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NEW MODELS OF HIGHER EDUCATION FOR LOW-INCOME COUNTRIES

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Abstract

In low-income countries, increasing access to higher education is particularly challenging. While tertiary education may boost a country's prosperity, the high cost of education, despite subsidies, remains a barrier to access. The digitisation of existing approaches to tertiary education is insufficient, and a more radical approach is needed.

The Atlantic Technological University has been working on two approaches that hold potential for addressing this challenge. A work-based degree in engineering has placed a student in Mozambique in a mining company, where they will learn the required practical engineering skills and study online. Although this approach will allow the student to earn an income as they study, the fees will still be significant as it is based on existing forms of online learning. Separately, the university is developing a 2-year low-cost Engineering programme based on free online content, modest payment for examinations, and supervision of a capstone project.

This paper focuses on the design of these programmes and the challenges involved. Attendees will learn how these new models of higher education for low-income countries could potentially address the cost barrier to access and significantly increase participation in tertiary education, leading to improved prosperity and economic growth.

Keywords:
low-cost higher education, low-income countries, work-based learning, self-directed learning, apprenticeship

The challenge of increasing access to higher education in low-income countries

Tertiary education is expensive. In the developed world this is unlikely to be sustainable. Demographic changes are likely to decrease enrollment levels but more significantly divert more private and public funds towards pensions and healthcare. However, it is a significantly bigger challenge in low-income countries.

It has been generally recognized that tertiary education is a necessary component of the economic development of low income countries (Margison 2016). However, given their economic situation they are unable to afford to provide mass access to tertiary education and training. Even when tertiary education is highly subsidised, as in Europe, students still have living expenses, ever increasing accommodation expenses, as well as expenses for books and other required learning resources. Added to this, they have the very significant opportunity cost of reducing, if not removing, their ability to work.

Could the problem in low-income countries be that they are copying an expensive educational model from the developed world, a model that emerged from universities in the Middle Ages? Copying this model puts low

income countries in a dilemma. Because they are poor they cannot afford the expensive format used in the West, and because they cannot afford this they cannot provide tertiary education that is required for their economic development.

But does tertiary education need to be this expensive? Are there alternative models? Could learning technology be the key to making tertiary education more affordable, and thus massively increasing participation in low-income countries.

The Atlantic Technological University

The Atlantic Technological University is a new university located on the west of Ireland formed in 2022 from the merger of three Institutes of Technology. The Sligo campus, previously named Institute of Technology Sligo, has been working on a number of technology based solutions to the financial challenge of access to higher education that could be applicable in low-income countries. The potential for cost reduction in these two initiatives are based on three core ideas:
1. Integrating programmes with work allows students to "earn as they learn".
2. Online distance learning can significantly reduce costs in travel, accommodation and access to learning resources.
3. Independent study with "challenge examinations" for well motivated and capable students, can massively reduce tuition costs.

A Work-Based Degree in Engineering

Apprenticeships have been with us for some time. However, these are generally highly regulated and can be slow to evolve and exploit the potential of learning technologies. Rather than navigate the bureaucracy of apprenticeship regulation, the university launched in 2020 an ordinary degree in Mechatronic Systems Engineering, aimed at students in Ireland finishing secondary school, which copied many of the features of the apprenticeship model of education but also exploited the potential of learning technologies.

The young students recruited within Ireland onto this course were hired by manufacturing employers and required to work 24 hours per week. The students were required to carry out and report on certain specific tasks in the workplace, but beyond that (and unlike skills-based apprenticeships), because of the huge variety of manufacturing operations, employers were free to allocate tasks relevant to the nature of the processes in their own business. In this programme, the students receive one third of their credits for the evidence they produce of their learning in the workplace. For the other two thirds of their credits students attend regular online synchronous classes.

Even now in 2023, although it may be too early to definitively say how successful this approach has been, the initial signs are positive. Recruitment has been growing slowly but steadily. Employers have tended to be intrigued at first by the programme and then excited about the possibilities. They see this as a way to recruit young people locally that are likely to stay with the company and also as a way of addressing the lack of "work-readiness" of the campus graduates they usually recruit.

Secondary school students who are making their plans for after graduation tend to be somewhat puzzled by the idea, but many are extremely interested and to date there have been more applications from students than trainee positions within companies. However, interest from employers is growing steadily and the existing employers have expressed a moderately high level of satisfaction with their recruits. Because of this, the recruitment strategy adopted has been to firstly find suitable employers and then to recruit students from local

secondary schools. It should also be noted that there has been significant interest from employees within manufacturing companies who have no previous engineering qualifications and this has helped quickly make the programme financially sustainable.

In 2022, a mining company in Mozambique expressed an interest in employing local young people and sponsoring them on the engineering programme. Having identified three potential trainees, one student reached a satisfactory level of English language and was accepted onto the programme. To date, his academic achievement has been good and his employer is very satisfied with his progress.

Challenges and Responses

Laboratories

The most obvious challenge in the delivery of a completely remote engineering programme is the access of students to laboratories for practical work. However, the institution had been delivering Mechatronic Engineering online within Ireland since 2006 and in that time had developed and sourced both simulations and remotely accessible equipment in order to minimise attendance on campus. In addition it had become apparent that the exposure that learners were getting to real equipment and processes in their workplaces was more valuable than the artificial experiences we could provide for them on campus. This work-based programme was launched in the first year of the Covid 19 pandemic, at which point it was decided that attendance at labs on campus was to be no longer required for work-based learners. Because the employer in Mozambique was able to demonstrate that they could expose the student to suitable control equipment, it was possible to allow that student on to the programme.

Fees

From the student's point of view this is a great opportunity to gain an otherwise unaffordable engineering degree. However, it does represent a significant investment for the employer both in terms of trainee supervision and tuition fees. Tuition fees for students from low-income countries have a low-level of subsidy from the Irish government and are normally approximately \$9,000 per year. The employer considered this to be too expensive and because the university considered that exploring this model was valuable, reduced the fee to €2,000. However, the implication from this experience is that although a work-based degree could make engineering education more accessible for young people in the developing world, the high tuition fees will reduce the number of employers that are able to afford to take on trainees and thus massively reduce the number of traineeships available.

Skills and Work Supervision

Because the students recruited to this programme do not yet have any significant relevant knowledge or skills they are of limited value to the employer and require significant supervision. This again will reduce the attractiveness of the programme to employers.

To address the challenges described above another solution is being proposed.

Self Directed Learning

There are differing views on the success of MOOCs (Massive Open Online Courses). While they have achieved massive enrollment levels, completion levels are much lower and it is still unclear how such platforms can generate sufficient income to achieve financial sustainability. However, from these MOOCs and other initiatives we have learned much about at-scale provision and some closely linked models that exploit the cost reduction potential of scale have emerged.

Of particular note is the Georgia Tech masters degree in Computer Science. This programme, with a tuition cost of approximately $5,400 had an enrollment of over 12,000 learners in 2022 (Mendez 2022). Although not an openly accessible programme, it utilises many of the delivery and support approaches of MOOCs and places an emphasis on robust assessment.

Another noteworthy initiative is the University of the People (UoP). UoP delivers "tuition free" online degrees with no charge for instruction or books, only charging for assessment. It also, through philanthropic donations, organises scholarships for many who cannot afford the assessment fees. Accredited by the US Distance Education Accreditation Committee (DEAC) and with over 100,000 students in Business Administration, Computer Science, Health Science and Education, UoP appears to have been very successful at recruiting and graduating students (Coy 2022).

Inspired by these two models, the Atlantic Technological University is in the early stages of planning to create an "open" Higher Certificate (Associates Degree) in Mechatronic Engineering. This will use the model of free access to learning materials and payment for assessment.

Challenges and Responses

Cost of Content Creation

Traditionally the high cost of content creation has been a major barrier to entry into distance learning. However, the rise of "user generated" content has shown us that this is no longer necessarily true. In this project, content creation has been inspired by the original Kahn Academy videos and its many imitators on the web. Youtube has many channels of moderately good quality academic content for Engineering students, much of it published under Creative Commons licences. These videos can be produced very easily and with some relatively cheap recording facilities and simple, effective recording techniques, can be made to appear quite professional. In this institution we are training lecturers to simply create courses by both recording videos and curating them from the web. By adding self-test quizzes and peer assessments we can not only allow learners to gauge their own progress, but also monitor progress and issue certificates of completion.

Laboratories

Like the work-based degree described above, the development of practical skills is a challenge for remote students. However, unlike those work-based students, self-directed learners may not be in a related workplace thus not have exposure to real engineering equipment. Luckily, while many engineering activities require large expensive equipment, the key principles and practical skills in Mechatronics (physical devices, electronic control and software), can all be demonstrated at small scale using cheap equipment that can be purchased online. This can be augmented by online simulations which are widely available on the web.

Assessment

Four types of assessment will be used in this programme:

1. Unsupervised automated objective tests (quizzes)
2. Peer assessed assignments.
3. Supervised projects.
4. Proctored examinations.

While learning content can be made available for free, reliable assessment, which is crucial for certification cannot. Objective tests can be used to measure lower level learning outcomes at virtually no cost, but if the tests are not proctored they are not reliable indicators of achievement for certification purposes. However, they can be useful knowledge checks for the learners themselves.

Peer assessed assignments are another low-cost way of assessing performance and can test higher order outcomes. However, even though they are an excellent self-check for the learners, because the institution has no control over the assistance a learner might have available to them, they are not particularly reliable for the awarding of grades.

Supervised projects, as well as improving the learning experience of the students, are a more reliable way of measuring authentic learning. Because students are required to make interim submissions and will be interviewed on their submissions the opportunity for cheating will be much reduced. However, this is a relatively labour intensive form of assessment and to keep costs low, will be used sparingly in specific courses and also used in conjunction with peer assessment.

Although summative examinations are considered to be less authentic, proctored online examinations will form the most important part of assessment for accreditation because they are more reliable and cheaper to provide. Identity verification is also an important challenge for these examinations. It is expected that a solution similar to that used by online banking will be used.

Institutional Accreditation

Accreditation is expected to be the most significant challenge in developing this programme. Normally a programme with little or no learner support would not be acceptable, but this programme is specifically targeted at low-income students in low-income countries who cannot afford such support. Peer support will be facilitated at no cost, and there are many talented and well motivated students who can cope and even thrive in such a learning environment. In addition, certification can be justified on grounds of competency under Recognition of Prior Learning (RPL) policies. Such policies generally allow for students to prove they have specific knowledge or competency, regardless of how it was acquired.

Combining these two approaches

The main obstacles to the success of the Work Based Degree are the fees that are required to cover the online teaching methods and the challenge of creating enough suitable traineeship positions and particularly with employers who can afford to subsidise the full fees that need to be paid. While working with small scale kits is very useful in understanding engineering principles, real work experience creates engineers who are of much greater value to employers. By combining the low-cost two-year programme with the 3rd and 4th years in the workplace, we can address most of the challenges in both approaches..

The low-cost 2-year programme will allow students to start studying before they have a traineeship position and it can also, by shortening the length of the traineeship, reduce the costs to employers who take on trainees. For those who do not have positions, gradual accumulation of credits will allow students to gain skills and credibility that can help them get positions, even before they complete the programme. The skills developed and knowledge gained from the 2-year programme will make graduates much more valuable to employers and justify the creation of much more traineeship positions.

Summary

The cost of higher education, whether to the individual or the state, is an increasing challenge in the developed world. In low-income countries the challenge is even worse. Online Learning, Self-directed Learning and apprentice-style Work-Integrated Learning all have the possibility of reducing the cost of gaining skills, knowledge and qualifications. By adopting these approaches rather than campus based higher education, low-income countries may be able to achieve much higher levels of participation and a much higher rate. This in turn will increase prosperity and ability of governments to subsidise mass participation. At that point, such governments may choose which model is most appropriate for them.

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