Digital interoperability: the new frontier for academic integrity in the post-school education and training system [1]

James Keevy and Rooksana Rajab
JET Education Services
james@jet.org.za
rooksana@jet.org.za

Sebolelo Nomvete and More Manda
merSETA
snomvete@merseta.org.za
mmanda@merseta.org.za

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Introduction

While several roleplayers in the PSET system are moving towards the development of ICT-enabled solutions and platforms in South Africa to improve operational efficiency and governance, these developments are largely uncoordinated. The interface between these different developments lack interoperability and stands to benefit from improved coordination which will enhance efficiencies within the PSET system. This is in line with the decision for shared services to be developed across the SETAs in particular, but also in relation to the interface between SETAs, the DHET and other systems, including universities. What if we can use the disruptive technologies that have become so pervasive in the modern context to improve our education and skills systems? We now have the technology to develop self-sustaining electronic platforms for collaboration and learning opportunities, including the utilisation of data. These new digital ecosystems can provide us with limitless opportunities to rethink academic integrity, standards and qualifications in a new world based on the principles of interoperability. As authors based at a non-profit research organisation, and a Sector Education and Training Authority, we have been extremely privileged to be at the nexus of many of these developments.

In this paper we share the emerging experiences and insights that are part of a collaborative projected in the PSET system in South Africa. In particular we explore two concepts central to the undertaking, namely interoperability and a digital ecosystem.

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NOTE: this is an unedited draft prepared for the conference. Further work and refinement will be done prior to publication of the paper. We welcome any inputs and suggestions during this period.

The paper ends with a reflection on the nascent implications of these concepts on academic integrity in PSET, looking at this from a technological perspective.

Digital interoperability

The concept of interoperability amongst entities in the same network has been growing popular as a measure to promote information sharing, collaboration and improve efficiency in operations, planning and decision making. Interoperability can be defined as "the ability of independent systems and processes (technical and non-technical) to exchange data and information and communicate using common standards to enhance efficiency and service delivery" (adapted from Dos Santos & Reinhard, 2012:72). Interoperation thus occurs "whenever independent or heterogeneous information systems or their components, controlled by different jurisdictions/administrations or by external partners, smoothly and effectively work together in a predefined and agreed upon fashion" (Scholl & Klischewski, 2007:900).

In smart societies and smart government, public institution, civil society, business and other social partners need to adapt and collaborate with each other to fully leverage the advantages of new technologies. Interoperability is thus important in fostering collaboration between organisations (Manda & Backhouse, 2016). Moreover, Information sharing, focuses on the exchange of information, experience, innovation etc. among participating agencies so as to enhance efficiency and service delivery for the benefit of all stakeholders. For effective information sharing amongst organisations in the same network, interoperability is a prerequisite for information sharing. Effective information sharing and collaboration thus call for the need for organisations to build systems that are interoperable, putting in place formal standards and business processes to allow inter-organisational data and information sharing (Gil-Garcia, Schneider, Pardo & Cresswell, 2005; Gil-Garcia, Chun & Janssen, 2009).

The role of technology in promoting interoperability cannot be downplayed in governing (Scholl & AlAwadhi, 2016). Advanced technologies such as sensor networks, data analytics, artificial intelligence, and robotics can certainly make organisations and governments "smarter" by aiding efficiency, decision making, information sharing, transparency, accountability and efficient service delivery (Scholl & AlAwadhi, 2016). Governments worldwide are transforming to "smart governments" as a way of responding to increasingly connected and smart societies that demand efficient service delivery. The integration and interoperability of e-government systems and information sharing emerged as one of the key enablers of transforming governments into smart governments (Du & Qin, 2014; Gil-Garcia, Zhang & Puron-Cid, 2016).

Moreover, "as technological advances in data gathering, processing, and management continue, our ability to move from an information society to a "smart" society will increasingly rely on improvements and expansion in technical, organizational, and other aspects of interoperability" (Jiménez, Solanas and Falcone,

2014:22). Governments are however still experiencing blockages in moving up to higher levels of maturity due to challenges with the integration and interoperability of systems (Lam, 2005; Pardo, Nam & Burke, 2012). Achieving high levels of e interoperability is thus one of the most significant challenges facing governments (Lisboa & Soares, 2014).

There are myriad of barriers to integration and interoperability that are still puzzling academic researchers and practitioners. This notion is substantiated by Scholl and Klischewski (2007:890) who argue that "the complex nature or the exact extent of these challenges and constraints regarding interoperability are not well understood, neither in practice nor in theory". Several e-government researchers acknowledge the gap that exists in the literature but few have approached interoperability and integration using a multidisciplinary approach as advocated by Scholl (2008). Few such studies have been conducted in a developing country context. This study, which is conducted in South Africa, a developing country is set to contribute in closing this gap in literature.

Research on information systems interoperability has identified a complexity of constraints such as technological, social, political, legal and organisational barriers. Although it is not the scope of this study to look at all the barriers, an understanding of these barriers is critical in developing context relevant strategies that are responsive to the needs of the PSET system and South Africa in general.

Realisation of the concept: the national digital ecosystem for PSET in South Africa

According to Hardin (G2 Crowd, 2018), at the highest level, digital ecosystems are comprised of companies, people, data, processes and things that are connected by the shared use of digital platforms. These partnering ecosystems are created to enable collaboration and provide mutually beneficial results to all parties involved. The purpose of creating the digital ecosystem is to create a collection of flexible services and shared resource that can shifted around, grown and quickly adapted to the ever-changing needs of a business[2]. Any attempt in creating a digital ecosystem within the post school education and training system, must first take note of the current landscape and its inherent complexities of fragmented strategies leading to fragmented processes within the sector. Technology and the networks established need to also take cognisance of both the people involved as well as the strategies to be implemented in a specific sector.

The post-school system is understood as comprising all education and training provision for those who have completed school, those who did not complete their schooling, and those who never attended school. It consists of the following institutions, which fall under the purview of the DHET (2013):

- 26 public universities comprised of 14 "traditional" universities, 6 universities of technology and 6 comprehensive universities[i]. "

[2] https://blog.g2crowd.com/blog/trends/digital-platforms/2018-dp/digital-ecosystem (accessed 18 February 2019)

- 50 public technical and vocational education and training (TVET) colleges (formerly known as further education and training [FET] colleges);
- public adult learning centres (soon to be absorbed into the new community colleges);
- private post-school institutions (registered private FET colleges and private higher education institutions, also to be renamed TVET colleges);
- 21 Sector Education and Training Authorities have been established, each focusing on a specific economic sector. SETAs are responsible for developing and implementing sector skills plans, establishing and promoting learning programmes, and monitoring the training and skills programmes conducted by employers;
- the National Skills Fund (NSF); and
- regulatory bodies responsible for qualifications and quality assurance in the post-school system – the South African Qualifications Authority (SAQA) and the Quality Councils.

Across many countries, post-school vocational systems share a common purpose of improving the skills of people (both those that have and have not completed school); but differ in the way that they are constituted, funded, respond to labour market needs and even what they are referred to. This stems from the wide range of institutions that offer post-secondary vocational programmes. There are dedicated institutions, which focus only on short-cycle programmes. For instance, professional colleges in Switzerland and professional academies in Denmark. Some institutions offer both upper secondary and post-secondary programmes, such as the further education colleges in the United Kingdom. There are even some universities in the United Kingdom that offer bachelor degrees with a focus on vocational training. Some countries (notably Germany) have specialised university-type institutions offering technical Bachelors qualification (OECD, 2014).

While several role players in the PSET system are moving towards the development of ICT-enabled solutions and platforms in South Africa to improve operational efficiency and governance, these developments are largely isolated and uncoordinated. In addition, the South African PSET system is characterised by a multitude of information systems, computerised and paper-based or manual, which provide the basis for the many business procedures in which the PSET system must engage. This requires, among others, the development of and adherence to effective and adequate information standards governing PSET management information systems (DHET, 2018).

In pursuing the need to investigate whether cutting edge technological approaches such as interoperability for the development of a self-sustaining electronic platform will provide a solution for collaboration, planning and other learning opportunities for the PSET system in South Africa, a non-profit research organisation JET and the merSETA have come together as project partners.

The purpose of the overall project is to establish an integrated digital ecosystem that will strengthen, integrate, coordinate and improve efficiencies in the governance and management of the PSET Ecosystem. The main objective of the project is to ensure that data sets are interoperable, well synchronized and used effectively as sources of information for analysis, planning and improving efficiency in the post school education and training system. Some of the biggest opportunities and advantages of creating a digital ecosystem includes the ability to leverage machine learning and deep learning for data analysis eliminating human bias.

This current initiative in South Africa, which attempts to improve interoperability across education and training systems in the post-school sector is at an early stage, but some of the main principles have been agreed and are briefly summarised below[3].

Principle 1: Cooperation on a systems level

Cooperation at this level is best sought nationally to start with and requires strong leadership. In some countries, this is best done by a government agency, and in others with more liberal economies, the private sector could take the lead.

Principle 2: Consolidation of systems

Linked to principle 1 above, a careful review of existing systems is required to provide a basis for interoperability. Many systems are in place on national levels, and these provide the first level of consolidation. Some may be outdated and based on expensive and archaic technologies, while others may be modern and ready for integration. The identification of obvious compatibilities is a good place to start, which can readily lead to a tipping point, as the core national systems are included in the emerging ecosystem. This process requires technical expertise with an inclusion of experts that may have had very little interaction with educational policy measures.

Principle 3: Data standards

Once a basic level of cooperation has been established, and system consolidation has been completed, the need for data standards will become obvious. These standards will provide the necessary guidance to find the synergies and common elements within individual systems which can be linked in a broader interoperable system.

Principle 4: Proactive development of missing sub-systems

Proactively coordinate, facilitate and encourage the development of sub-systems where gaps are identified, including the specific articulation with career development services, such as CDS and CACH, the NLRD, TVET MIS and others.

[3] Also see the five principles of the Joined-Up Data Standards project: using and re-using existing standards, not overlooking metadata, using common classifications wherever possible, publishing data in machine-readable formats and ensuring that standards are user-driven [Steele and Orrell, 2017]

Principle 5: Introduce innovation

Develop innovative and cutting-edge aspects of using artificial intelligence-based solutions, including tacit object modelling.

Principle 5: Knowledge sharing and creation

Set up and maintain a clearinghouse for research and publications that affect the PSET system.

Principle 6: Effective monitoring and evaluation

Develop and make freely available M&E tools.

Principle 7: Share with and draw on global learnings

Draw on the best insights and learnings from across the world (see Gloss et al 2015), UNEVOC, and the ILO, through the establishment of an international advisory panel.

JET and merSETA hold the view that digital solutions and ecosystems should be built only after understanding the interaction that needs to be facilitated for the participants on the system concerned. In addition, it is extremely important to ensure that building such an integrated interoperable national data system is both viable and feasible.

Implications for academic integrity

We see a trend towards digital ecosystems as a basis for new conceptualisations of lifelong learning. While policy measures, be they national, regional or global, attempt to provide greater levels of integration, progress remains slow and by far outpaced by developments in the digital world. We now have the technology to develop self-sustaining electronic platforms for collaboration and learning opportunities, including the utilisation of data. These new digital ecosystems can provide limitless opportunities to think about literacy and skills development for the new world based on the principles of interoperability. This may read as lofty claims, but the point is that in practice, much is already happening.

Policy measures, at various levels ranging from the SDGs, to regional and national mechanisms, are at one point or another translated into systems. The problem, as noted above is that policies change slowly, at least, much slower than what systems are able to evolve in the current context. So, while we should continue to collaborate as a global community on policy measures, perhaps it is time to embrace the disruptive nature of digital systems and shift our focus to increased cooperation and collaboration at this level. By actively engaging all roleplayers in a coordinated and consultative manner to ensure buy-in and collaboration we can start national conversations to start with, but also on regional and global levels, on the interrelationships between systems. In most cases, and more so in the developing world, systems are developed in isolation from each other, often with much duplication and limited attention to interoperability. This is not a criticism of the work

done by those that came before us, it is simply a fact that the technology we now have at our disposal allows us to think across systems, and beyond the limits of what the human mind can achieve.

One of the best examples to demonstrate this point is the thought leadership paper developed by Huawei and CSR Asia (2018) that explores how ICT can enable and accelerate the achievement of the SDGs. Amongst many useful contributions, the paper calls for "collective action, urging key players in the educational ecosystem – governments, regulators, policymakers, non-governmental organisations, educational institutions, teachers, content and ICT solutions providers, employers, investors and funders, learners and their families – to actively participate in helping shape a better future for education in the region" (2018: 2). A useful mapping of the roleplayers and key actions that each should take is included below (also see MGI 2018 and DIAL 2018: 5).

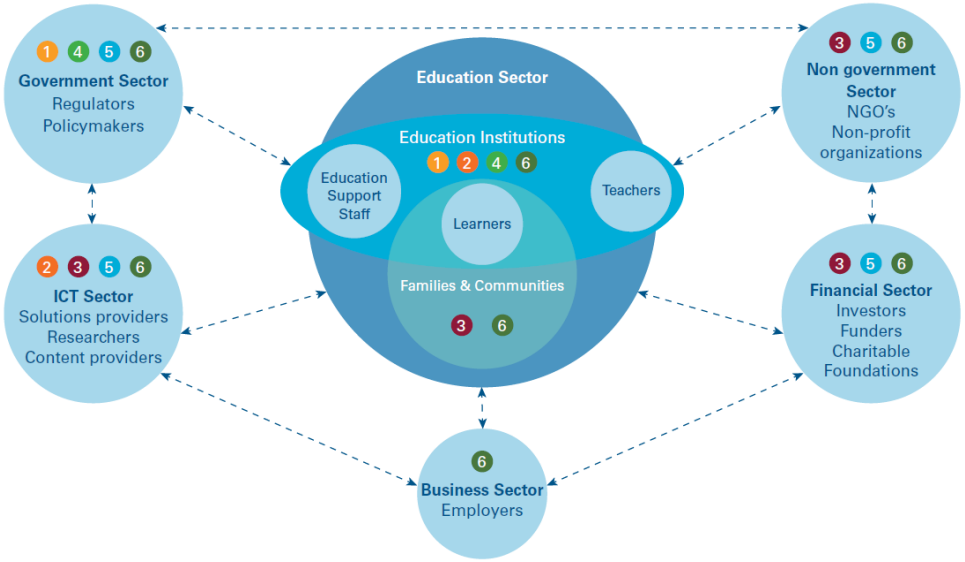

Figure 1: Roles of education ecosystem roleplayers (SAR Asia 2018)

(Legend: 1: Reboot education; 2: Rewire the classroom; 3: Zoom and scale; 4: Upgrade teachers; 5: Short circuit the barriers; 6: Enter the game)

In its simplest form, the type of interoperability being strived for in digital ecosystems, such as the two mentioned above, is about joining data from different sources, but in a standardised and contextualized manner. It is also more than datasets. The purpose is to enhance efficiencies beyond that which is humanly possible:

> In simple terms, interoperability is the ability to join up data from different sources in a standardised and contextualised way. However, it is about more than just the form and structure of data, it is also about solving problems in a joined-up way. Interoperability can help reduce the time, effort and expense exerted on data collection; eliminate the frustration and risks associated with handling inconsistent and incomplete data;

> and meet the need for internationally comparable, sustainable, disaggregated data to ensure that no one is left behind (Steele and Orrell, 2017: 1).

But what does these technological advances mean for academic integrity? There seems to be two views on this:

> Technology is making academic integrity easier every day. Electronic journals can be accessed from any computer, which makes getting the correct quote and right reference for your bibliography simple. RefWorks, for example, automatically formats, organizes and manages your citations. Unfortunately, technology makes violations to academic integrity easier, too[4].

A more interoperable data ecosystem in PSET in South Africa is undoubtedly subject to these tensions at the very elementary level of referencing. But there are also much broader systemic considerations to take into account, considerations that will impact on academic integrity in a much covert and undetectable manner. Increasingly the internal community is becoming more critical of online platforms that have become pervasive (think Facebook, LinkedIn, Twitter and many others), and that have in different ways shown weaknesses (think Cambridge Analytica). The emerging view is that the problem is not with the technology, but with human nature. Pariser (2019) in a recent contribution for *Time* draws an analogy from the conflict resolution context wherein "conflicts came about when people felt they were being disrespected and treated as worthless…", adding that "online spaces fail us on all these fronts" (2019:34). Pariser is not alone in this view.

While a more detailed analysis of the link between technology and academic integrity lies beyond the scope of the conference paper, it is safe to say that the implications of digital interoperability in digital ecosystems for academic integrity are multiple. We highlight a few below.

Firstly, improved interoperability provides a strong foundation for the enhancement of efficiencies, including the creation of shared data systems, and most critically the interfaces between systems within PSET. Triangulations of datasets will become the norm in this new context, and the weaknesses in some datasets, will be addressed by others. In other words, the whole will become much more than the parts it is made up of. This new ecosystem will allow for richer and more valid and reliable data harvesting, which in turn can only be good for research and data integrity.

Secondly, a move based on greater inclusivity, partnerships and consultation, and most importantly, a move that recognises the "value of 'non-traditional data'" such as data from citizens, NGOs and the private sector will contribute further to the spectrum of research that can be done in a credible manner.

Drawing on the 2017 UN World Data Forum (UNWDF), which resulted in the "Collaborative on SDG Data Interoperability" (Steele and Orrell 2017:20), we note thirdly that interoperability and data ecosystems can contribute to (2017:11):

[4] https://www.unl.edu/gradstudies/connections/academic-integrity-and-technology (accessed 24 February 2019)

- modernise governance and institutional frameworks to allow national statistical systems to meet the demands and opportunities of evolving data ecosystems
- modernise statistical standards, particularly those aimed to facilitate data integration and automation of data exchange across different states of the statistical production process

Concluding comments

The South African PSET system has many strengths and weaknesses. Our view is that instead of trying to address all these systems individually, there is greater power in the collective. Digital interoperability in PSET can have a significant backwash effect, through which we can strengthen academic integrity across PSET institutions.

The journey we are on as a global community, with South Africa strongly in the front runner's group, has been underway for some time and there is no turning back. The digital ecosystem being championed by JET and merSETA, now also with the CSIR, and in strong collaboration with the DHET, is at the cutting edge of these developments. As a country we can stand back and cite many concerns about the potential negative impact on academic integrity, personal information and intellectual property, or we can embrace this move, lead the way, and make sure we stay one step ahead.

In our view, better data harvesting, drawing on a modernised and agreed national statistical system, and guided by modern statistical standards, is fundamental to the South African PSET system and is undoubtedly the new frontier that we need to actively explore.

We invite all interested researchers to contact us as this journey starts in all earnest.

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[i] Traditional" universities offer general formative and professional academic programmes including undergraduate, Master's and PhD graduate programmes, while "Universities of Technology" are more focussed on providing undergraduate career-focussed programmes. Comprehensive universities combine the functions of both of these types of universities.