Data driven decision-making in education and training

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Abstract

While the purpose of education may be debated widely, its funders, whether state or private, increasingly are needing evidence of their return on investment in all aspects. Recent advances in corporate driven decision-making processes have informed a wider audience of the potential to transform education from a qualitative debate with markers that can take half a generation to show, to one that utilises on-going data analysis linked to fiscal markers and proxies to inform decisions on previously undreamed of short timescales.

However, there is still a wide gap in understanding how data can inform the process. This lack of understanding includes understanding the nature of the issue, identification of markers, methods of data collection, alternative approaches to interpretation, attaching financial values to the data, and the value of the data itself.

This paper looks at the process through two case studies selected to demonstrate the diversity and commonality of approaches, and how appropriate planning, collection and interpretation of data can have critical short term and long term impact on all levels from the individual to the state level.

Introduction

Education is driven by many competing forces, and while politicians, philosophers and commentators may make statements that suggest that it is for the good of the individual, in reality education is funded by the state, and the politicians will make funding decisions based on many competing factors, including individual ideologies, current educational fads and the economic climate. The decision makers in countries as diverse as South Africa and Ireland attempt to find a balance between fiscal efficiency, an informed electorate and providing the qualified workforce that can engage in and expand the economy. However, simply providing the financial support is not enough to ensure technical expertise within the workforce. In these current times of economic volatility, and an information explosion through the internet that makes it difficult to decide what course of action to take, it is increasingly important to have a mechanism to prove the effectiveness of the education provided and therefore the return on investment, whether it be government schools, private education, or parents requiring proof of learning. However, as Naisbitt said, even before the era of the internet, “We are drowning in information and starved for knowledge.” [1982]

There is much debate about data-driven decision-making in education in many countries, and concern among many of the potential adverse impact. For example, in some countries, teachers are concerned that they be unfairly evaluated and rewarded (See for example Burns J, 2013) but also decisions will be made that are not in the interest of the child. However, research has shown

that due care and attention has to be paid to the way monitoring takes place. For example, with respect to Performance Related Pay (where income is related to measurable results), research suggested that while this approach may be effective in physical activities, it may have an adverse impact in areas where cognitive skills are required, such as teaching. [Ariely D, Gneezy U, Loewenstein G and Mazar N, 2009]

Even where this is not an issue, there it is the fear of change, the fear of accountability, a perception of increased workloads, and a sense that nothing good will become of their additional work. Therefore, the introduction of any system that attempts to use computers to manage and support learning needs to be carried out with an understanding and support of the users, namely the teaching profession.

The recent increase in the social acceptance of computers and the internet the rise of services such as online banking, booking holidays and social networking, improved connection speeds, and the decreased unit costs of technology means that the potential to harness the power of data management in education is here now. With appropriate deployment and management it is possible to provide cost-effective monitoring of the return on investment that previously could only be created through huge investments in manpower, and whose costs often exceeded the benefit that would be derived from that monitoring process. It is now possible for decision-makers at all levels from the classroom teacher to ministry level to allocate resources where appropriate, and track progress to provide evidence of learning, and demonstrate that the correct decisions are being made.

Together these help eliminates delays in implementation making the changes in education that users and funders have been demanding, while helping to feed the “now” culture that the internet has helped promote [Attwood, 2009; Gleick, 1999].

In order to identify the common themes in the deployment of such systems, two case studies are presented, from South Africa in mainstream vocational education and Ireland, monitoring transition from Primary to Secondary Schools with particular respect to hidden impairments.

Case Study 1 – South Africa

In August 2012, the South African government announced a target for job creation of 11 million by 2030, underpinned by an annual enrolment rate of 1.25 million in vocational colleges. To achieve their targets, graduation rate of FET colleges will need to rise to 75%. This should ensure availability of the 30,000 artisans needed each year to sustain the required economic growth. Against this is background of struggling educational standards, research in 2007 showing that a third of all children at school had repeated a grade while 52% had repeated by the time they were in the Further Education and Training (FET) phase (Grades 10 to 12) [Department of Basic Education, 2011]. Furthermore, only around 40% of youths get to obtain some qualification at the FET level. Successful completion of secondary schooling is currently 39% in South Africa, compared to similar countries achieving upper secondary completion ratios of between 50% and 60%. While standards are improving, it is not happening at a rate that will fulfil this government vision. One of the reasons is that most analyses identify the level of failure, but do not provide sufficient data intelligence to identify causes of failure, and how the system could be changed for effective improvement. The purpose of this current study was to identify the most important factors, and how they would, through effective data management, inform the decision making process at all levels. Figure 1 shows the levels and benefits.

Figure 1 – Access levels and benefits accrued at each level

Access level	Impact analysis
National	On-going monitoring of targets and progress, and influence planning. Potential to intervene before failure ensues. It can also identify the needs of the secondary school system to feed further education colleges.
District	Provide data to local authorities who can adapt to the needs at the district level, including how secondary schools promote courses to fulfil national vocational targets.
College	Identify hot spots of potential failure which need urgent support, and delivery of pan-college disability services. Helps identify areas that could benefit from increase marketing to maximised student intake in key courses.
Faculty/ Campus	Assist in the allocation of places upon student entry, matching the student skills to the necessary skills (e.g. literacy levels) required for courses, thus minimising the risk of failure. Also helps allocate student disability support services.
Course	The tutor is able to identify those students who need additional support, and who may be at risk of failure. It provides the potential to group according to ability, and ensure teaching is efficient and effective.
Student	Identify specific strengths and weaknesses and barriers to learning of the individual, highlighting areas that need supporting, and offer advice about alternative courses if the student is at risk of failing their course.

Against this background, a project was developed within the five colleges and 42 campuses of the Gauteng (Johannesburg) Province Further Education and Training (FET) Colleges to identify the potential of computer monitoring combining online and offline testing of students. Following a successful initial pilot study, the project was rolled out across all campuses and all courses. To date (March 2013) over 7500 students have been evaluated.

The Testing Protocol

Most analyses to date have, at best, attempted to highlight the academic failures, and not offered suggestions of where best to target support, or identify possible changes in policies. It was important that the protocol not only identified the areas of academic failure, but also attempted to highlight some of the weaknesses in underlying skills as well as the potential impact of socio-economic indicators. Research has clearly identified a hierarchy of skills that underpin literacy acquisition. [See for example Lehtonen A and Treiman R, 2007: Moats, 1995]. Therefore the testing protocol included not only the primary areas of reading and spelling, but also the secondary skills, such as syllabification, rhyming, alliteration, non-word reading and non-word spelling. To this was added a socio-economic questionnaire including language usage, as well as a set of self-assessment questions to help identify hidden impairments. Thus it was possible to identify the development level of each Individual.

Research has highlighted that acquisition of the cognitive skills that underpin literacy are not development but are part of reciprocal learning with literacy [Morais, Bertelson, Cary and Alegria, 1986]. This means that if these individuals had not been taught basis literacy skills (e.g. phonics) at an earlier age, they would still require that explicit teaching. Without it they would have difficulty advancing, especially when trying to access new vocabulary within the specialist curriculum

Although FET youths are at an age when would be expected to have been acquired these skills, the data shows that it is important not to make any assumptions without data-driven evidence. In this South African cohort, there were several compounding factors that suggested this approach was appropriate. These included:

1. Diversity of language background and early language acquisition
2. Diversity of socio-economic status and its potential impact
3. Educational history
4. Variability of teacher qualifications and teaching skills

Outcomes

To date, the most important outcome of the project has been the proof of concept and the potential to implement more widely, not only in FETs but also in Primary and Secondary schools. As more data is collected, the norming process will be refined, and the results become more robust, including using data intelligence to compare and contrast courses across colleges [Rana, Pabitra, Dey, Nath and Ghosh, 2012]. But already the implications are being seen in a wider context, and as integral to the fulfilment of government objectives.

Case Study 2 - City of Dublin Vocational and Educational Committee (CDVEC)

One of the functions of the Psychological Services section of the City of Dublin Vocational and Educational Committee (CDVEC) is to assist in the monitoring of academic progress of all individuals, including those with specific learning difficulties such as dyslexia. Complimentary to that is supporting teachers who help those identified as having literacy difficulties. Increased demands on the limited service had led to the investigation of viable alternatives, including

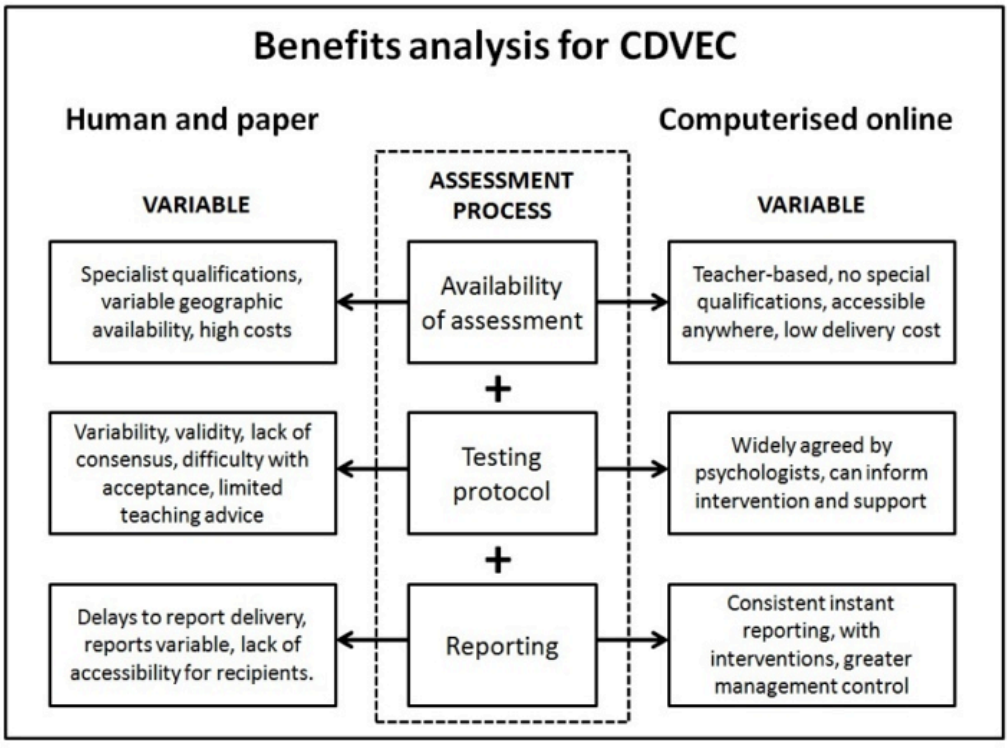
delivery of computerised assessment, at least in the role of a triage process. In order to ensure effective roll-out, six areas were identified as key to successful implementation. These were:

- The system could be used by classroom teachers with minimal training on the system.
- Tests would appropriate for the local population.
- The deliver should be through the internet, to provide the potential for central data management.
- Testing should be in a group setting, with minimal teacher support.
- Available reports would identify individual strengths and weaknesses as well as suggested interventions.
- There should be the option for grouping children with similar needs.
- It must provide a low cost solution.
- It must be sustainable within a wider community.

As part of the process of development, a qualitative comparison was made between the human/ paper based approach and that available with the computer. (See Figure 2.) The significant advantages offer through computerised testing, especially in terms of instant deployment and availability of results, were also significant drivers towards implementation.

One of the primary drivers was the need to provide monitoring of those pupils in transition from Primary to Secondary School. Traditionally, teachers knew the support needs of pupils in primary school. However, on transferring to a new school, that information did not always travel with the child. Consequently, the process of identification of the needs and support of the child would have to start again, with a potentially devastating impact upon the child.

Figure 2 – Comparison on human vs computerised assessment



The assessment battery was designed to reflect the standard testing protocols, combining the standard markers of academic performance (literacy and numeracy measures) with those know to be potential reasons why some children may fail in certain areas. Thus cognitive measures such as rhyming and alliteration were included in accordance with standard theories of a hierarchical structure to literacy skills development similar to that used in South Africa. The adaptation to local needs was facilitated by working with CDVEC Psychological Service, who also worked with local teachers to ensure all aspects suited their needs. To maximise acceptance, tests were developed to reflect those delivered by paper based methods. From the start, the system was designed to avoid the use of labels such as dyslexia. However, questionnaire were included that would facilitate the identification of the underlying traits that would help identify those with specific learning difficulties such as dyslexia (a difficulty in the acquisition of reading and writing skills) and dyspraxia (sometimes known as Developmental Coordination Difficulties – DCD).

The process has been widely accepted and moved beyond the piloting phase. Teachers have fully accepted the system, and have been encourages to contribute to its development, finding it useful not only for transition, but also for monitoring progress of all students. Increased use of video allows students greater direct access to support, thereby relieving teachers of what was originally seen as additional work. An important part of the acceptance is to acknowledge that it still has shortcomings, and does not in any was attempt to replace other specialist services.

Conclusions

> *Data is not information, information is not knowledge, knowledge is not understanding, understanding is not wisdom.* (Clifford Stoll)

Data is easy to generate. The difficult part is to implement change from an intelligent interpretation of that data. And in order to do that it is important to map out needs, and the purpose(s) of the exercise.

In both the case studies, the intent was loosely defined at the beginning, with the intention of discovering the potential given the level of acceptance. Since initial trials four years ago, the internet has become ubiquitous, with booking holidays and checking bank accounts not only be commonplace but also heralding an acceptance of online services not available until recently. This should not be underestimated from the perspective of acceptance of change by the end user. Add to that the knowledge gained from implementation, and we are now in an informed position to realistically map out client needs, potential fulfilment by technology and the expected (and realised) outcomes.

Without doubt, the capabilities and potential of the technology, even in the short term, has clearly exceeded many educators expectations, and while human assessors will be required for a long time to come, there is wide acceptance that with due respect to the limitations, many of the current shortcoming within this area of education can be overcome.

In addition there is exciting potential for researchers in the field of psychology and education. For example, we know that there is a strong correlation between the literacy of the parents and that of

the child and that learning through a second language has its own implications. But having access to data sets in the tens of thousands, in a county such as South Africa where there are eleven official languages and a chasm between the rich and poor, could produce much richer results than traditional small scale research.

Eight point plan for the roll out of national and local computer-based monitoring and evaluation services

- Engage teachers and those managers with respect to roll out of services – they need to feel a level of engagement, and the level needs to be just right. Provision of support material appropriate to the local needs
- Ensure material corresponds to something everybody is familiar with – the greater the leap to a new system, there more will be resistance to chance.
- Include the ability to group pupils and students by abilities – provides the teacher with an additional reason as to why they should use it.
- Identify those with similar special educational needs – Although label should be avoided, the protocol should assist identification in areas such as dyslexia and dyspraxia.
- Provide a brief summary report about an individual as well as more detailed analysis – teachers are busy, and do not have time to read all the information that can be produced.
- Provide hierarchical data for management – this provides details of where best to target support, whether it is at classroom or national level.
- Provide tracking through repeat measures – Re-testing after say six months is important to monitor learning and return on investment.
- Provide plenty of training – not to overcome shortcomings of the system, but to maintain the human side.

There is no doubt that online testing is here to stay. However, the format and roll out is still in question. It certainly has the capability to inform management and to support individuals. It will help overcome problems in key areas of support such as identification of special educational needs, shortage of specialists, geographic and time restrictions, speed of response, and costs. There are still some areas for improvement, especially around internet speeds in remote locations. And while there may be legal imperatives in the future (e.g. the UK Equality Act 2011), history show us that it is demonstrating the advantages of a system to its users, rather than any legal arguments, that will ensure its uptake.

However, assessments will also change in another way. At the moment, we are obsessed about demonstrating that learning has taken place after a given time and amount of learning, and that there is a valued return on investment. But if that assessment was integral to ongoing learning? Then the learner would have enhanced effective learning through selection of the most appropriate materials not only in subjects such as history and geography, but also literacy learning. And it is this type of paradigm shift that could change, for example, identification and support of those with difficulties in acquiring literacy skills.

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