Challenges faced by lecturers in the use of fourth industrial revolution tools to equip pre-service teachers in a South African university

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ABSTRACT: Higher education institutions are experiencing a progression in terms of embracing fourth industrial revolution (4IR) tools to equip pre-service teachers, and universities in Gauteng, South Africa, are no exception. However, this is not the case at every university there; hence, in this article, the authors present the challenges faced by some lecturers in the use of 4IR tools to equip pre-service teachers at one such university. The study employed a qualitative method, pertaining face-to-face interviews with six lectures from selected departments at that university. The collected data were analysed manually identifying the relevant themes by the use of codes. These themes are presented and discussed in a narrative way together with some verbatim comments. The findings indicated that there was a lack of adequate professional development (PD) for the use of 4IR tools in lectures and the used 4IR tools were inadequate. Based on these findings, the researchers recommended that higher professional development standards have to be adopted coupled with appropriate funding for the required 4IR resources.

INTRODUCTION

The 4th Industrial Revolution (4IR) is beyond an enhancement of the 3rd Industrial Revolution (3IR), as in the 4IR the progression of new technologies blurs the lines between the physical, digital and biological worlds. The new technologies evolve at an exponential pace, and there was no historical precedent that marked the beginning of the evolution; hence, the name *disruptive technologies* was coined. These advancements are led by the emergence of artificial intelligence, robotics, the Internet of Things (IoT), autonomous vehicles, bio and nanotechnology, 3-D printing, materials science, quantum computing and energy storage [1].

The integration of 4IR tools in educational structures is a relatively new approach that is currently being incorporated in learning environments. The driving force behind this new approach is to increase the quality of teaching and learning, which has been a seemingly important concern for systems of education in general, and South Africa is no exception.

Presently, there is a growing emphasis in educational policies on the integration of ICT in teaching. This is due not only to the rapid development of ICT, but also to the pursuit of quality teaching practices in improving student outcomes. [2]. In the case of universities, technology has begun to change education, affecting how students acquire the skill sets needed to prepare for careers and how lecturers integrate digital technological instructional strategies to teach.

LITERATURE REVIEW

With the rapid advancement in educational technology, many researchers have suggested the use of technology across all disciplines, including teacher education to produce positive results in teaching and learning [3]. The new vision of learning promotes learners to learn not only the skills and knowledge that are needed, but also to identify the source to learn these skills and knowledge [4].

Learning is built around them as to where and how to learn, and tracking of their performance is done through data-based customisation. Peers become very significant in their learning. They learn together and from each other, while the teachers assume the role of facilitators in their learning. Fisk argues that there are nine trends related to 4IR teaching and learning environments [5]. These trends entail:

1. Learning takes place anytime, anywhere through engaging e-learning tools;
2. Learning is personalised to individual students as they may be introduced to harder tasks only after a certain mastery level is achieved;
3. Students have a choice in determining how they want to learn, as they are still free to choose the learning tools or techniques that they prefer;

4. Students are exposed to more project-based learning, and are required to apply their knowledge and skills in completing a couple of short-term projects;
5. Students are exposed to more hands-on learning through field experience, such as internships, mentoring projects and collaborative projects, taking advantage of the progression in technology, which enables the learning of certain domains effectively, thus making more room for acquiring skills that involve human science and face-to-face interaction;
6. Students are exposed to data interpretation in which they are required to apply their theoretical knowledge;
7. Students are assessed differently and the conventional platforms to assess students may become irrelevant or insufficient;
8. Students' opinions are considered in designing and updating the curriculum;
9. Students become more independent in their own learning, thus forcing teachers and lecturers to assume a new role as facilitators who guide the students through their learning process [5].

Moreover, research has indicated that the progression of technologies keeps on changing and transforming the teaching method and the setting of the learning process, and that in the next five to seven years, there will be a huge change in the layout of the classroom; virtual and augmented reality will change the educational landscape; flexible assignments will accommodate multiple learning styles; and massive open on-line courses (MOOCs) and other on-line learning options will impact education [6].

However, in a keynote address at the 63rd International Council on Education for Teaching (ICET) World Assembly 2019, it was indicated that:

1. Although the 4IR presents an array of opportunities to many people and better opportunities for organisations, it also requires people to be digitally savvy;
2. Mere possession of 4IR skills does not necessarily equal a meaningful use and impact;
3. New practices towards achieving a meaningful impact require cultivating digital fluency and training, especially at first-year student level;
4. To empower people in education, there need to be alternative education modes through short learning courses, diverse modules and cost-efficient courses that have widened content;
5. Although the 4IR will be the driver and beneficiary of the South African higher education sector, there are challenges in broadening access to higher education for the poor, creating larger pools of unemployed graduates, under diminished state funding for education, among other tests;
6. There is still a huge gap between human and computerised problem-solving skills [7].

The consensus view seems to be that the greatest single contributor to student academic success is the successful development of highly 4IR skilled lectures. Simply talking about this revolution in education will not lead to high-quality outcomes if instruction remains static. Lecturers need ongoing opportunities to attain and refine the highly specialised skills needed to instruct in new ways demanded by technology and a competency-based curriculum [8].

High standards for lecturers and teaching need to be in place, through equipping them with appropriate technology, curricular and instructional guidance, 4IR resources, and high-quality professional development (PD) and support. As a result, lecturers, who are the change-drivers, can successfully deliver high quality, interactive and outcome-based instruction that is responsive and adaptive to the changing needs of the pre-service teachers, in South Africa and in other parts of the world.

To be successful, technology-related initiatives must be systemic. To be systemic, 4IR training must provide lecturers with ways to apply new learning directly to their teaching and support teachers as they do so. One-shot workshops with little direct connection to the classroom or follow-up have minimal impact on teachers' advancement [9].

Further, research has noted that lecturers are continuously seeking methods to maintain student attention and to develop forms of interactivity as a feature of enhanced pedagogy, and that it is crucial to understand the way through which teachers and students interact and benefit from the use of the technology that is supposed to lead to educational advantage [10]. Hence, in the context of the 4IR expectations, the ultimate goal of any educational system would be that technology be a central part in providing teachers with high quality PD and support, so that pre-service teachers receive a high-quality education. However, this is not the case at the departments involved in this study; hence, the need to explore the challenges faced by some lecturers in the use of fourth industrial revolution tools to equip pre-service teachers. It was with regard to such challenges that the researchers were motivated to investigate the perceptions of lectures involved in this study in order to alleviate or minimise them.

RESEARCH METHODOLOGY

This study used qualitative research methodology to explore the perceptions of six lecturers in the use of 4IR tools in their teaching and learning environments. Qualitative methodology is defined as a methodology that does not accept that there is only one reality in the world one lives in. Qualitative researchers assume that everyone views the world in their own way. Therefore, one cannot trust that …*there is a single unitary reality apart from our perceptions* [11]. The qualitative research approach holds the view that the world is not fixed, single or measurable.

A qualitative approach is chosen due to the reason that it shows a great potential value to this study for the researcher to get in-depth and rich data on the experiences of teachers in the use of digital technology for teaching and learning. Since the qualitative research approach assumes that the world cannot be viewed as a single reality, it is suitable to be used in this study, because the way the participants gave different accounts of their experiences on the use of digital technology depended on their natural setting. Convenience sampling was used to select the participants of this study. Convenience sampling is a type of sampling that …*involves the selection of the most accessible subjects, it is the least costly to the researcher, on terms of time, effort and money* [12]. The six lecturers from various departments of the faculty that provides teaching in the use of fourth industrial revolution tools to equip pre-service teachers were investigated through face-to-face interviews.

In this qualitative study, the researchers were obliged to ensure that the research findings were credible and trustworthy, so that they could be interpreted, applied in the field and benefit researchers and other interested parties. Validity in qualitative research refers to the degree of congruence between the explanation of the phenomenon and the realities of the world [11]. Qualitative researchers, such as McMillan and Schumacher [13] and Given et al [14] suggested that the validity assumptions applicable in the naturalistic paradigm are inappropriate for evaluating qualitative research, and proposed four trustworthiness criteria, which include credibility, transferability, dependability and confirmability. These criteria and their specific activities were adhered to in this study.

Before going to the field, the researchers ensured that all the participants were informed about the purpose of the study. Participation in the study was voluntary as the participants were informed of their rights to withdraw from the study at any time. Consent forms were distributed to the participants to confirm or decline their participation in this study. Confidentiality and anonymity were ensured by concealing the participants' real names.

RESULTS

The demographic information of the lectures who participated in this study was elicited through the first part of the interview schedule. This was done in order to better contextualise the results. Table 1 below represents the profiles of the participants.

Table 1: Profiles of the lecturers.

Gender	Female		Male	
	2		4	
Age	20-30 years	31-40 years	50 years and above	
	2	3	1	
Level taught	Level 1	Level 2	Level 3	
	1	3	2	
Lecturing experience at university	1-5 years	6-10 years	11-15 years	16 years and above
	2	2	1	1

The study reconnoitred the lecturers' views under the following themes, which emerged from their responses:

1. The adequacy of 4IR tools to equip students with the required skills.

The lecturers were asked to elucidate their experiences on whether or not there were adequate 4IR tools to equip pre-service teachers with the required skills. Some of the lecturers' views are presented below:

- *There are not adequate 4IR tools to equip pre-service teachers in the University;*
- *Tools are not provided to equip students with the required skills, in terms of using media and projection of information;*
- *Not adequate;*
- *I have not seen any, except the projectors that do not function most of the time;*
- *Nothing of that nature yet;*
- *There are no 4IR tools around.*

2. Challenges that lectures face in developing the necessary skills and knowledge for teaching with 4IR tools.

The lectures were requested to indicate any challenges that they faced in developing the necessary skills and knowledge for teaching with 4IR tools. In this regard, the following are some of the responses from the interviews:

- *Yes, the challenge that we face as lecturers is that the tools are not provided for students so that good teaching can be created;*
- *Yes, the lack of tools;*
- *There is a lack of 4IR tools, as well inadequate exposure on how to use these tools;*

- *Yes, the tools are limited, e.g. digital technology, high-speed mobile Internet;*
- *Yes, we are experiencing problems because the resources are limited. Today, the 4IR is driven by digital technology and its ability to fuse physical, digital and even biological elements; which we lack in this department;*
- *Yes, due to the lack of resources, we end up teaching only the theory part of curricula.*

3. Guidance by the subject curriculum on how to integrate 4IR tools with teaching and learning.

The lectures were requested to elucidate if the curriculum of their subject(s) guide them how to integrate 4IR tools with teaching and learning. About this matter the following are some of the responses captured from the interviews with the concerned lecturers:

- *No;*
- *No, it does not guide but as a teacher I would think of how to make use of these tools if only they were made available;*
- *No, actually most of it is now irrelevant if we were to use 4IR tools;*
- *Not at all;*
- *Partly, some aspects of it are irrelevant to the future economic climate and job trends;*
- *No, it does not have a guideline regarding that.*

4. Satisfaction with the 4IR opportunities given by the pre-service educational structure and curriculum framework.

The lecturers were asked to elucidate their experiences on whether or not they were satisfied with the 4IR opportunities given by the pre-service educational structure and curriculum framework. Some of the lecturers' views are presented below:

- *Not satisfied;*
- *No, not enough tools provided;*
- *Not satisfied as it is limited;*
- *I'm not satisfied because the resources are limited;*
- *No, I am not, because I think the department can do better than it is doing now;*
- *No, because 4IR opportunities were not given.*

5. Possible solutions to any perceived challenges that hinder 4IR tools from being used in some classes.

The lecturers were asked to provide briefly their own views of the solutions to any perceived challenges that hinder 4IR tools from being used in some classes. Some of the lecturers' views are presented below:

- *Need more development;*
- *We need to catch up with latest trends but it starts with training and procurement of relevant resources which are still at a very low level now;*
- *More training and development is needed in this field;*
- *Internet access and security must be improved on;*
- *Provide adequate 4IR tools and equipment, as well as align curricula to 4IR trends;*
- *More tools should be generated in order to enhance 4IR.*

CONCLUSIONS

The findings indicated there was a lack of adequate professional development in the use of 4IR tools in lectures; inadequate 4IR tools; and that the lecturers were not satisfied with the 4IR opportunities given by the pre-service educational structure and curriculum framework. It was evident that there were substantial factors that deter some lecturers from the use of fourth industrial revolution tools to equip pre-service teachers. Lecturers need ongoing opportunities to attain and refine the highly specialised skills needed to instruct in new ways as demanded by technology and a competency-based curriculum [7].

Research has noted that lecturers are continuously seeking methods to maintain student attention and to develop forms of interactivity as a feature of enhanced pedagogy, and that it is crucial to understand the way through which teachers and students interact and benefit from the use of the technology that is supposed to lead to educational advantage [10].

Based on the findings of this study, the researches recommend that the departmental heads should urgently adopt high quality standards that guide the professional development of lecturers, as well as ensure the adequate funding for the fourth industrial revolution resources in order for the lecturers to effectively equip pre-service teachers. Also, the researchers intend to conduct another study in which they will deliver lectures together with the lecturers using relevant 4IR tools. This will be done in order to further investigate the perceptions of the lecturers on the impact that these tools have in education.

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