CHAPTER

12

Considerations in Costing ODL and ICTs in TVET

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Introduction

Open and distance learning (ODL) and information and communication technologies (ICTs) are viewed by many policy makers, at both national and institutional levels, as a potentially cost-effective means of tackling the challenges of access, equity and quality in education. Sound and rigorous financial planning is essential for governments and institutions seeking to harness these methods, but unfortunately there has been little analysis of the costs of such provision in the Technical and Vocational Education and Training (TVET) sector. Arguably, this is because there appears to have been less of a focus on research in TVET compared to tertiary education. Also, there may be a perception among some in the sector that ODL is an inappropriate means of imparting vocational and technical skills, a perception that possibly derives from memories of the shortcomings of earlier correspondence education and the notion that technical and vocational skills can only be mastered in the workplace or training centres.

With the growing ability to present simulations and modelling using ICTs, it is becoming increasingly possible to offer new forms of TVET at a distance. However, there may be misguided or ill-informed assumptions and claims about the cost savings of employing these technologies that suggest that ODL is less expensive than traditional contact education. For a start, achieving economies of scale can be a major challenge in integrating ICTs in TVET, since the training demand in most developing countries is for small numbers of graduates in a wide range of occupational profiles (UNESCO IITE, 2005). Economic concerns can raise major barriers to offering ODL programmes in TVET. This is particularly challenging in contexts where government funding for TVET is low. For example, in Zambia, the level of government subvention to TVET institutions is less than 6 per cent in some cases (Herd and Mead Richardson, 2015). This lack of funding limits the

extent of training, the number of students who can be trained and the quality of the training, with the recruitment of teachers, modernisation of equipment and acquisition of training resources being especially affected (Siriwardene and Qureshi, 2009).

With many TVET systems in the developing world now considering the adoption of ODL and ICTs because of the promised cost efficiencies, it is important to examine the costing of these new educational and training practices. Given the dearth of resources focusing specifically on costing ODL in TVET, this chapter focuses more generally on costs in the use of ODL and ICTs and extrapolates these findings to the TVET context. This chapter explores the costs of ODL and how to avoid the ramifications of weak financial planning.

Key Terms Used in Costing

It is useful to clarify some cost definitions before venturing further into costing issues since these all need to be considered in costing the alternative delivery methods available to TVET:

- **Direct costs** are those costs that are directly attributable to an activity, such as the costs of course material, course design, co-ordination, teacher time, student administration and student support.
- **Indirect costs** are course-related costs that are not specific to that course. They can also be considered as "overhead expenses" that might have to be apportioned to an activity — for example, the costs of equipment, such as computers or television, that the students need to use the teaching materials.
- **Marginal costs** are costs that would not have been incurred if the activity had never been started.
- **Cost analysis** refers to estimating all the costs involved in a particular activity and breaking down the costs of courses into constituents and studying and reporting on each factor. In ODL, this can include analysis of such costs as direct professional staff, support staff, capital equipment, equipment maintenance, consumables and use of joint facilities.
- **Unit cost** is often used as a measure of resource impact for a specific unit of analysis (depending on what is measured) — for example, the cost per student, cost per hour or cost per course module.
- **Fixed costs** do not alter when the scale of an activity increases — for example, telephone rental is unaffected by an increased number of students.
- **Variable costs** do alter — for example, telephone usage charges are affected by the number of students.
- **Total cost** is the fixed cost plus all of the variable costs.
- **Opportunity cost** is the income or benefit lost in going ahead with an activity.
- **Cost-effectiveness** refers to the extent to which an institution or programme produces particular outputs (which are concrete and measurable) or outcomes (which may not be measurable). It represents

striking the optimal balance between cost, student numbers and educational quality, a balance that changes according to educational context.

- **Cost-efficiency** refers to the extent to which an institution or programme maintains a particular level of production with fewer resources or increases the level of products or services it produces with a less than proportionate increase in the resources used. It thus refers to the "cheapness" of educational provision.

Costing ODL

There has been no consistent or comprehensive research into the comparative costs of ODL. Some of the studies undertaken have focussed on institutional costs, others have considered public expenditure costs, and yet others have focussed on the total economic costs. Some focus on fixed costs, considering the initial costs for processes such as designing, developing and producing instructional materials for the first offering, and the one-time technological infrastructure costs. Others accept that there are significant continuing costs which can vary over time, such as the number of students per course and location, the costs of distributing materials, course updating and revising, supporting the students, researching and developing the delivery systems, and the ever-changing technological infrastructure (Bart, 2008).

Nevertheless, the literature does suggest that ODL programmes can be more cost-efficient than their conventional equivalents *if* they enrol large numbers of students on every course and thus reap large economies of scale. ODL courses are not restricted by classroom size, so per student costs decrease as enrolments increase. The literature also suggests that ODL institutions *can* be more cost-effective than conventional institutions when they offer high-quality learning materials and tutorial support for students, thereby securing satisfactory retention and graduation rates. Conversely, if they fail to achieve satisfactory retention and graduation rates, they may well be much more expensive, particularly in terms of cost per graduate, and especially if the graduation rates are the sole measure of educational value added. Cost calculations based only on successful graduations favour conventional institutions because distance education students who are satisfied with partial completion of programmes (particularly in the context of lifelong learning and low-cost fee environments) are ignored and their costs are charged to graduations (Butcher and Roberts, 2004).

In ODL, the literature on costing typically concerns seven main areas: student costs, student support costs, teacher costs, instructional technology costs, material design costs, course delivery costs and administrative costs. These are discussed briefly below, with a more in-depth consideration of the issues later in the chapter.

Students' Costs

In face-to-face education and training, students' contributions towards their study costs usually comprise fees, textbooks and other educational or training materials, living expenses, accommodation, meals, travel and possibly a loss of, or reduction in, income. Students' perceptions of the cost and value of their programmes relate to the return on investment (ROI) — that is, whether the

studies and qualifications raise their prospects for employment, promotion, higher earnings or enhanced personal goals (Thompson, 2005). In the case of distance, flexible or blended education, regardless of location or mode, some of the costs, such as accommodation and travel, can be avoided and the learners may be able to combine their studies with full- or part-time work and contribute to the family income. However, they may incur additional costs, such as those of accessing a computer and connecting with the Internet.

Student Support Costs

The costs to institutions of providing student support depend upon the number of enrolments, together with the lecturer-to-tutor, tutor-to-student and student-to-student ratios. These ratios generally increase the direct cost of providing student services. The quality and quantity of student support becomes an important cost driver (Griesel, 2012). For example, the role of a tutor in an institution like the UK Open University includes:

- Providing individual support through teaching and grading of assignments.
- Playing a key role within the assessment scheme in the ultimate recognition of learning through credit and qualification.
- Paying attention to the progress of students, both through response and intervention.
- Providing opportunities for social learning, where possible in groups, and a dimension of the local and familiar through a face to face contribution to learning.
- Providing support with regard to administrative and other systemic issues. (Tait, 2014, p. 8)

Student support costs are also incurred in non-academic functions such as enrolment/study options, advisory services, counselling, library services and ICT-based administration and support.

If such student support activities are not costed or planned for, teachers and trainers may spend large amounts of unpaid/personal time responding to student queries and concerns. Under-investment in student support may reduce the cost of delivery per enrolling student but significantly increase the cost per successful student, as reduced or poor quality student support is likely to lead to higher attrition and failure rates. However, as Tait (2014) observes, online course materials can now be designed to contain self-management tools and learner support which can reduce the problems and costs of over-dependency upon tutors. This is now becoming even easier with the availability of learner analytics that allow providers to diagnose and respond to learners' needs through real-time data collection and intervention.

Teacher and Trainer Costs

The cost of teachers and trainers in traditional TVET institutions is directly related to student numbers and is one of the main cost drivers. The costs of face-to-face teaching rise every time a desirable class size is exceeded. If the recommended maximum class size is 20, and a further 15 students are enrolled, another class

will be needed and another teacher assigned to this class. ODL can change this by substituting the expensive addition of extra staff with the less expensive mediated learning and management of students' learning. This can lower costs per student, *provided* large numbers of students can take the course and the resulting unit cost advantage is not eroded by lower success rates (Butcher and Roberts, 2004).

In using ICTs in TVET, there is often a need to upgrade the teachers' knowledge and skills in integrating the new method and technologies in teaching and learning (Herd and Mead Richardson, 2015). Thus, in costing ODL, it is important to budget for the costs of inducting and training teachers and supporting and mentoring staff in their uses of the new methods and resources, creating reliable assessment procedures, effectively managing their students and keeping the course content up to date and relevant (Butcher and Roberts, 2004). Furthermore, there may be merit in ensuring that funding is allocated to other teacher incentives such as innovation grants, teaching excellence awards, conference attendance, and tenure and promotions for those who perform well (all too often, these incentives — including time-release — go to researchers rather than teachers).

Technology Costs

Historically in ODL, technology costs were limited to print production, correspondence and, more rarely, use of radio and television. While these may still be called for, especially in developing countries and areas lacking a reliable or affordable Internet connection, the move in ODL is towards ever greater use of ICTs and the myriad teaching and learning options they provide. With this greater reliance on technology to deliver instruction and support the learners, it is inevitable that the technology costs will rise. These can be considered in four categories: initial purchase price of hardware and cabling (including periodic replacement of obsolete equipment); cost of software and related resources; costs of connectivity; and support, maintenance and training costs.

Many institutions are now investing in Learning Management Systems (LMSs) and related online learning platforms and specialised assessment software to facilitate online, mobile and blended learning. Investing in these may pose a challenge in some countries. In Zambia, for example, the level of government funding for TVET institutions is so low that it is cost-prohibitive for institutions to progress to the use of ICTs. If the technologies are adopted, the costs of these are usually passed on as increased fees to the students, which then reduces the number of people who can afford TVET study (Herd and Mead Richardson, 2015).

Furthermore, there are significant costs associated with the repair, maintenance, security and replacement of technology. There is also the all-important issue of providing funds for training personnel in the use of this technology. Each technology option considered therefore has its own cost structure and implications, and ICTs are, of course, in a constant state of transition and change, so with each new technology with the potential for new and better forms of delivery of learning, there will be new costs to consider. Therefore, particularly in developing countries, it may be better to stick with easy-to-use, robust and low-maintenance technology (see Chapter 10).

Course Design Costs

The key to quality in the various forms of ODL, regardless of delivery mode, lies in the instructional design of the courses and programmes — that is, the rigorous links between the instructional goals, methods, assessment methods and learning outcomes. A core expectation of any educational or training institution is effective teaching and learning, which requires appropriate investment in curriculum and course design, materials development, ongoing evaluation and regular revision and overhauling of the curriculum and course design. Because these costs can be tracked and managed, they are the ones most often studied.

Course and courseware development costs can be high in ODL — particularly if they involve the use of "expensive" media and technologies (Butcher and Roberts, 2004). Course development is a fixed cost incurred by education providers regardless of the number of students who study the course. In addition to fixed costs, there are ongoing costs such as updates and additions to course materials or course revisions, depending on the volatility of the material. Hence, a development budget can range from the very simple (e.g. a contract to write learning materials that are then turned over to a production unit to shape into a suitable ODL package) to the very complex (e.g. a budget that must allow for internal cost recoveries and internal and external contracts for special services and long-term suppliers of technical support for the development phase of a project) (Thompson, 2005).

Course design, renewal and remediation is potentially a bottomless pit of expense, since it is always possible to add more person-power to course design teams or seek more expensive media and technologies. But this may not be necessary. Many effective courses have been designed with a relatively small number of personnel. However, a generalisation that has fairly high reliability in the case of ODL is that the quality of the course (subject matter and pedagogy) is related to the level of investment in its design (Butcher and Roberts, 2004).

ICT Costs

Course development costs have generally increased over time, as ICT-based multimedia materials and interactive learning systems are significantly more expensive to develop than the traditional printed materials that have been the most popular means of teaching practical skills in TVET at a distance. However, it is important to note that some of the production tools for video and multimedia have become both cheaper and more readily available. Costs differ according to the types of media used. For example, generally speaking, the higher the number of students, the lower the per capita costs of printing the learning packages. It used to be that if print runs were too large or there was a need to make major modifications to, or even discontinue, courses or programmes, there could be major losses (nowadays, digital presses allowing for short-run, just-in-time printing have changed the economic models for printing).

Alternatives such as video instructional materials are increasingly being used and can lead to better practical skills acquisition (see, for example, Donkor, 2010). Thus, while video and simulations may be more expensive to produce than printed resources, they can be more cost-effective in contexts where practical demonstrations are required. And the same content can be used to teach successive cohorts and increasing numbers of students over a period of several years, provided

that the design allows for easy amendments and updates to the content and envisaged use in a range of applications and markets (Griesel, 2012). Videos and multimedia presentations are particularly useful and likely to generate cost savings where the content is unlikely to change (e.g. in trades such as bricklaying or online in-service programmes on the basic principles of TVET teaching and training).

The Cost Benefits of Using Digital Resources and Open Educational Resources

There can be enormous cost benefits from using openly licensed digital materials in TVET course development. Developers can access existing content and contextualise it to their own curriculum, thus speeding up the process of materials development. Teachers lacking technical expertise in specific vocational subjects can use expertly designed materials from other sources to bridge the gap. Simulations can provide learners with access to laboratory experiments where no laboratories are available (Herd and Mead Richardson, 2015). And students can gain from the shared use of well-designed materials that provide better learning outcomes at a lower cost.

As institutions make strategic decisions to increase their levels of investment in the design and development of better educational programmes, embracing open licensing environments and harnessing existing open educational resources (OER) is a cost-effective way of doing so (Butcher, 2011). However, when it comes to TVET, there is currently a shortage of well-designed instructional content that can be shared within the sector (Stevens, 2001) and few OER content repositories specifically focussed on technical and vocational subjects (Herd and Mead Richardson, 2015). So it would seem to be more of a case of the TVET sector having to build its own collections of OER from the ground up. It will take time, effort and money, but through collaboration or partnerships between faculties, or multiple faculties in different institutions involved in the same content areas, a larger, richer database of content can be developed more efficiently, have broader use and prevent duplication of efforts (Boettcher, 2006). Every word, every image, every example, every definition and every other aspect of the OER they create will then be available for localisation, adaptation, remixing and improvement by the users in TVET who could number hundreds or even thousands. Not only will the TVET institutions have a greatly expanded content base to draw upon, there will also be no copyright clearance processes to manage.

One way of approaching this is to create consortia whereby two or more institutions (or units within organisations) agree to share the responsibility for and the costs of designing and delivering sets of courses or entire programmes. Each institution will have its own management structure and contribute personnel to the various tasks. Each institution will also manage the delivery of the courses to its own students (World Bank, n.d.). Such initiatives may be especially worthwhile if they involve institution-industry collaborations, thus allowing the content to be relevant to both TVET and industry needs. The content of many TVET courses is globally relevant and, as shown in Chapter 10, the three main languages — English, Spanish and French — are understood in many countries, and so consortia in particular countries or regions can produce content that is readily usable or adaptable worldwide, something that is increasingly important in the globalised knowledge economy.

One example of harnessing different specialists' knowledge, skills and experience; minimising duplication of effort; and saving costs through a consortium approach is the Commonwealth of Learning (COL)–supported project undertaken with the eight countries of the Southern African Development Community (SADC) which involved developing ODL training materials enabling teachers to enhance their professional skills. The various modules were developed by teams of writers in Botswana, Namibia, South Africa, Zambia and Zimbabwe. Throughout the writing phase, content input and review of the materials remained the collective responsibility of all the participating countries. Once the core modules were developed, each country was able to adapt them to meet the needs of its people. Thus, the cost of the initiative to any one institution, agency or country was dramatically reduced, and the quality of the finished product was higher than if only one institution or country had undertaken the development of the course and materials (Wright, Dhanarajan and Reju, 2009).

As shown elsewhere in this book, the advent of Massive Open Online Courses (MOOCs) means that high-quality educational materials are now being made available across the world, free for students registering for non-formal study and inexpensively for those seeking credit. The MOOCs concept could well be adopted and adapted for TVET. Inexpensive, simple-to-produce MOOCs could take the form of self-produced lectures delivered in front of a webcam and uploaded via an open source platform such as Google's Course Builder. Slightly more complex and costly videos could be shot in workshops, industrial sites and other locations. The most expensive MOOCs could be multimedia and interactive courses that have been produced to the highest professional standards and developed by rethinking course structures, rewriting content, creating multiple-choice quizzes, adapting assessment software, recording lectures and possibly founding discussion groups and building up online course pages. Once these MOOCs went online, there would, of course, be further costs arising from, for example, operating analytics, monitoring chat feeds, repairing technical glitches, administrating the enrolments and providing learner support (Dejong, 2013).

By adopting such approaches, TVET has opportunities to reassess the needs, resources available on particular topics, approaches needed for specific subject areas and the international dimensions of TVET provision. The educational, logistical and cost benefits as well as earnings could be massive, and this could improve the TVET brand internationally and encourage a more collaborative culture and environment.

Estimating the Costs of Course Design and Development

There have been several attempts to estimate the costs involved in course design and development. For example, Boettcher (2006) estimates that it takes an average of 18 hours (a range of five to 23 hours) to create one hour of instruction for publication on the Web that can be studied independently of an expert faculty member. Kruse (2004) notes that in TVET training, providers generally use a "rule of thumb" approach to estimating the cost of developing ICT-mediated teaching and learning. This can be based on either a per hour or a per screen rate. Kruse observes that it takes 600 person hours to develop one hour of high-quality ICT-mediated teaching and learning material as compared to only 300 hours to develop simpler Web- or computer-based training without audio or video elements

(UNESCO IITE, 2005). However, a key consideration here is that such estimates change over time because new technologies that come on-stream often reduce the hours required to achieve similar results (e.g. the digital tools now available for the creation of computer graphics and animations, editing and formatting text and desktop editing of digital video).

Bryan Chapman (2010) of Chapman Alliance[1] conducted a survey of nearly 4,000 learning development professionals from 249 companies to try to arrive at the average time required to produce one hour's training of various types. Table 1 shows the results.

Table 1: Average design time requirements for one hour of training material
(Source: Chapman, 2010)

Level	Average hours	Range
Instructor-led training	43	22–82
Level 1 eLearning (Basic): incorporating content pages, text, graphics, simple audio, simple video, test questions and PowerPoint presentations	79	49–125
Level 2 eLearning (Interactive): incorporating Level 1 plus 25% (or more) interactive exercises allowing learners to perform virtual "try it" exercises and liberal use of multimedia (audio, video, animations)	184	127–267
Level 3 eLearning (Advanced): highly interactive, possibly simulation or serious game-based, use of avatars, custom interactions, award-winning–calibre courseware	490	217–716

Of course, these are "averages." Any one programme might take as little as 22 hours or up to 716 hours, depending on the experience, skills and knowledge of the designer(s) and complexity of the subject matter and instructional design. For example, a course on thermodynamics will clearly take significantly longer to design than one on basic office procedures (Dashe and Thomson, 2010).

Mays (2011) provides a breakdown of the staff hours required for the development of a module at the University of South Africa.

Table 2: Staff hours to develop a module
(Source: Mays, 2011)

Activity	Hours
Course design preparation	8
Curriculum design	250
Compiling of study material	1,300
Editing (if done by academic department)	50
Translation (if done by academic department)	300

1 www.chapmanalliance.com

But as Mays himself observes, the number of staff hours required to compile this study material could be reduced from 1,300 hours to 650 by the use of a prescribed textbook and "wrap-around" study guide that helps the students work through this textbook. Estimates for course design tend to vary across a range of such variables as the tools used, the learning methods involved and the availability of existing content (Johansen and Wiley, 2010). Also, staffing costs may be much lower and technology provision and access costs much higher in developing countries than in developed countries.

Kruse (in UNESCO IITE, 2005) argues that the flat-rate estimate does not reflect the true costs of eLearning. He suggests a ten-factor analysis approach to determining the costs of ICT-mediated teaching and learning:

1. Mode of training delivery.
2. Bandwidth requirements for Web-based courses.
3. Subject matter content.
4. Duration of training.
5. Special features, such as audio, video and animations.
6. Source of content.
7. Need for student-tracking capabilities.
8. Project start and end dates.
9. Nature of in-house contribution in training development.
10. Life span.

Considering the Expertise of the Course Developers

One challenge in course design is estimating the person-power needed to design one notional hour of student learning time. Given that design time itself is not a stable quantum, it is worth considering how different combinations of expertise might affect student performance. For example, a course development team consisting of an instructional designer and an editor is likely to be less effective than a course development team comprising multiple specialists such as:

- A project manager to oversee production and to keep the development process on track, as well as manage the assigned development budget.
- The content specialist/instructional designer.
- A content reviewer/editor.
- A graphics and interface designer.
- A media specialist.
- A technical support team, including programmers, Web designers and technical support staff.

Increasing interactivity in courses typically requires more time and often more specialists to develop the content and methods (Boettcher, 2006; Mays, 2011). Historically, the functions required in curriculum and courseware design have tended to be spread across multiple specialists, thus raising the costs. However, as course developers become more experienced and comfortable with the available

tools and technology, the number of hours required to produce content should decrease. They may become multiskilled, capable of combining the functions of, for example, instructional designer, graphic and Web designer, and general editor. Such multitasking is being greatly facilitated by the growing number of ICT-based content development tools.

Course Delivery Costs

Successful ODL systems are likely to require as much attention to the presentation as the preparation of courses. As highlighted, course delivery systems that allow a wide distribution of the course materials and can then be reused can significantly reduce costs. However, as student numbers grow through increased distribution, either the amount of interaction with students decreases (which affects the quality and completion rates, thus raising the cost per graduate) or the student-trainer interaction increases (which raises the costs of the service provision). The degree and nature of the interaction in learning and support interactivity will depend upon the pedagogical needs of particular programmes and the values and mission of the training institution. This, in turn, will influence the types of technology used and associated costs. Thus, a programme with tutorial-style interaction will cost more than one where the content is simply presented online with self-learning expectations (Sadik, 2009). Somewhere in all of this a balance has to be struck because, as Curtain (2002) argues, while high levels of interactivity will be more expensive, learning effectiveness, assessed in terms of student satisfaction levels, depth of learning outcomes and graduation rates, is likely to be much better than with low-interaction, traditional distance education courses.

Training providers can also plan for infrastructure and facilities that allow collaboration between and among students, students and staff, and staff. Collaboration between colleagues who have never met each other physically is possible with computer conferencing, instant messaging, Voice-over Internet Protocol (VoIP) applications like Skype, and social interaction tools like Facebook and helps to nurture communities of practice. These tools, once considered expensive, are now mostly free or relatively cheaply available, particularly where broadband connectivity is readily available.

Blended delivery can also be used, combining ICT-based learning with practical hands-on components within institutional settings or workplaces in partnership with employers and industry. As shown in Chapter 11, which describes the use of e-apprenticeships, the benefits of such an approach are increased flexibility, reduced opportunity costs for the students and employers and efficiency gains for TVET providers arising from decreased institutional training time requirements (Stevens, 2001).

Research shows that the effectiveness of ODL and ICT-based teaching and learning depends on the trainer's understanding of the target audiences and students' needs and circumstances, how to make best use of the technologies and how to organise and deliver the content and materials (Valentine, 2002). This calls for investment in their professional development. As they become more proficient at using the new methods and technologies, they will be able to resolve problems more quickly and effectively and their dependency on technicians and other support staff is likely to decrease — unless, that is, changes in technology or approaches require new forms of support.

Thus, course delivery costs depend on the choice of media, the level of support required in a programme (and corresponding level of synchronous interactivity), the level of training required by the trainers, the levels and nature of the technical support required (which will likely decrease over time as proficiencies increase but may still be required as new technologies arise) and recurrent costs for software licences if proprietary software is being used.

Administrative Costs

The effective delivery of programmes and financial sustainability of institutions relies in no small part on the efficiency of the administration. The administrative costs usually involve those functions designed to support the development, delivery and support services of an institution, particularly the human resource, financial and student support, and service systems. Effective management of institutions is increasingly reliant on ICTs. Management information systems (MISs) save time and avoid unnecessary duplication by capturing and making available required information in integrated systems (although they can also lead to significant time wasting if poorly designed). Importantly, these systems can also support strategic decision making and policy implementation by stimulating and supporting the free flow of information, thereby facilitating better planning, monitoring and resource allocation. Such investments in designing online administrative systems for distance education are generally regarded as fixed (although the costs of running the administration are obviously not).

Institutions may develop their own administration systems to enable students to access information about and register for courses, and staff to track student progress, publish course results and address such matters as payment, resources procurement and facilities management. Others may use databases such as Oracle and PeopleSoft, which offer institutions a virtual platform to organise registration systems and payroll and manage such matters as staff requests for leave. In all of these cases, there will be the costs of purchasing and maintaining the licences for these systems, as well as training the staff to operate them.

Conclusion

As shown in this chapter, costing and evidencing the cost-effectiveness and cost benefits of ODL and other forms of technology-based teaching and training in order to make well-informed decisions about educational options is complex and can be problematic. Using various modes of delivery or technologies for a programme does not necessarily make that programme more or less cost-effective. And every country has particular barriers to overcome in terms of access to, and costs of, ICTs: the levels of government, donor or NGO funding; and staff expertise in using ODL and ICTs. So their choice of how to overcome these barriers must be considered holistically for the impact it may have on all the stakeholders involved (Thompson, 2010).

Applying a strict comparison of expenditures for administration, materials development and delivery of an ODL programme versus the traditional face-to-face model would likely result in a lower per student cost for ODL, and particularly so if all the costs are amortised over the life of the programme. However, if the judgements of cost-effectiveness include outcomes such as student satisfaction

levels, completion rates, improvements in teacher quality and opportunity costs, then the measures are far harder to quantify.

To make ODL programmes more cost-effective, it is necessary to consider all aspects of expenditures and revenues over a programme's lifespan (Thompson, 2012). As shown above, cost-effectiveness in ODL systems is affected by several factors, including the number, nature and circumstances of the students enrolled, scope and complexity of the curriculum, course development costs, choice of teaching and learning methods and technologies, required level of student support and number of partners or collaborators. Arguably, the main consideration highlighted here is that design costs are incurred regardless of the number of students who study the course. Low unit costs then follow only if large numbers of students study the materials successfully and the person-power devoted to "presenting" the course is substantially lower than in face-to-face settings.

In the case of TVET, training demand in most developing countries is for small numbers of graduates in a wide range of occupational areas (UNESCO IITE, 2005). Furthermore, given the practical nature of TVET, it makes more sense for courses to be provided in multimedia format, as opposed to print. This can be more costly, but cost efficiencies and savings can be achieved by forming consortia, sharing costs between institutions and/or partnering with industry, creating OER and MOOCs and establishing public repositories of resources relevant to TVET. Given the nature of TVET, there should, in all likelihood, be fewer problems with cultural bias in much of the content.

There is no one clear model that can accommodate all the challenges of costing. Each country, TVET system and training institution needs to find the best and most cost-effective ways of serving its students' needs. To do this, they need to understand the problems and pitfalls, develop business plans and take the appropriate and time-honoured steps in their costing (identification, decision, measurement, analysis and presentation).

To date, there are very few comparative cost studies to show how the cost structure of TVET is affected by new technologies and approaches. And there is no evidence, even from countries with mature eLearning systems, that ICTs improve efficiency in TVET (Herd and Mead Richardson, 2015). More research in these areas is badly needed. In the current economic climate, innovations and proposals for change are increasingly likely to come under critical scrutiny and only receive funding if there is solid evidence that money can be saved and that activities making heavy demands upon staff and resources disproportionate to their benefits can be identified and replaced. It is therefore essential that teachers and trainers themselves become involved in costing and cost analysis and in providing quantitative data to ensure that the ODL- and ICT-based innovations in teaching, learning, support, administration and assessment are cost-beneficial and cost-effective. Such cost studies are essential for using ODL and ICTs in the effective transformation of TVET.

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