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ATTEMPTS TOWARDS ALLEVIATION OF SOCIAL INJUSTICES WITHIN SOUTH AFRICAN UNIVERSITIES

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Abstract

Education is viewed as a tool that is used in South Africa to achieve equity, eliminate historical inequalities and promote national growth. The South African education system is characterised by socio-economic disparities which serve to perpetuate social injustices in relation to the provision of quality education. The South African Department of Higher Education (DHET) advocates for strongly for a social justice intent, through its Open Learning Policy Framework. The DHET's Open Learning Policy is built around the constructs of pedagogy, access to learning and mechanisms of success. The DHET's primary goal is to improve access to higher education to all South Africans. The COVID-19 pandemic, resulted in an increased distance between student and contact universities, consequently widening already existing social injustice. A generic qualitative study was undertaken to explore, the approaches adopted by one South African university to determine the mechanisms applied by the institution's faculty of education, to alleviate social injustices through open learning. Purposeful sampling was followed for participant selection. Data was then collected in the form of interviews, public facing documentation and institutional reports. Guided by Nancy Fraser's social justice theoretical framework, results emanating show that universities understanding of "open learning" is shaped by their contextual readiness for open learning. The results emanating from the study indicate that South African universities are creating opportunities of greater access, through alternative routes to learning to school leavers and as well as some working professionals. This is achieved through the development of a Virtual and Augmented Reality (VAR) hub at a South African university. The VAR hub serves as a tool to address the articulation gap between the schooling and post schooling sector through parity of participation within the broader South African context. The hub creates opportunity for access to students for the sustainable integration of VAR applications in the field of science education thereby enhancing epistemic and epistemological access in science education. Thus, the use of VAR applications has the potential to alleviate socio-economic injustices.

Keywords: *Access, education, open learning, science, social justice, virtual reality, augmented reality.*

1. Introduction

Over the years, universities have been instrumental in addressing various social injustices globally. This is because universities play a crucial role in shaping the values and beliefs of individuals who are likely to be future leaders in different fields. As such, many universities are making significant efforts towards alleviating social injustices globally. Access to quality education has been a long-standing problem in South Africa. In 2020, the COVID-19 pandemic, and national shutdown, reverberated the inequalities that still exist some twenty plus years into a democracy. A digital divide, challenges of wireless connectivity, load shedding, and access are but a few that made the continuation of learning challenging for many students. According to Pearson Jr and Reddy (2021), the post COVID-19 era, is likely to widen the education inequality gap. Sadly, the South African Population and Registration Act of 1950, classified and categorised people based on their race. Sociologists term this structural racism that still influences the education opportunities available to individuals and their ability to succeed (Caliendo, 2015). As such this cascading effect influences students' access to universities in South Africa, placing emphasis on students' final grade twelve results and their access to financial resources (Rogan & Reynolds, 2016). Hence the DHET's Policy on Open Learning, explicitly aims to "introduce open learning practices as one practical way of addressing crucial issues of widening access to affordable, quality learning opportunit[ies]" (DHET, 2017, p.366). Thus open learning is defined as an educational approach which combines the principles of learner-centeredness, lifelong learning, flexibility of learning provision, the removal of barriers to access learning, the recognition for credit of prior learning experience, the provision of learner support, the construction of learning programmes in the expectation

that learners can succeed, and the maintenance of rigorous quality assurance over the desire of learning materials and support systems (DHET, 2017, p.363). According to DHET, as a principle-based concept "open learning is fundamentally about access and success, with flexibility of provision contributing to expanded access and quality of provision contributing to improved student success.

1.1. Virtual and augmented reality

Virtual reality (VR), augmented reality (AR), are examples of immersive systems that have the protentional to enhance student learning. Virtual reality is defined by Sacks et al., (2020) technology that makes use of computers, software, and peripheral hardware to generate a simulated environment for the user. Whilst augmented reality combines the real and virtual worlds in an active manner through animations. Empirical study by Abdinejad et al., (2020) suggests that these technologies respond to students' curiosity and consequently has the potential to enhance student conceptual understanding of abstract concepts such as those taught in the field of sciences. Thus, virtual reality (VR) and augmented reality (AR) technologies have great potential to enhance the learning experience for students with disabilities, including those with visual or auditory impairments. By providing an immersive and interactive environment, VR and AR can create a more engaging and accessible learning experience. Thus, as society progresses into the 21st century we see the use of VR and AR becoming increasingly popular. These technologies create simulations that allow students to experience a particular environment or situation, such as a historical event or a scientific experiment, in a way that would not be possible in the real world. AR can be used to enhance the learning experience by overlaying digital information on top of the real world, such as labeling objects or providing additional information about a particular topic.

1.2. Open learning

Open learning in the South African context refers to a flexible and accessible mode of education that allows individuals to access educational opportunities, regardless of their physical location, time constraints, or financial status. This mode of education is becoming increasingly important in South Africa, as it helps to address the challenges of unequal access to education, particularly among disadvantaged communities. The South African Department of Higher Education and Training (DHET) introduced Open Learning as a transformative response to the many challenges it faced during the apartheid era. DHET has promulgated several policy documents on open learning (DoE, 1997; DHET, 2013); DHET, 2017). Open learning is defined in the White Paper for Post-school Education and Training as an "approach which combines the principles of learner centredness, lifelong learning, the flexibility of learning provision, the removal of barriers to access learning, the recognition for credit of prior learning experience, the provision of learner support, the construction of learning programmes in the expectation that learners can succeed, and the maintenance of rigorous quality assurance over the design of learning materials and support systems" (DHET, 2013: 48). This definition is also encapsulated in the Open Learning Policy Framework promulgated by the Department of Higher Education and Training (DHET, 2017). Open Education Resources (OER) are freely accessible educational materials that can be used, adapted, and shared by anyone (Hoosen & Butcher, 2019). OER includes textbooks, videos, assessments, and other types of learning content that are openly licensed and available for use by educators, students, and self-learners. According to Cannell, Macintyre, & Hewitt (2015), OER's have the potential to expand access and promote student success.

1.3. Social justice

The study is underpinned by the theory of social justice framework proposed by Fraser (2005). As a theoretical lens, the framework provided insightful elucidation into the extent to which initiatives promoting access, quality and success respond to historical and contemporary social injustices as well as conditions that enable and constrain success. According to Fraser (2005) social justice can be achieved through "parity of participation". Fraser (2005) assigns a generic meaning of justice to "parity of participation" as all individuals having equal opportunities to participate fully and equally in all areas of education. Thus, parity of participation indicates that all individuals should have equal access to educational opportunities, regardless of their socio-economic background, race, gender, or any other characteristic. This includes access to quality schools, teachers, resources, and facilities, as well as opportunities for extracurricular activities and higher education.

2. Methodology

The study adopted a qualitative research design located within the interpretivist paradigm. The qualitative design provided insightful interpretation into the universities initiatives towards opening up learning avenues to its students through the use of VAR applications as a means to alleviate social

injustices in STEM education. Data collection involved the use of semi-structured interviews with purposively selected VAR team members. The VAR team members provided insights into the pedagogical affordances of the integration of VAR applications as a means to develop scientific literacy in STEM education through open learning. The VAR hub development team members further provided insights into the strategic vision that inspired the establishment of the hub itself. Collected data were transcribed verbatim and the emerging themes were generated from participants' narratives. Qualitative data was subsequently thematically analysed using axial coding.

3. Findings

Key findings that emanated from the study are presented as follows:

Theme 1: Professional Development of STEM teachers

The establishment of the VAR hub was inspired by the critical need to professionally empower pre-service and in-service teachers with knowledge and skills in the use of advanced learning technologies in STEM. The hub provides opportunities for innovative utilisation of VAR applications to develop disciplinary knowledge to address pervasive knowledge gaps in key STEM domains. These sentiments are encapsulated in the following excerpt from the VAR team members.

> *Broadening educational pathways in STEM education requires the use of interactive technological applications such as VAR applications to foster pedagogic innovation in STEM teaching and learning. These applications can be harnessed to demystify abstract scientific concepts in key STEM knowledge domains* (Participant 1).

Professional empowerment of pre-service and in-service teachers with knowledge and skills in the use of advanced learning technologies in STEM remains a key strategic imperative. The realisation of this key strategic imperative hinges to a large degree on the active involvement of the Department of Basic Education and other key stakeholders in innovative undertakings of this nature as the following excerpt illustrates.

> *The VAR hub development team is engaging the Department of Basic Education and other key stakeholders to forge a partnership geared towards the promotion of public awareness of the pedagogical affordances of VAR applications in South African schools. It is envisaged that appropriate arrangements can be made to train teachers on the use of VAR applications as part of the partnership* (Participant 2).

Theme 2: Significance of VAR applications in STEM education

The participants highlighted the pedagogical significance of VAR applications in the development of scientific literacy in STEM education. Pedagogical affordances of VAR applications in STEM education are explicated in the following excerpt.

> *VAR applications can be used to develop learners' visuo-semiotic reasoning skills and foster interactive learning in science classrooms. In addition, they can be used as semiotic tools to enhance conceptual understanding of abstract scientific concepts* (Participant 3).

It is argued in this paper that access to VAR applications can be facilitated through open learning. Virtual and augmented reality (VR and AR) have the potential to revolutionize education by providing immersive and interactive learning experiences that can enhance student engagement, understanding, and retention of knowledge when dealing with abstract science concepts. VAR can provide a 3D visual representation of complex concepts, making them easier for students to understand and visualize. For example, students can use VAR to explore the inner workings of cells or to understand the principles of physics. VAR can also provide a safe and controlled environment for students to conduct experiments and simulations that would be dangerous or impossible in the real world

Theme 3: VAR applications as a means to support academic research

While the efficacy of VAR applications in the enhancement of teaching and learning is duly acknowledged, there is a critical need for formal empirical studies on the use of VAR applications within the broader South African context. The following excerpt highlights possible areas of research.

> *Teachers' and learners' experiences of VAR applications can be examined as part of formal empirical studies. Pedagogical affordances of domain-specific VAR applications can also be investigated. In addition, the extent to which the use of VAR tools fosters deep learning through the development of higher-order thinking skills merits investigation as well. Other research areas include the use of VAR tools to foster science inquiry-based learning and the exploration of the impact of the use of VAR tools on different individual characteristics (e.g., level of performance, motivation, spatial ability)* (Participant 4).

Context-specific exploration of the impact of VAR applications on teaching and learning is of vital significance as this critical endeavour would serve to provide insightful elucidation into the nature of intrinsic and extrinsic contextual factors affecting the sustainable integration of VAR applications in

STEM teaching and learning in various educational settings. VAR is expected to be a critical enabler of industry 5.0, by providing new opportunities for innovation and enhancing productivity across various industries. Fukayama (2018), states that Industry 5.0 is a smart society guided by innovation and propagates the convergence of physical space and cyberspace. Industry 5.0 is an era that demands the mastery of science and technology but also emphasises humans' ability to carry out their functions in collaboration with technology. Essentially, humans require the competence to solve emerging problems by utilising technology, intelligence and the economy to achieve sustainability. 5IR is not a mere chronological progression of 4IR, but rather, an effort to exploit technology, resulting in technological and social integration to augment the quality of life.

Theme 4: The integration of VAR applications as a means to foster epistemic and epistemological access in STEM education

The use of VAR applications can be harnessed as a means to enhance epistemic and epistemological access in STEM education. The South African basic education system is characterised by socio-economic disparities which serve to perpetuate social injustices about the provision of quality education. Innovative use of VAR applications can be adopted as a means to alleviate socio-economic challenges which stifle the provision of quality education in South African schools as the following excerpt illustrate.

> *Access to VAR applications can be harnessed as a means to address the complexity of the articulation gap between school and higher education. Enhancing student preparedness for tertiary studies is of crucial significance* (Participant 5).

The enhancement of epistemic and epistemological access in STEM education requires a clear and critical understanding of the complexity of the articulation gap between school and higher education. Various institutions of higher learning in South Africa responded to this fundamental challenge through the implementation of extended curriculum programmes which are aimed at addressing student under-preparedness for tertiary studies. Confronting social injustices bedevilling the provision of quality education requires robust intellectual exchanges which disrupt the prevailing status quo. These intellectual exchanges ought to be predicated on a "business unusual approach" and unorthodox philosophical practices.

4. Discussion

It is important to point out that VAR tools can be used as semiotic tools to enhance conceptual understanding of abstract scientific concepts. The communication of any science is mostly through vision semiotic models such as graphs, tables, diagrams, or simulations (Frezza et al., 2018). VAR tools can be used to foster science inquiry-based learning. The impact of the use of VAR tools on different individual characteristics (e.g., level of performance, uo, spatial ability) can also be explored as part of formal empirical studies.

In a similar vein, the use of VAR applications can be harnessed as a means to enhance epistemic and epistemological access in STEM education. However, the South African basic education system is characterised by socio-economic disparities which serve to perpetuate social injustices about the provision of quality education. Evidence-based solutions are required to adequately address the complexity of the articulation gap between school and higher education within the broader South African context. In support of this assertion, Morrow (2009) posits that epistemological access promotes alignment between institutional values and students' epistemological attributes.

At another pragmatic level, professional empowerment of pre-service and in-service teachers with knowledge and skills in the use of advanced learning technologies in STEM remains a key strategic imperative. The realisation of this key strategic imperative hinges to a large degree on the active involvement of the Department of Basic Education and other key stakeholders in innovative interventions of this nature.

5. Conclusion

Coherent and sustainable integration of VAR applications in STEM education provides a solid basis for the promotion of epistemic and epistemological access to alleviate social injustices bedevilling the provision of quality education. However, VR and AR should not be seen as a replacement for traditional teaching methods, but rather as a supplement to them. These technologies can be used to enhance the learning experience and provide additional opportunities for students with disabilities, but they should not be used as a substitute for other forms of instruction.

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