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Interactive exhibits for career awareness: A case study involving secondary school Geography learners in Limpopo, South Africa

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ABSTRACT

Interactive science centres present a unique opportunity to assist learners in their career choices. However, the types of information delivered, and the manner of knowledge transfer are also important. This study investigated and reports a mixed-methods approach to identify the role of interactive exhibits in advancing career awareness. The Science Education Centre of the University of Limpopo conducted a pilot survey with 153 grades 8 to 11 learners interested in potential careers in Geography and Geology to investigate the impact of various Geography/Geology-related exhibits and different presentation methods on their career knowledge and aspirations. The exhibits included a GPS demonstrator, a remote sensing satellite model, and puzzle maps. Learners' attitudes were evaluated using a structured questionnaire. Results indicate that learners exposed to interactive exhibits demonstrated a significant increase in both their knowledge of science careers and the specificity of their career descriptions. Once printed materials and verbal briefings were supplied (experimental group), they had a fair idea of the potential careers associated with the exhibits. This suggests that interactive science centres, such as the one at the University of Limpopo, can effectively support learners in exploring and choosing science careers. These results have implications for educators and policymakers seeking to enhance STEM career readiness and engagement in under-represented communities.

Keywords: Career guidance and choice, Information presentation, Occupational information, Science Centre, Vocational education



INTRODUCTION

As of the first quarter of 2024, the unemployment rate among South African youth aged 15–34 was 45.5%, significantly higher than the national average of 32.9% (Statistics SA, 2023). This figure includes many school leavers with matric or tertiary qualifications. Among this age group, 63% of unemployed individuals are African women. Each year, many young people complete Grade 12 without a clear plan for securing post-secondary employment. A primary reason for this issue is a lack of career guidance in high schools (Farao & du Plessis, 2024). These statistics highlight the challenges South Africa faces in addressing youth unemployment, which remains a significant socioeconomic concern. As such, it is unsurprising that Bernes et al. (2007) highlighted the need for more research on the effectiveness of career guidance and counselling across educational and organisational settings, and for people of diverse cultural and economic backgrounds. Research demonstrating the effectiveness of career guidance and counselling at various levels is essential to advancing the field's future.

Science centres, also called science museums or interactive science centres, are pivotal in advancing scientific literacy and engaging visitors through hands-on learning experiences. These institutions offer a distinctive, interactive setting where learners can delve into and engage with various scientific concepts and technologies (Falk & Needham, 2010). They present a range of exhibits, demonstrations and programmes designed to ignite curiosity and enhance visitors' comprehension of scientific principles. Traditionally, science centres have been regarded as venues for informal science education (Callanan et al., 2011), where visitors can grasp scientific concepts through interactive exhibits and demonstrations (Allen, 2004).

Although limited, some studies have investigated the influence of interactive exhibits at science centres on learners' and students' career decisions (e.g., Allen, 2004; Barriault & Pearson, 2010; Dancstep et al., 2015; Pedretti & Iannini, 2020; Dodd-Walls Centre, 2022; Dvorzhitskaia et al., 2024). Such research underscores the potential of science centre exhibits to shape learners' career paths. For instance, Dancstep & Sindorf (2018) focused on the design of science exhibits at an Exploratorium and their effect on visitor engagement and learning preferences. The findings showed that well-crafted interactive exhibits that foster engagement and inclusivity can positively impact learners' career choices, especially in Science, Technology, Engineering and Maths (STEM) fields. Bobbe & Fischer (2022) emphasised that a central theme in the literature is identifying the factors that enhance the effectiveness of interactive exhibits in shaping learners' and students' perceptions and career decisions. These factors encompass exhibit design, the role of educators and facilitators, the integration of real-world applications, and alignment with the school curriculum. Understanding these factors is vital for developing and refining interactive exhibits to maximise their influence on learners' career trajectories.

To assess whether South African science centres can assume a leading role in career guidance beyond their primary mandate of curriculum support and science popularisation,

this study was conducted to evaluate the impact of interactive science exhibits on secondary school learners' career awareness and choices. The study participants were secondary school Geography learners who visited the University of Limpopo's Science Centre in Polokwane, Limpopo Province, South Africa. Insights from this study may also lay the groundwork for further exploration of the role of regional science centres in preparing youth for STEM careers, particularly in the underrepresented rural areas of South Africa.

THEORETICAL FRAMEWORK

This research aligns with calls to enhance science communication across diverse cultures and social contexts, emphasising the importance of collaborative and interdisciplinary strategies to reach underrepresented groups. It is also consistent with Falk & Dierking's (2013) contextual model of learning, which stresses that learning in informal settings is shaped by the interaction of personal, sociocultural, and physical factors. These overlapping contexts influence how visitors interpret exhibits, derive meaning, and integrate new knowledge with prior experiences. Falk & Dierking's (2013) model posits that the physical context of a museum, social setting (e.g., peer groups or facilitators), and personal context (e.g., prior interest in science) converge to shape the learning experience. Through this lens, the science centre emerges as a dynamic space where learners' personal backgrounds, physical experiences, and social interactions foster deep, memorable learning linked to career exploration.

In addition, Kolb's (1984) Experiential Learning Theory supports this multimodal design. Kolb's model has four stages: (1) Concrete Experience – learners engage directly with exhibits; (2) Reflective Observation – learners consider what they experienced; (3) Abstract Conceptualisation – learners connect experiences to broader concepts; and (4) Active Experimentation – learners apply new knowledge to career thinking. These stages were reflected in the exhibit design, which encouraged hands-on interaction, reflection, and career contextualisation. For example, learners explored GPS and satellite exhibits, discussed their relevance, and linked them to real-world careers. The study also draws on constructivist and sociocultural learning theories, which support informal, experiential learning. Constructivism underpins learner-driven exploration, while sociocultural theory highlights the importance of context and social interaction. These frameworks informed both the design of the intervention and the interpretation of learners' responses.

MATERIALS AND METHODS

Interactive exhibits

At the University of Limpopo's Science Centre, four interactive exhibits were purposively chosen based on specific criteria: they were related to Geography, interactive, aligned with the CAPS (National Curriculum and Assessment Policy Statement) curriculum for the grades tested, and could be linked to career-oriented questions. The selected exhibits

included a puzzle map of Africa (Figure 1a), a puzzle map of the Earth featuring its seven continents and five oceans (Figure 1b), a Global Positioning System (GPS) demonstrator (Figure 1c), and a remote sensing satellite demonstrator (Figure 1d). The intervention concentrated on particular careers in earth science. These exhibits combined visual, auditory, and hands-on elements to create an immersive learning experience aligned with Kolb's experiential learning principles. The intervention focused on careers in earth science, aiming to enhance both career awareness and the specificity of learners' understanding of Geography-related professions.



Figure 1. Examples of exhibits in the University of Limpopo's Science Centre. (a) A puzzle map of Africa, (b) An earth puzzle map, showcasing its seven continents and five oceans, (c) GPS demonstrator communication via satellite, (d) Remote Sensing satellite demonstrators.

Study group

The study involved 153 secondary school learners (grades 8 to 11) who visited the University of Limpopo's Science Centre. The sample included 55 boys and 97 girls and reflected a diverse range of socio-economic backgrounds, as determined by school quintile classification and urban/rural location.

Study setting

This study utilised a quasi-experimental design with a control and an experimental group, enabling comparisons of career awareness and descriptive knowledge between learners who engaged with interactive science exhibits and those who did not. Quasi-experimental designs are frequently employed in educational research, particularly when random assignment is impractical, as they enable researchers to observe treatment effects in real-world settings (Cook & Campbell, 1979).

Experimental design

All participants completed a structured questionnaire before the intervention to collect biographical data and baseline career awareness. Learners were then assigned to groups using purposive sampling, ensuring comparability in age, grade, and prior exposure to career information. The control group (n = 42) and experimental group (n = 111) were not randomly assigned due to logistic constraints. Purposive sampling was employed to ensure the groups were comparable in terms of age, grade, and prior exposure to science-related career information, as per the guidelines of Patton (2002).

Control group

The control group initially watched a video featuring the Earth and the Sun. Subsequently, they explored four Geography-related exhibits (Figure 1) that explained the scientific principles underlying them. However, they did not receive any specific information related to careers. Finally, the learners completed a Geography career-related questionnaire.

Experimental group

The experimental group viewed the same video as the control group. Subsequently, they were guided through four Geography-related exhibits that explained the scientific principles underlying each one. In addition, they received specific career-related information, including potential vocations related to specific geographic areas, as well as science career clusters and pathways associated with each exhibit. Finally, participants completed a post-intervention questionnaire to capture their detailed impressions of the specific careers introduced through the four interactive exhibits.

Data collection instrument

The survey instrument was subjected to pilot testing to ensure its reliability and validity, with feedback used to refine the language and structure of the questions. According to Creswell's (2014) guidelines, validity in educational research is enhanced by using clear and culturally relevant language, especially when working with diverse learner populations. Information was gathered through a final questionnaire comprising four main sections: biographical information, sources of career-related information, knowledge about Geography, and questions focusing on the aforementioned interactive exhibits and their connection to career choice. The questionnaire consisted primarily of fixed-choice items.

Open-ended responses were collected separately during post-intervention discussions and used for thematic analysis.

In terms of biographical details, learners were asked about their age, school grade, gender, and whether they had started considering potential future careers. Regarding sources of information, they were asked to indicate if they received any career-related guidance from their teachers and, if so, what specific information was provided. If no information was given, they were asked what information they would have liked to receive. Learners were also asked to rank (1=most, 6=least) their preferred sources for receiving career information and to identify their primary sources of career information. Participants were further requested to rank their primary sources of career information from 1 (most) to 6 (least).

In terms of Geography knowledge, learners were asked whether they believed Geography encompasses the world/earth, maps, places (countries, towns, cities), physical features like rivers/environment, weather, people, physical and human aspects, physical and human interaction, natural hazards such as global warming, and processes occurring around us. They had to choose from 'agree', 'disagree' or 'do not know'. Interviewees were questioned on whether they thought Exhibits 1 (Figure 1a) and 2 (Figure 1b) could be associated with certain professions, with 16 career pathways provided. Learners could select career options by ticking boxes labelled 'Yes, definitely applying to this exhibit', 'No, not at all' or 'I do not know'.

For Exhibits 3 (Figure 1c) and 4 (Figure 1d), learners were asked to evaluate the suitability of each of the 11 provided career choices for the two exhibits. For each career choice, learners could select: '1 = A very descriptive statement', '2 = A somewhat descriptive statement', '3 = Not a descriptive statement', or 'Nc = not certain'. The 11 career choices included Soil and Plant Specialist, Water Resources Specialist, Environmental Scientist, Cartographer (Map maker), Transportation Manager, Community Resource Specialist, Market Researcher, Geospatial Information Scientist and Technologist, Programmer, GIS Developer, and Commercial Pilot.

Data analysis

Descriptive statistics, including frequency counts and percentages, were used to examine the distribution of responses regarding career interests and descriptive knowledge in both the control and experimental groups. For inferential analysis, paired t-tests and independent-samples t-tests were conducted to assess pre- and post-intervention differences, providing a statistical basis for evaluating the intervention's impact, per Field (2013). A pre-test was conducted prior to exhibit engagement, and all participants completed both the pre- and post-tests. Thematic analysis (Braun & Clarke, 2006) was applied to open-ended responses to identify key themes in learners' career descriptions. Findings from qualitative and quantitative strands were integrated to strengthen interpretation, following Creswell & Plano Clark's (2017) mixed-methods approach.

Ethical considerations

The study complied with ethical guidelines for educational research, including obtaining informed consent from participants and ensuring anonymity and confidentiality of responses, in accordance with BERA (2018). Learners were informed of the study's purpose and their right to withdraw at any time. All participants signed a consent form. To maintain anonymity, the completed questionnaire did not require learners' names. As the study involved minors, both learner assent and guardian consent were obtained before participation. The project received approval from the University of Limpopo's Ethical Committee, with the clearance number TREC/129/2016:IR.

RESULTS AND DISCUSSION

Biographical information

Of the 153 learners, 24% were aged 14–16, 66% were 16–18, and 6% were older than 20. Grade distribution was: Grade 8 (2%), Grade 9 (1%), Grade 10 (60%), Grade 11 (36%), with 1% not indicating grade. Females comprised 64% of the sample. The majority (82%) had already started with their career planning, 15% had not, while 3% did not answer the question.

The age range of 16 to 18-year-olds is a developmental stage where learners typically begin considering post-school opportunities more seriously (Eccles, 1994). This age is critical for career interventions, as learners are receptive to exploring career options and may benefit from guidance that clarifies various career paths, especially in fields like Geography that may be less commonly highlighted in mainstream career guidance (Bandura et al., 2001).

The fact that nearly all learners (96%) are in grades 10 and 11 aligns with this focus on career planning. According to career development theories, grades 10 and 11 are important years to begin career exploration (Super, 1980). In South Africa, career interventions introduced during this period can thus have a meaningful impact on their perceptions and decisions. This is because Grade 11 learners (age 17) must also submit their final marks for provisional admission to Higher Education Institutions, such as universities or Technical Vocational Education and Training (TVET) colleges, after completing basic education (secondary school). Thus, it is no wonder that 82% of learners reported having started career planning. Consequently, our intervention aligns well with their needs, providing relevant insights into geography-related careers at a time when they are likely exploring various fields.

Sources of career information

The majority (81%) received career-related information from their teachers, 17% did not, while 2% did not complete the answer. However, 93% of learners did not receive any salary-related information, 84% did not receive information on the skills required for certain

jobs, and 86% did not receive information on potential employers such as government agencies, mines, and self-employment opportunities. This reveals insight into the role of educators, parents, and other influencers in shaping learners' perceptions of Geography-related careers. However, there are significant gaps in the information provided. This aligns with research by Gati & Saka (2001) suggesting that career guidance in schools often lacks comprehensive details, such as salary and employer information, which are critical for informed career planning. These omissions can limit learners' ability to fully understand the opportunities and challenges of each career path. The Life Orientation subject taken by all learners (DBE, 2011a, 2011b) must be comprehensive enough to present all this information.

A majority of learners (63%) received information on what school marks area need to study further. As for career choices, 64% of learners received information as to careers available for the specific subject of their teacher. However, 91% indicated that teachers did not inform them of where to look for such jobs. Without this information, learners may be unprepared for the practical steps necessary to transition from academic knowledge to employment. Super's (1980) career development theory emphasises that self-directed career exploration should be strongly developed with learners.

Learners were asked to rank (from a list) from whom they would like to receive information about careers. Most (43%) learners ranked teachers, 39% their parents, 30% friends, 24% from books, magazines and pamphlets, and 21% from educational television programmes. Although this highlights the central role of teachers, it also reveals gaps in the depth of career guidance provided such as on practical issues like salary, required skills, and employer options. The high percentage of learners receiving academic guidance without actionable career advice (such as job search strategies) highlights a gap in career education. The close ranking of parents accords with work documented that parental influence is a strong factor shaping career choices, but with a bias towards parents' own careers, or emphasising certain prestigious careers to enhance the family's reputation (Blustein, 2001). Thus, there is a need for career programmes that engage both teachers and parents.

The fact that learners also received career-related information from friends and various media sources (digital and analogue) suggests that they employ a multi-faceted approach to career guidance. Media sources, in particular, can help address gaps in knowledge about diverse fields and careers.

Knowledge about Geography

Learners mostly associated Geography with maps (94.6%) and weather (89.9%). They least associated it with physical and human aspects (35%) and physical and human interactions (41.6%). Table 1 highlights varying levels of understanding across different geographical concepts, suggesting that some areas are well comprehended, while others remain unclear or misunderstood, resulting in a limited understanding of integrated or abstract topics. The high percentages of agreement on topics like maps, weather, and

the world/earth aligns with educational findings that basic topics in Geography, often introduced in early schooling, are well retained by learners (Foskett & Hemsley-Brown, 2001). In contrast, more complex topics such as physical and human interactions are gaps in learners' understanding. According to learning theories, such concepts are often challenging for learners because they require both abstract thinking and the ability to synthesise multiple disciplines into one (Kolb, 1984).

Interestingly, knowledge about natural hazards (85.1% agree) and processes around us (65.6% agree) suggest that learners have a better understanding of applied and observable geographical phenomena, likely due to media exposure and curriculum emphasis. This aligns with findings that learners tend to understand and retain concepts better when they can observe or relate them to real-world events (Gardner, 1993). There is also substantial uncertainty or lack of knowledge in areas like people (31.7% disagree, 18.3% do not know). This result may reflect a gap in understanding social geography, a field that examines how humans interact with and are influenced by their environment. Expanding on this concept in the curriculum could help learners understand both physical and social dimensions of Geography, aligning with interdisciplinary educational goals that emphasise holistic understanding (Bruner, 1960).

Table 1. Learners' perceptions of what Geography is about. Percentages do not always add up to 100%, as some participants did not make a selection.

Elements of Geography	Agree (%)	Disagree (%)	Do not know (%)
Maps	94.6	2.7	2.7
Weather	89.9	7.4	2.7
Natural hazards (global warming)	85.1	10.8	4.1
The world/earth	82.6	9.0	7.6
Places (countries, towns, cities)	80.3	14.3	5.4
Physical features (rivers/environment)	77.7	12.2	10.1
Processes such as what happens around us	65.6	17.9	16.6
People	50.0	31.7	18.3
Physical and human interaction	41.6	24.8	33.6
Physical and human aspects	35.0	42.7	22.4

INTERACTIVE EXHIBITS AND THEIR RELATIONSHIP WITH CAREER CHOICE

Control group

Learners were asked to state if Exhibits 1 (Figure 1a) and 2 (Figure 1b) related to the presented Geography careers (Table 2). Although this group did not receive any career-related information, they associated the two exhibits mostly with a climatologist

(85.7%), cartographer (85.4%), and surveying and mapping technician (80.5%). Career pathways such as politician (20.6%) and journalist (27.8%) were least associated with the exhibits. The high level of relevance of some careers suggests that learners had a clear conceptualisation of these roles within the context of Geography. According to Kolb (1984), learners more readily connect with career concepts when they observe concrete applications, such as through interactive exhibits. Conversely, the lower relevance scores for some careers may indicate that learners lack understanding of how these interact with geographic content. Foskett & Hemsley-Brown (2001) suggested that learners often overlook interdisciplinary applications of Geography in the social or economic sciences, unless these are explicitly demonstrated. Integrating these roles more explicitly into exhibit content could improve learners' perception of the relevance of these careers to Geography.

Some careers, such as Transportation Manager (38.5% 'Yes, definitely applies') and Community Developer (51.4%), received mixed responses, reflecting uncertainty about their relevance. For example, a transportation manager's work with logistics and infrastructure planning requires a strong geographic understanding, yet this may not be immediately apparent to learners. Enhancing the exhibits to emphasise these connections could improve career perception by highlighting the geographic aspects of these roles (Gardner, 1993).

The large percentage of 'I do not know' responses for certain careers, such as Hazards Analyst (34.2%) and Interpreter (34.3%), suggests that learners may lack exposure or familiarity with these professions. Expanded career education in Geography to include such roles are crucial in global and multicultural contexts (Gati & Saka, 2001).

Table 2. Control group responses on the relationship between exhibits 1 and 2 and career pathways. Percentages do not always add up to 100%, as some participants did not make a selection.

Career choice	Yes definitely applies to this exhibit (%)	No, not at all (%)	I do not know (%)
Climatologist	85.7	9.5	4.8
Cartographer	85.4	12.2	2.4
Surveying and mapping technician	80.5	9.8	9.8
Graphics editor	72.5	17.5	10.0
Urban and regional planner	61.5	15.4	23.1
Teacher	56.1	31.7	12.2
Community developer	51.4	21.6	27.0
Scientist	51.4	25.7	22.9
Tour guide	45.9	35.1	19.0
Hazards analyst	42.1	23.7	34.2
Transportation manager	38.5	23.1	38.5

Career choice	Yes definitely applies to this exhibit (%)	No, not at all (%)	I do not know (%)
Farmer	35.1	37.8	27.0
Interpreter	28.6	37.1	34.3
Journalist	27.8	47.2	25.0
Politician	20.6	47.1	32.4

Experimental group

Learners were asked to state if Exhibits 1 (Figure 1a) and 2 (Figure 1b) related to the presented Geography careers (Table 3). Some occupations, such as Teacher (66.7% 'yes, definitely applies'), Surveying and Mapping Technician (58.1%), and Scientist (56.3%), received high relevance responses. Kolb's (1984) Theory of Experiential Learning suggests that when learners connect to real-life contexts, they are better able to connect theoretical knowledge to tangible careers. Lower values for Cartographer (43.8%) and Transportation Manager (45.9%) show learners may have difficulty understanding Geography's contribution to these professions. This is similar to results from Gough (2002) who found that complex, less direct geographic applications are difficult for learners to grasp without examples or direct interaction with a professional in the field. Lower relevance scores were received for roles like Politician (38%) and Urban and Regional Planner (36.5%). Learners usually need the main subject to have explicit connections so as to see its broad application, such as how Geography overlaps with planning and policymaking.

Notably, there was a substantial 'I do not know' response to many careers, such as Community Developer (18.6%) and Interpreter (29.0%). These indicate that learners may lack familiarity with these careers and their connection to Geography, despite the intervention. This finding aligns with career education literature, such as Gati & Saka (2001), which suggests that learners often require sustained exposure to lesser-known career paths to develop a clear understanding. Additionally, while the career of a Journalist saw an improvement in perceived relevance (48.5%), the significant percentage (38.6%) of 'No, not at all' responses suggests lingering confusion.

Table 3. Experimental group responses on the relationship between exhibits 1 and 2 and career pathways. Percentages do not always add up to 100%, as some participants did not make a selection.

Career choice	Yes, definitely applies to this exhibit	No, not at all (%)	I do not know (%)
Teacher	66.7	24.8	8.6
Surveying and mapping technician	58.1	21.0	21.0
Scientist	56.3	23.3	20.4
Graphics editor	55.8	24.0	20.2
Climatologist	55.8	21.2	23.1
Community developer	49.0	32.4	18.6
Journalist	48.5	38.6	12.9
Transportation manager	45.9	29.1	25.0
Cartographer	43.8	27.6	28.6
Tour guide	42.6	37.7	29.7
Farmer	40.4	41.4	18.2
Hazards analyst	39.6	31.7	28.7
Politician	38.0	32.0	30.0
Interpreter	37.0	34.0	29.0
Urban and regional planner	36.5	33.7	29.8

Practical guidelines to link interactive exhibits to career information

Designing interactive exhibits to support science career interests is a powerful strategy in informal science education. When thoughtfully crafted, these exhibits can spark curiosity, demonstrate the relevance of science to real-world jobs, and empower young visitors, especially those from underrepresented communities, to imagine themselves in science-related careers. Table 4 presents ten design principles that will align interactive science exhibits with career development theories like Holland's (1997) RIASEC model, by allowing visitors to explore realistic tasks (hands-on, tool use), engage in investigative thinking (problem solving), see artistic elements in science (design, storytelling), understand social impacts of science careers, experience enterprising roles (project leadership), and use conventional skills (data analysis, procedures).

Table 4. Career design principles for interactive exhibits, with examples specifically related to the career of Climatologist.

Design principle	Application in exhibit design	Examples related to climatology
Career-relevant context	Connect exhibit content to real-world applications and STEM careers	'Climatologist' interactive station showing how to build weather forecasting work
Role model representation	Include visuals, videos, or audio featuring diverse professionals discussing their work	Video booth with interviews of local weather scientists, IT engineers, and mainframe technicians
Hands-on problem solving	Create challenges that mimic real scientific work	Visitors predict the weather using data from actual weather stations
Personalisation and identity building	Allow users to explore exhibits based on their interests and strengths	Digital quiz that links visitor interests to possible weather/ geography careers, with paths shown visually
Narrative and storytelling	Use career-based storytelling to make abstract science concepts more relatable	Exhibit tracing a day in the life of a climatologist working in a nearby weather station
Interactive technology and gamification	Use AR/VR, simulations, or gamified tasks to replicate work done in science careers	VR goggles simulating a climatologist's tasks at the local weather forecasting centre
Career pathway mapping	Provide clear information on educational steps and training required for featured careers	Wall graphic or touchscreen showing steps from Grade 9 subject choices to university programs
Real tools and equipment	Let learners handle or simulate the use of tools used by professionals	Operating micro-weather stations' thermometers, rain gauges, and hygrometers
Mentorship integration	Link physical exhibit experiences with mentoring or outreach opportunities	QR codes linking to online career chats or mentorship programs
Local relevance and language	Feature science careers found in local industries and use multiple languages	Exhibit about climatology careers information in local languages

Limitations of this study

This study has several limitations that should be considered when interpreting the results. First, the quasi-experimental design without random assignment limits the ability to make strong causal claims about the impact of the interactive exhibits. Unobserved factors may have influenced the observed changes in career awareness. Second, the sample was confined to learners from one region of South Africa, which restricts generalisability to other populations. Third, the study relied on self-reported data from learners, which

may be subject to social desirability bias. Finally, the intervention was relatively brief, and long-term effects on actual career choices were not measured. Future research using randomised controlled trials, larger and more diverse samples, objective measures of career knowledge, and longitudinal designs could address these limitations and provide stronger evidence for the impact of interactive science exhibits on career guidance.

Future research directions

Future studies should examine the longitudinal effects of interactive exhibits on learners' actual career paths, rather than just their awareness or perceptions. Randomised controlled trials across multiple provinces in South Africa would help generalise these results. Additionally, future research should investigate how exhibit design can be optimised for specific cultural groups, languages, and gender identities. Finally, comparative international studies could help determine whether the findings from Limpopo align with trends in other African regions or the global South context.

CONCLUSIONS

The study set out to investigate, for the first time in South Africa, the association between various Geography-related exhibits and different presentation methods in advancing career choices. Results from pre- and post-intervention questionnaires from secondary school learners show that an integrated approach concerning scientific information and its linkage to careers is best. Thus, this study demonstrates that more needs to be done to guide young people towards suitable career choices. In this regard, interactive exhibits can play a vital role if appropriate career information is provided. The research emphasises the role of science centres as pivotal spaces for informal science education. Learners who engaged with interactive Geography-related exhibits gained a deeper understanding of scientific careers, and this can support shift in perception of gender roles in the field. This supports the broader literature advocating for experiential and participatory learning approaches in STEM education.

The South African context presents unique challenges, including rural-urban disparities, resource inequalities, and limited career guidance infrastructure. These factors influence how learners access and interpret career information, especially in under-resourced schools. For these reasons, based on the findings of this study, the following recommendations are proposed: (1) Integrate interactive exhibits into school-based career programmes, especially in Life Orientation classes; (2) train teachers to use exhibits as experiential tools for career guidance, with support from science centres; (3) develop multilingual and locally relevant exhibit content to ensure accessibility across diverse learner groups; (4) engage parents and communities in career awareness initiatives to complement school efforts; and (5) expand science centre outreach to rural schools through mobile exhibits and virtual platforms.

REFERENCES

- Allen, S. (2004). Designs for learning: Studying science museum exhibits that do more than entertain. *Science Education*, 88(S1), S17–S33.
- Bandura, A., Barbaranelli, C., Caprara, G. V., & Pastorelli, C. (2001). Self-efficacy beliefs as shapers of children's aspirations and career trajectories. *Child Development*, 72(1), 187–206.
- Barriault, C., & Pearson, D. (2010). Assessing exhibits for learning in science centers: A practical tool. *Visitor Studies*, 13(1), 90–106.
- BERA (2018). *Ethical Guidelines for Educational Research*, 4th Edition. British Educational Research Association, London.
- Bernes, K. B., Bardick, A. D., & Orr, D. T. (2007). Career guidance and counselling efficacy studies: An international research agenda. *International Journal of Educational and Vocational Guidance*, 7, 81–96.
- Blustein, D. L. (2001). The interface of work and relationships: Critical knowledge for 21st Century psychology. *The Counseling Psychologist*, 29(2), 179–192.
- Bobbe, T., & Fischer, R. (2022). How to design tangible learning experiences: A literature review about science exhibit design. In: Lockton, D., Lenzi, S., Hekkert, P., Oak, A., Sádaba, J., & Lloyd, P. (eds), *DRS2022: Bilbao, 25 June–3 July*. Design Research Society. <https://doi.org/10.21606/drs.2022.195>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101.
- Bruner, J. S. (1960). *The Process of Education*. Harvard University Press, Cambridge, MA.
- Callanan, M., Cervantes, C., & Loomis, M. (2011). Informal learning. *WiRES: Cognitive Science*, 2(6), 646–655.
- Cook, T. D., & Campbell, D. T. (1979). *Quasi-experimentation: Design and analysis issues for field settings*. Houghton Mifflin, Boston.
- Creswell, J. W. (2014). *Research design: Qualitative, quantitative and mixed methods approaches*, 4th Edition. SAGE, London.
- Creswell, J. W., & Plano Clark, V. L. (2017). *Designing and conducting mixed methods research*, 3rd Edition. SAGE, London.
- Dancstep, T., Gutwill, J. P., & Sindorf, L. (2015). Comparing the visitor experience at immersive and tabletop exhibits. *Curator: The Museum Journal*, 58(4), 401–422.
- Dancstep, T., & Sindorf, L. (2018). Exhibit designs for girls' engagement (EDGE). *Curator: The Museum Journal*, 61(3), 485–506.
- Department of Basic Education (DBE) (2011a). *Curriculum and Assessment Policy Statement: Life Orientation Senior Phase Grades 7–9*. Department of Basic Education, Pretoria.
- Department of Basic Education (DBE) (2011b). *Curriculum and Assessment Policy Statement: Life Orientation Further Education and Training Phase Grades 10–12*. Department of Basic Education, Pretoria.

- Dodd-Walls Centre (2022). Community engagement. Available from <https://www.doddwalls.ac.nz/our-impact/community-engagement>, retrieved June 16 2025.
- Dvorzhitskaia, D., Zamora, A., Sanders, E., Verheyden, P., & Clerc, J. (2024). Exhibition research and practice at CERN: Challenges and learnings of science communication 'in the making'. *Journal of Science Communication*, 23(2), N01. <https://doi.org/10.22323/2.23020901>
- Eccles, J. S. (1994). Understanding women's educational and occupational choices: Applying the Eccles et al. model of achievement-related choices. *Psychology of Women Quarterly*, 18(4), 585-609.
- Falk, J. H., & Dierking, L. D. (2013). *The Museum Experience Revisited*. Routledge, New York.
- Falk, J. H., & Needham, M. D. (2010). Measuring the impact of a science center on its community. *Journal of Research in Science Teaching*, 48(1), 1-12.
- Farao, A., & du Plessis, M. (2024). The need for structured career guidance in a resource-constrained South African school. *African Journal of Career Development*, 6(1), a116. <https://doi.org/10.4102/ajcd.v6i1.116>
- Field, A. (2013). *Discovering statistics using IBM SPSS statistics*, 4th Edition. SAGE, Los Angeles.
- Foskett, N. H., & Hemsley-Brown, J. (2001). *Choosing Futures: Young people's decision-making in education, training, and careers markets*. Routledge, London.
- Gardner, H. E. (1993). *Multiple Intelligences: The theory in practice*. Basic Books, New York.
- Gati, I., & Saka, N. (2001). High school students' career-related decision-making difficulties. *Journal of Counseling and Development*, 79(3), 331-340.
- Gough, A. (2002). Mutualism: A different agenda for environmental and science education. *International Journal of Science Education*, 24(11), 1201-1215.
- Holland, J. L. (1997). *Making vocational choices: A theory of vocational personalities and work environments*, 3rd Edition. Psychological Assessment Resources, Odessa.
- Kolb, D. A. (1984). *Experiential Learning: Experience as the source of learning and development*. Prentice-Hall, New Jersey
- Patton, M. Q. (2002). *Qualitative research and evaluation methods*, 3rd Edition. SAGE, Thousand Oaks, California.
- Pedretti, E., & Iannini, A. M. N. (2020). Towards fourth-generation science museums: Changing goals, changing roles. *Canadian Journal of Science, Mathematics and Technology Education*, 20, 700-714.
- Statistics SA (2023). *Quarterly labour force survey - Quarter 4: 2023*. Department of Statistics, Pretoria.
- Super, D. E. (1980). A life-span, life-space approach to career development. *Journal of Vocational Behavior*, 16(3), 282-298.