was staggering.

ProctorFree, a Charlotte-based startup had been founded to address the epidemic of academic dishonesty in higher education. Educators estimated that 75% of all students cheat at some point in their academic career. Furthermore, the problem was expected to become worse as colleges and universities moved in the direction of increased online education. He and co-founder Velvet Nelson had developed a product that could play a key role in addressing the situation: a browser-based approach to ensuring the integrity of the testing process. Designed to monitor a student during the course of online testing, the system captured video, screen, and audio streams during the test session. In that way, the test-taker's identity and activities could be verified, either in real time or during later inspection.

In mid-June 2013, the company had achieved an important milestone, receiving a \$40,000 grant from the *NC Idea*, a not-for-profit organization that was founded to help high-growth startup companies in North Carolina. With that funding, it could undertake some initial marketing efforts and put finishing touches on the product. There remained a number of questions that needed to be addressed quickly, however. The first involved the most appropriate customer. Possible candidates included educational institutions, the students themselves, or even publishers, who might conceivably bundle it with test materials. There was also the question of pricing strategy. Charges for proctored testing at independent 3rd party locations could be as high as \$300/session. While he and Nelson did not anticipate product pricing to be anywhere near that high, there remained questions regarding whether per test, per semester, per user, or per institution pricing would be most effective. And what should the amounts be?

Finally, there was the question of how the technology should evolve. They planned to have their initial base feature set completed by mid-July. Eventually, however, many other capabilities—including facial and voice recognition, as well as other biometric feeds could be incorporated. Were such enhancements needed and how would their overall effectiveness compare with standard face-to-face proctoring?

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Online Distance Learning in U.S. Higher Education

Online distance learning refers to instruction that is delivered using information and computer technologies (ICT). It nearly always involves freedom-of-place, meaning that students can access materials from a variety of sites and, sometimes, using a variety of devices. It may, or may not, also provide flexibility in the timing of instruction, allowing delivery in two modes:

1. *Asynchronous*: Students may access materials at any point during a specified block of time. In the most extreme case, a fully self-paced course, coursework may be completed at any point during the entire semester or quarter.
2. *Synchronous*: Students must access the course at a specified time, often through a web-based conferencing system such as *WebEx*, *Elluminate Live!* or *Blackboard Collaborate*.

Often, online instruction is included as a component of a course that also incorporates face-to-face sessions. Such designs are often referred to as blended or hybrid courses.

In the U.S., the principal driver of the need for online proctoring was the growth of online education in the U.S. Although data related to the penetration of distance learning varied widely, in a 2011 report the U.S. *National Center for Educational* statistics estimated that in the eight years between 1999 and 2007 (the most recent year for which statistics had been compiled):

- The percentage of students enrolled in a full-time distance learning program had doubled, from 2% to 4%.
- The percentage of students enrolled in at least one distance learning course had increased from 8% to 20%, out of a sample drawn from a population of over 24 million undergraduate and graduate students.

According to a study by the *Sloan Consortium*, by 2011 the latter number had increased to 32%--meaning that in the near future it was likely that more than half of all students in U.S. higher education would take at least one course online.

Online Examinations

A particularly challenging aspect of distance learning has always been testing. There are normally two key aspects to maintaining the integrity of the testing process:

1. *Identity Verification*: Ensuring that the identity of the individual taking the test actually matches the identity of the student who claims to be taking the test.
2. *Preventing Inappropriate Aids*: Depending on the rules of the test, these might include use of books or notes, access to websites during the test, or acquiring assistance from other students (or paid accomplices) during the test-taking process.

In face-to-face classes, the integrity of tests—particularly high-value exams—is normally ensured through proctored examinations. Individuals may be required to show photo ID cards to verify their identity, and a supervisor—known as a proctor—monitors activities of students throughout the entire course of the test.

One approach that has long been used to ensure the integrity of testing has been to require students to sit in on proctored exams, given at the university or a testing center. There are two issues raised by such a solution. First, it interferes with the freedom-of-place associated with the course, as well as interfering with freedom-of-time, if the course is asynchronous. While such a problem may not be insurmountable in a program that targets local students, it becomes increasingly unsatisfactory if a course targets a national or global population of students.

The other problem with on-site proctored examinations, particularly when administered by third parties, is the cost (and related concerns about the security of the facility). It was not uncommon for examinations administered at a test site to cost \$50 per person or more. This could represent a substantial fraction of the cost of the course, making it a significant burden for the student or the institution, depending upon who paid.

In fairness, it should be noted that studies have been conducted showing both that online courses have higher cheating rates and lower cheating rates than face-to-face courses. Hiring someone to take a test has always been a concern in large classes; one well-known scion of a well-known Massachusetts political family, and later at U.S. Senator, was once nearly thrown out of *Harvard College* for hiring a native Spanish speaker to take an introductory Spanish exam for him. Today's technology environment has increased the problem. Cell phones with answers in memory, IM/text messaging, search engines and a variety of other techniques for inconspicuous collaboration are now available to the typical student. Nevertheless, such cheating tends to be easier in the unsupervised online environment. That, in turn, feeds into the attitudes of educators towards distance learning.

Administrator and Faculty Attitudes

In any university community, decision-making is accomplished through a process of collaboration between faculty members—who actually teach courses and conduct research—and administrators—who manage the institution. The process is referred to as *shared governance* and is enshrined in most university policies, although not always followed in practice.

The issue of online distance education has always been a potential source of tension between faculty and administrators. From an administrator's standpoint, taking a course online offers many benefits. For example:

- It reduced the strain on brick-and-mortar capacity, since web-based courses were not physically constrained by space. This is particularly valuable for schools where enrollment was increasing or was highly volatile.
- It could potentially open up new markets, both extending the distance from which students could attend and, potentially, making programs more attractive to students with full-time jobs.
- It provided possible opportunities for the reuse of course material; particularly in subject areas that were not rapidly changing, a high quality set of course materials could remain relevant for years, or even decades. This aspect of online courses meant that for some courses, a high-priced faculty member might be paid to design a course that would then be turned over to much lower-priced adjunct faculty or teaching assistants to deliver.

As a consequence of these benefits, administrator attitudes have been moving in the direction of favoring distance learning. For example, according to the 2012 *Sloan Foundation* Report "Changing Course: Ten Years of Tracking Online Education in the United States":

- 69% of chief academic officers saw distance learning as critical to their long-term strategy, a number that had been steadily rising for a decade.
- 77% percent of academic leaders believed that distance learning provided comparable or superior learning outcomes compared with face-to-face courses, a number that had increased from 57% in 2003.

The news from administrators was not all positive, however. The report expressed continuing concerns about the need for more mature, self-directed students, the lower retention rates associated with online classes, and the lack of employer acceptance of online programs. Furthermore, administrators perceived

that faculty members had become slightly less convinced of the benefits of online learning over the previous 5 years, from 33.5% estimated to be acknowledging the benefits in 2007 to 30.2% in fall 2012.

Faculty enthusiasm for distance learning tends to be much more muted (except for those who actively enjoyed the challenge of pedagogical innovation). Among their concerns:

- The question of course reuse raised a number of intellectual property issues. Would the materials a faculty member prepared be used indefinitely without adequate remuneration? And would such reuse be limited to slowly changing domain. For example, a telecourse called *Economics USA* developed by *Annenberg/CPB* in the mid-1980s was later distributed on VHS tapes and DVDs and continued to be used in many high schools—with minimal updating—25 years later. Was macroeconomics truly a field that had not evolved during the period?
- They could be held accountable for the lower retention rates and course evaluations that often resulted from going online.
- Would they be given adequate training on how to design an effective online course? Older faculty members, in particular, had often never taken such a course. As a consequence, unlike face-to-face instruction they had no models upon which to draw.
- Would they be compensated additionally when such courses took substantially more time than their face-to-face counterparts? According to the survey, at public and non-profit universities even administrators were recognizing that delivering a distance course could be substantially more time consuming than a face-to-face course. Interestingly, administrators at for-profit universities were becoming *less* convinced that the time demands of online instructions were greater.

What both faculty and administrators could agree upon was that guaranteeing the integrity of online courses would be a critical contributor to their future success or failure. For administrators, a particularly crucial issue was acceptance of such courses by employers. Increasingly, schools were being evaluated based on the ability to place their graduates.

For faculty members, the issue was not only one of academic rigor. The inability to ensure effective testing could be used as a lever to halt or reduce the spread of online courses—should the faculty member be so disposed. And rigor could be used as a powerful argument as cheating in higher education grew ever more prevalent.

Cheating in U.S. Higher Education

Integral to the question of maintaining the integrity of online learning was the broader issue of cheating in higher education. While “hard” data on the subject was very difficult to come by, the broad consensus was that cheating in higher education was prevalent and largely accepted by peers. For example:

- In a 1990 study of 232 *Rutgers University* undergraduates reported by Michael Moffatt only 22% claimed never to have cheated in college and 33% reported having cheated in an average of 8 classes (to date).
- In a 2009 study of 273 alumni conducted by faculty from *Utah State University* and *George Mason University*, 82% admitted to having cheated at some point in their undergraduate careers.
- A 1999 U.S. News and World Report article by Carolyn Kleiner and Mary Lord reported the following:

Every day across America, millions of students from middle school to medical school face similar ethical quandaries—and research indicates that most choose to cheat. In a recent survey conducted by *Who's Who among American High School Students*, 80 percent

of high-achieving high schoolers admitted to having cheated at least once; half said they did not believe cheating was necessarily wrong--and 95 percent of the cheaters said they have never been caught. According to the Center for Academic Integrity at Duke University, three quarters of college students confess to cheating at least once. And a new U.S. News poll found 90 percent of college kids believe cheaters never pay the price.

There was also a general consensus that cheating and its acceptance were growing. In that same USNWR article, *Emporia State University's* professor Stephen Davis reported that over 50 years ago, only one in five students admitted to cheating while in similar surveys today, the range is more likely to be between three quarters to 98%. This was consistent with other studies; for example the 80% self-reported cheating rate among the *Who's Who* students represented a 10% increase from the value reported ten years before.

Online Cheating

While there was little dispute regarding the degree to which technology contributed to the ease of cheating, there was far less evidence that taking courses online increased the pervasiveness of cheating. For example, in a study of 635 undergraduate and graduate students at *Marshall University* in West Virginia conducted by professors George Watson and James Sottile, the number of students self-reporting cheating was nearly identical (32.1% face-to-face versus 32.7% online, well within the margin of error). The biggest difference, in fact, was with respect to students reporting having received answers to a quiz or test from someone who had already taken it; here the face-to-face rate (33.2%) was substantially higher than the online rate (20.3%). That difference may, in large part, have been due to the greater ease of administering an online test to the entire population at one time as opposed to section-by-section at different times.

The self-reported cheating on face-to-face versus online cheating appeared to be consistent with other approaches to detecting cheating that involved merging the results of a student survey with class-specific information. The benefit of this approach was its ability to remove the subjective and self-interested bias associated with self-reported data. Professors Therese Grijalva and Clifford Nowell from *Weber State University* collaborated with Professor Joe Kerkvliet from *Oregon State University* to conduct such a survey. Based upon a sample of 555 responses, they found online and face-to-face cheating rates to be indistinguishable.

Despite this evidence, faculty members remained skeptical that cheating in online classes was no more common than in face-to-face classes. Furthermore, it was the type of question to which there would likely never be a definitive answer. Since different pools of students often took online courses and face-to-face courses, and the two types of courses often had different designs and weightings applied to test results. Since all of these factors could influence cheating rates, nearly all face-to-face/online comparisons tended to have an apples to oranges aspect to them.

Strategies for Reducing Cheating

Faculty members had a variety of tools at their disposal for controlling the frequency and severity of cheating. In an article published in the *Online Journal of Distance Learning Administration*, Melissa Olt proposed the existence of four broad strategies:

1. *Modify elements of the course specifically to combat cheating.* Examples of this approach included the following: a) improved test security measures—e.g., log in, identification, browser lock-down, b) frequent changes to test content, c) including multiple individualized tasks in the class, d) making assessments open-book, e) controlling access times for tests to make it harder

- for students to help each other while taking a test, and f) use monitoring capabilities of course management systems (such as Blackboard) to verify activities of students.
2. *Expend substantially greater effort on online assessment design and creation.* For example, requiring students to submit successive drafts of their work, rather than emphasizing high-stakes testing, should make it harder to cheat by increasing the time required to cheat effectively. Similarly, the use of essay questions involving critical thinking—particularly those that require relating the answer to the student’s personal experiences—are less susceptible to rapid copying. In addition, tools are available for detecting duplicate answers within a student population. Common to nearly all the approaches available in this strategy were substantially greater instructor time demands. That factor would likely slow their adoption.
 3. *Require substantial original work.* By making students write creative works or complete complex projects, their ability to cheat was substantially reduced. Or, at least, such projects substantially raised the cost of cheating. Frequent changes to assignment parameters were appropriate for this approach, as was the use of plagiarism detection software since commercial paper-mills offered many pre-packaged “creative” works for sale.
 4. *Honor codes.* Evidence suggested that cheating could be reduced significantly if students were required to sign an honor code specifying that they would not cheat.

None of these approaches was fool-proof or offered a complete solution. Nevertheless, they suggested that instructors had some alternatives to simply ignoring the problem.

Secure Testing Solutions

Any attempt to combat cheating through security measures would necessarily focus on the vulnerability of testing procedures. In the online course environment, where students could not be expected to report to an exam room specified by the university, a variety of approaches had emerged. A summary of key offerings in the secure testing space compiled by the company is provided in Exhibit 1.

Remote Testing Centers

A number of commercial companies, such as *Pearson VUE* and *Prometric*, offered proctored testing at a variety of controlled locations. Such test centers offered a variety of tests (e.g., software certification, professional exams, college entrance tests) and had strict ID requirements and controlled testing environments. While generally viewed as being the most secure solution available, they were also expensive--\$50 to \$100 per test session being a typical range, and costs as high as \$300 sometimes incurred. As such, they were unlikely to be of much use for the type of routine testing often conducted in college classes.

Proctored Online Testing

Another approach to secure testing was the use of online (human) proctors. Test takers were observed (by webcam) by a remote proctor typically responsible for 6-8 students. In the event the proctor observed anything suspicious, the proctor notified the instructor and supplied the relevant video recording. An example of a company providing this service was ProctorU. Typical costs for the service range from \$15 (for a 1 hour test) upwards, depending on notice and scheduling.

Unproctored Secure Online Testing

Like proctored online testing, the unproctored testing approach monitored students during testing using a webcam or specialized device. Unlike the proctored approach, however, attempts to detect cheating were automated, using a variety of different approaches to ensure the student taking the test was the same student who signed up for it. These included gathering both biometric, system, and photographic data. Some examples follow.

SecureExam Remote Proctor: Uses a specialized device, combining a webcam and fingerprint reader, to acquire and store photo and user screen information for later retrieval while locking down the user's desktop—a commonly used technique that prevented the user from gathering data from outside sources, such as Google searches, during the test. The device itself cost approximately \$125 with additional per test fees.

Kryterion: Uses a webcam to perform facial recognition and simultaneously monitors keystroke patterns, as unique to each user as his or her fingerprints.

Respondus Monitor: A companion product to the *Respondus Lockdown Browser*, widely used for testing purposes on Blackboard. Gathers video and session statistics during tests, making them available for later review by the instructor. The system cost was based on site licensing, with a student-paid option of \$10/semester (paid by each student) also available.

Tegrity Remote Proctoring: A companion to the publisher McGraw Hill's *Tegrity* classroom capture products, the product supports browser lock down, webcam recording, and screen capture while a student takes a test.

Database-Driven Identity Checking

In addition to these services, another service, *Axiom*, could be used as a supplement to test proctoring services. This service used data on the individual accessed from a variety of commercial sources, such as credit records, to formulate questions whose answer would only be known by the individual. It could be used as an identity verifier prior to testing and could also be used as a pop-up verifier during testing.

ProctorFree/MyLearningID

ProctorFree, which had just changed its name from *MyLearningID*, had been founded by Mike Murphy and Velvet Nelson to fill a void in the low cost secure testing marketplace. Its “elevator pitch” was as follows:

MyLearningID deters cheating and academic fraud in online education through continuous identity verification using the student's computer. Currently, no company uses biometric facial and voice recognition to address online identity verification in education. MyLearningID provides a low cost, high fidelity, effective, and convenient proctoring solution that will transform online education, resulting in increased enrollments, integrity, and improved public perception of the online education industry.

Achieving the ambitious goals that it had established for itself would not be easy. The company had achieved a number of milestones in the course of its evolution, however, and felt that they had a solid product plan based upon their analysis of the market.

Evolution of the Company

The two principals of *ProctorFree*, Mike Murphy and Velvet Nelson, had first met three years earlier, while both worked for *Everblue*, an educational company that provided training in green solutions for building and community design and maintenance, leading to LEED certification. At that firm, Murphy had been *Director of Marketing*, while Nelson had been *Director of Sales & Accreditation*. Almost from their first meeting, the pair had toyed with the idea of forming their own venture and when *Everblue* was acquired, they decided to move forward.

Murphy and Nelson had backgrounds that complemented each other. Murphy had worked for a decade within the defense intelligence and operations community, both as a soldier and as a contractor. His skills included analysis, project management, and systems design and development. Nelson, in contrast, had worked for a similar length of time in higher education, particularly online education, in both community colleges and universities. Together, they felt they offered both the security and industry-specific expertise needed to launch a secure testing product.

To move the project forward, the pair submitted a grant proposal to the NC IDEA, an organization intended to stimulate local startups, described on its website as follows:

The mission of NC IDEA is to foster economic development in North Carolina by helping young startups commercialize their innovations. We help companies overcome small business obstacles that can make the difference between growing the business and going out of business. NC IDEA is committed to supporting North Carolina's economic development by helping young, innovative companies grow, create jobs and become major contributors to the state's business community.

The grant program is a catalyst for technological breakthroughs developed in North Carolina that have a significant potential to successfully transition into commercially viable high-growth enterprises. NC IDEA recognizes that many new technologies are not successfully transferred out of universities and research institutions because of a funding gap between government and private equity support. NC IDEA implements its Grants program to help fill this funding gap.

In early April 2013, the company was named a semi-finalist. In mid-June, a press release (Exhibit 2) announced to the world that the company was one of the five grant awardees. With the grant in place, the company decided to temporarily halt development in order to hire key personnel—most notably, a Chief Technology Officer (CTO)—who would play a major role in guiding future development.

Product Phases

The release of the *ProctorFree* product was to take place in two phases. In Phase 1, a product that would meet minimum customer requirements would be released. This product, nearly complete at the time of the case, would have the following features:

1. Ability to capture and store webcam video for later retrieval
2. Ability to capture and store screen video for later retrieval
3. (To be Determined) Ability to capture and recognize keystroke patterns, which tend to identify users as reliably as fingerprints.

While this collection of features would not differ markedly from those offered by other secure test platforms, such as *SecureExam Remote Proctor*, Murphy and Nelson expected to offer it at a significantly better price.

The feature set to be implemented in Phase 2 was expected to be vastly more comprehensive. Among the possibilities were included:

- Facial recognition
- Iris scanning
- Biometric (e.g., fingerprint) verification
- Voice recognition

The idea behind this phase was that the product would not only acquire data that could be later examined to determine the integrity of a particular test, it would also proactively attempt to determine if the student being tested was trying to defeat the system. A mock up showing how this might appear is presented in Exhibit 3.

The advantage of a system with phase 2 features would include both heightened security and the ability to tag suspicious test-takers, rather than requiring an instructor to look through all individual tests after a session. Furthermore, there were a variety of open source components that could be adapted to perform many of the tests contemplated, such as the *OpenCV* and *libface* facial recognition libraries. Thus, from a pure technology standpoint, constructing the more advanced phase 2 version of the product seemed like a very achievable goal.

These added capabilities would likely come with some drawbacks, however. These included greater demands on the user's system (and correspondingly higher possibility of crashes or incompatibilities) and a large number of false positives. There were also two broader questions that needed to be asked before investing substantial time and energy into new features:

- Did users, particularly faculty members, perceive that the new features would add significant value?
- What, if any, privacy issues would be raised as more and more biometric information was moved to *ProctorFree*'s cloud servers?

Market Analysis

Based on the company's estimates (see Exhibit 4), the potential market for the *ProctorFree* product was huge. According to IBIS Capital, global education expenses were in excess of \$4 trillion. The portion of that market devoted to post K-12 education in the U.S. was estimated to be \$432 billion. Assuming that roughly 10% of those expenditures were related to testing, the total market for *ProctorFree* and related services was as high as \$43 billion. Even 5% of the market would represent \$2 billion/year in revenue—a large company by any means.

A number of issues would complicate the path to achieving such lofty sales goals. One challenge was the degree of involvement of different stakeholders. For example:

1. *Faculty members*: Would benefit from the product to the extent that it a) reduced the time and effort involved in ensuring the integrity of the testing process, b) increased their flexibility in delivering tests, and c) caused students to perceive the system as being fair, since inequities perceived by students tended to be reflected in faculty teaching evaluations. On the other hand, they might object to the product if it required them to do more work, led to technical issues that they were ill-prepared to resolve, or—significantly—if it served to undermine their arguments against moving towards distance learning on the grounds of its lower perceived rigor. Ironically, the last of these sources of resistance would tend to grow with the perceived efficacy of the product.
2. *Students*: Given the high levels of self-reported cheating, it might be expected that students would object to the use of products such as *ProctorFree* that make it harder to cheat. There was little evidence of such reactions to existing products, however. To the contrary, what made students object most strenuously was environments where it was easy for some students to cheat, but not others. To the extent that a product was seen as leveling the playing field, acceptance by students would seem the most likely outcome. They might, however, be expected to object if they perceived that they were being asked to pay the cost of cheating deterrence (e.g., with a per-test fee levied upon them to cover the cost of the product).

3. *Administration*: University administrators were not directly involved in delivering education but, instead, were tasked with managing the institution and—to a great extent—setting its strategic direction. They also tended to have power over purchasing decisions and would, in consequence, play an important role in any sales process. Their motivations with respect to such a product would be ambiguous. On the one hand, to the extent that the product provides concrete assurance that the institution is ensuring the rigor of testing, it would be viewed positively. This would be particularly true for institutions seeking to increase their distance learning portfolio. On the other hand, to the extent that it added costs to course delivery, it would be treated skeptically. In addition, the use of biometric data (e.g., facial recognition, fingerprints, keyboard patterns) would likely raise privacy concerns, particularly when the information was transferred to a third party.

Another challenge was the expected length of the sales cycle. Large institutions, in particular, tended to take a long time—often measured in years—in making decisions related to instructional technology. Reasons for this included institutional inertia common to many large organizations. In universities, this was compounded by the principle of “shared governance”, whereby academic decisions needed the consensus of both faculty members and the administration—and consensus takes a long time. Finally, there was the matter of institutional power. Large universities had multi-billion dollar budgets and thousands of employees. Particularly when dealing with smaller vendors, they were quite willing to use that power in bargaining. By extending the sales process, they were frequently able to extract major concessions. Moreover, during protracted bargaining periods new competing products were often introduced into the marketplace—these could lead to further erosion of the vendor’s bargaining position.

From Murphy and Nelson’s standpoint, the nature of the marketplace underscored a critical question: who would be the principal beneficiary of the product and who would be paying for it? Getting the answer to this question right would be critical in terms of the future of the product.

Current Situation

By mid-July 2013, the company had made considerable strides towards achieving its phase 1 technology goals and was on the brink of hiring a new CTO. With the product on track, Murphy and Nelson needed to turn their attention to bringing it to market. Of particular concern was clarifying the role that faculty members would play in the marketing and sales of the product. Of particular interest:

- How strong was the motivation of faculty members to use the product in order to increase the integrity of their testing processes?
- How important was automated detection of potential cheating as opposed to simply archiving test data/video to make it available for later inspection?
- How did faculty members perceive the tradeoffs between having redundant tests for cheating (e.g., keyboard, video, screen information, other biometric feeds) and the potential complexity of the product?
- How important would it be to involve faculty members in trials of the product?
- How important would it be to have faculty members publish research on the product and present their experiences to conferences?

How to go about answering these questions was a matter of pressing interest.

The question of product pricing was also one that Murphy and Nelson were grappling with. The simplest model was a price-per-student/test instance. The pair had a number of around \$10 in mind, well below that charged by most other solutions in the secure testing space. Nevertheless, such pricing could become prohibitive in courses that employed extensive formative testing (e.g., 10 tests per semester would not be

unusual). In addition, if such costs were passed directly to the student, considerable resistance might be expected—was it fair that they were being asked to pay the price of preventing themselves from cheating?

Other pricing models might include a per-course cost (paid by the faculty member or the institution) or and institutional site license. In the latter arrangement, *ProctorFree* would need to decide if they would allow institutions to host their own database of test results. One advantage of such an arrangement is that it would place all privacy issues squarely in the hands of the institutions acquiring the hosting license. Unfortunately, it could also dramatically increase the challenge of providing technical support, since *ProctorFree* might not have control over the environments where hosting took place.

Also of interest, a faculty member commenting on their plan had recently pointed out that two potential customers—publishers and course management system suppliers—had not really been considered. For publishers, the tool could be a valuable supplement to textbooks that were increasingly losing sales to the used book market. Already, *McGraw Hill* had entered this space with its *Tegrity* line of products. An advantage of aligning with a textbook publisher would be easing the barriers to adoption, since textbook publishers already had a large sales network that allowed them to work directly with faculty members. On the other hand, such a relationship would dramatically reduce margins and would also likely entail some loss of control over the product.

Another possible strategic relationship would be with the companies that supply course management systems, the largest of which (by far) was Blackboard. Many third party products were already incorporated into these environments, such as the Respondus line of products (including Respondus Monitor). Murphy and Nelson also recognized that they would, in the long term, need to ensure seamless integration into these tools in order to maximize adoption by institutions. In addition, Blackboard had been very aggressive in acquiring companies that produced learning tools, which might provide a viable long term exit strategy for ProctorFree's founders and early investors. On the other hand, negotiating with large organizations such as Blackboard would be challenging and, in all likelihood, would require the company to relinquish a large percentage of the product's potential value.

None of these questions had easy answers; most probably did not even have right answers. But the choices that Murphy and Nelson made of the next few months would likely have a huge impact on the ultimate fate of the company.

Additional Readings

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Exhibit 1: Competing Approaches to Secure Testing

	MyLearningID	Pearson VUE	Prometric	ProctorU	Kryterion	SoftwareSecure	Acxiom	Self-Administered
Description	Online test proctoring and student analytics product.	On-site testing at one of their facilities.	On-site testing at one of their facilities.	Live, online test proctoring.	Pre-Scheduled Online Testing. Testing Session is Reviewed by Test Experts at a Later Time.	Pre-Scheduled Online Testing by Instructor. Testing Session is Reviewed by Test Experts at a Later Time.	Student Authentication with No Proctoring.	On-Campus College Testing Centers or Testing Sessions.
Authentication Process	Audio Video Screen Capture Facial Recognition Browser/Student Analytics	Face-to-Face Visual Vein Reader	Face-to-Face Visual Vein Reader	Show Valid ID Photo Taken Acxiom Report	Show Valid ID Facial Recognition Keystroke Analytics.	Fingerprint Biometric Reader	Answer personal questions pulled from public records search	Valid Photo ID Student ID
Special Equipment Required					✓	✓		
Browser Lockdown/Monitoring	✓	✓	✓	✓	✓	✓		✓
On-Demand Testing	✓			✓+\$	✓		✓	
Student Travel Required		✓	✓					✓

Source: MyLearningID internal documents

Exhibit 2: NC IDEA Press Release

NC IDEA Awards \$220,000 in Grants Bringing Total Funding Mark to Over \$2.9 Million

Funds to serve as catalyst for young, high-growth technology startups

DURHAM, NC – June 13, 2013 - NC IDEA, an organization committed to supporting business innovation and economic advancement in North Carolina, announced today that it has awarded \$220,000 in grants to five North Carolina startups. Since its inception in 2006, NC IDEA's grant program has awarded nearly \$3M to 77 companies across the state, with these most recent awards resulting from the 15th cycle of the program.

The five grant recipients were chosen after a highly competitive four-month application and selection process which drew 159 applications from 24 counties across the state. A committee comprised of experienced venture investors, industry experts and seasoned entrepreneurs assisted NC IDEA in selecting 30 companies to submit full proposals, which was further narrowed down to 11 finalists who were given the opportunity to pitch their idea in person, ultimately resulting in five winners.

"This grant cycle was extraordinarily competitive and had one of the strongest contingents of applicants in the history of NC IDEA's grant program, making our decisions incredibly difficult," said David Rizzo, CEO and President of NC IDEA. "We were impressed with the pool of companies and so many were deserving of funding. In the end, we were convinced that our grant money would have the most significant impact on our five recipients."

The following five companies are NC IDEA's most recent grant recipients for the Spring 2013 cycle:

BaseTrace – RTP, NC

BaseTrace designs DNA-based tracers that can establish liability, generate valuable information and reduce costs for oil and gas firms engaged in the highly-scrutinized 'fracking' industry. The well-specific tracers are added to hydraulic fracturing fluid used for oil and gas extraction. BaseTrace's simple detection process can determine whether hydraulic fracturing fluid has migrated into drinking water, reducing litigation exposure for companies and improving relations with local communities. Although hydraulic fracturing is the primary focus of the venture, BaseTrace can employ the tracer in other future applications including leak detection, chemical tracing and hydrology. Learn more at www.basetrace.com.

INRFOOD – Durham, NC

INRFOOD, a personalized "Food GPS", is starting a revolution in personal nutrition by analyzing food's core components: the ingredients. Today's food environment is full of misinformation, and has really become more chemistry than biology. You almost need a PhD to understand what is in your food. Society as a whole has tried to simplify these complexities by emphasizing counting calories. However not all calories are created equal. INRFOOD analyzes ingredients in your food and takes into account real time issues with your health and advises you toward an optimal personalized diet. INRFOOD is as convenient and simple as scanning the bar code of any of 250,000+ food products from your smartphone. Remember you are what you eat, know what's "in our food." Learn more at www.inrfood.com.

MyLearningID – Charlotte, NC

MyLearningID is an identity verification and student authentication solution that deters cheating and academic fraud in online education. With the rapid proliferation of online course offerings, the potential for cheating has come into focus as a potential barrier to validation and accreditation for higher education. MyLearningID provides a low cost, high fidelity, effective and convenient solution that will transform online education, resulting in increased enrollments, higher integrity and improved public perception of the online education industry. Learn more at www.mylearningid.com.

NeuroSpire – Durham, NC

NeuroSpire brings neuromarketing technology to the mass market. Their software platform allows companies to record the brainwaves of consumers to uncover their subconscious emotional responses to media, making it easy to gather consumer insights and test media campaigns with brain scans. Though Fortune 500 companies have invested hundreds of millions in neuromarketing research, the widespread adoption of this technology has been limited by costs, timing and personnel requirements. The NeuroSpire platform makes neuromarketing studies simple to run and cost effective, while simultaneously cutting the time for completion and eliminating the need for personnel with neuroscience and programming expertise. Learn more at www.neurospire.com.

Novocor Medical Systems – Chapel Hill, NC

Novocor Medical Systems provides solutions that help Emergency Medical Service first responders save lives. Their patent pending product, HypoCore, is an innovative rapid chilling device for inducing therapeutic hypothermia in cardiac arrest, traumatic brain injury, heat stroke and heavily concussed patients to markedly improve patient survival rate. HypoCore is ready on demand. It is easily stored in ambulances, fire trucks and helicopters. It does not require external power and is compatible with standard medical equipment. Learn more at www.novocormed.com.

“Although 57% of our applicants were from the Triangle this cycle, we are seeing a steady increase in competitive applications from across the state. Some notable examples of companies to keep an eye on include CTASIT (Greensboro), MindsMesh (Charlotte) and Strubwerks (Cullowhee). North Carolina is home to an impressive entrepreneurial community and we hope to continue to see more statewide participation in future cycles,” Rizzo said.

NC IDEA’s grant program is a catalyst for technological breakthroughs developed in North Carolina that have a significant potential to successfully transition into commercially viable high-growth enterprises. The grants, which are up to \$50,000 per recipient, support business plan research and development, reduce risk of early failure and advance projects to the point of suitability for angel or venture capital investment. In addition to the funding, NC IDEA and its network of seasoned business and technology partners mentor and guide the grant recipients through the complex growth cycles that young companies encounter, while also connecting the startups with other investors, institutions and business leaders to maximize their prospects for commercial success.

The upcoming Fall 2013 grant opportunity for North Carolina based companies will open in mid-August.

Exhibit 3: Mock Up of Facial Recognition

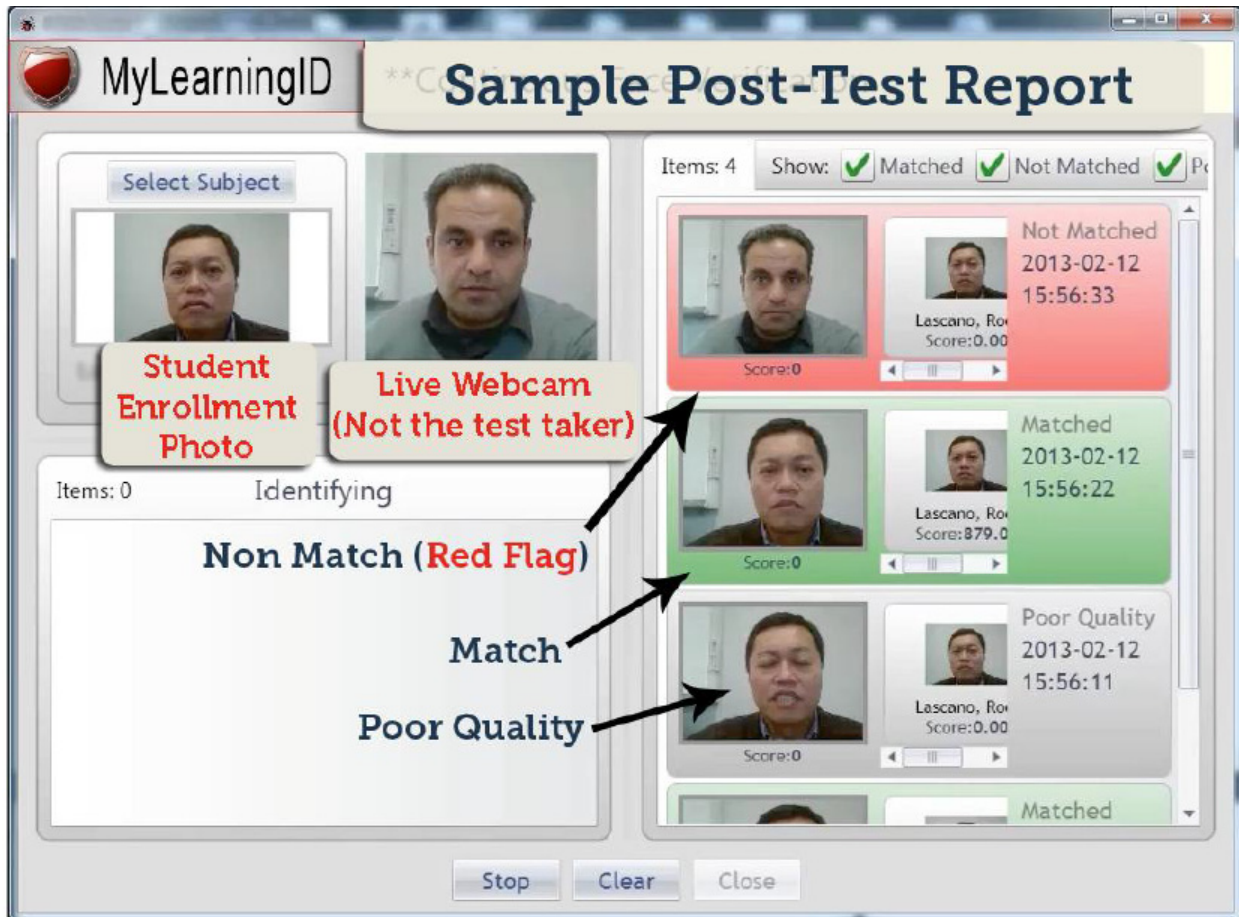
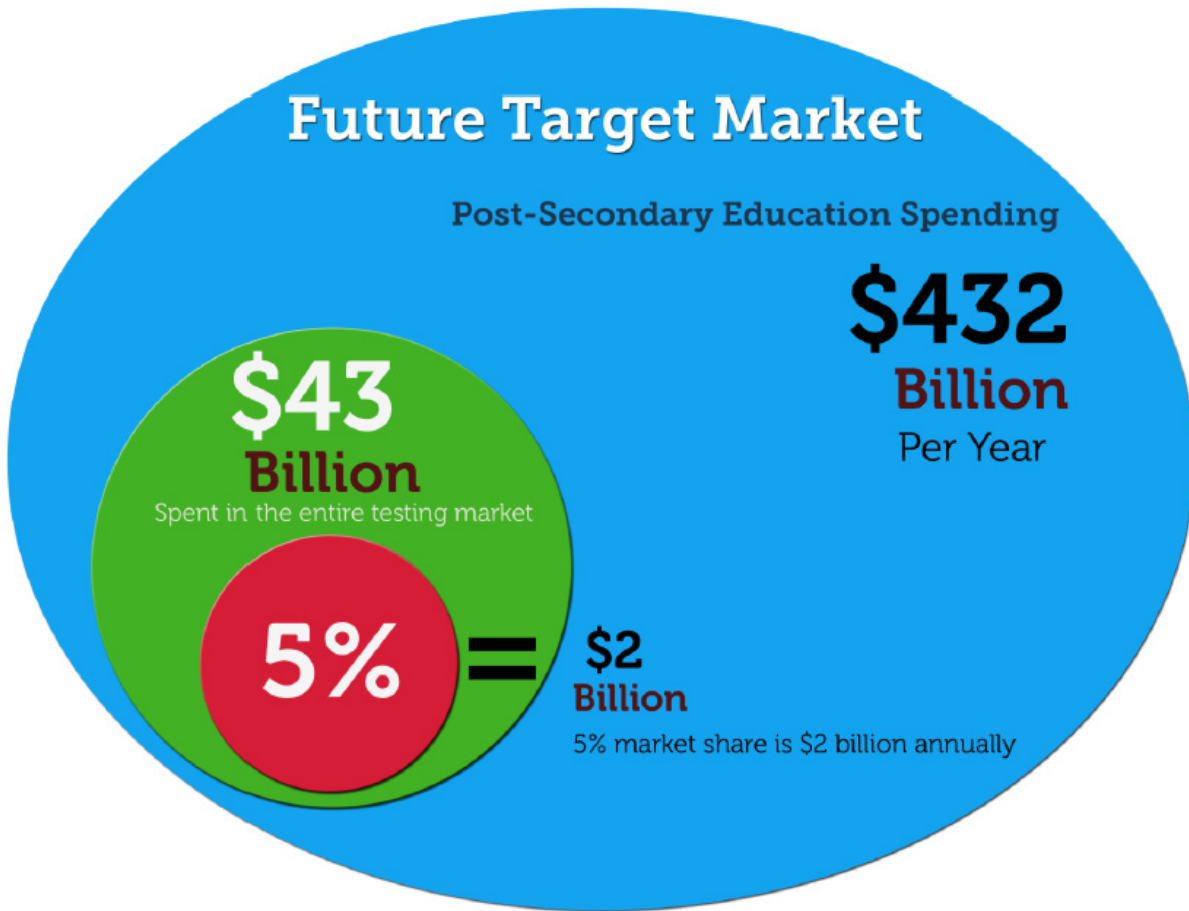


Exhibit 4: Potential Testing Market



Source: MyLearningID/ProctorFree internal estimates