The incorporation of indigenous knowledge into graphic design technology

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With the single descriptive case study reported on here we aimed to explore incorporating indigenous knowledge (IK) into the teaching of graphic design (GD) as a part of Grade 9 Technology lessons. Incorporating IK into GD could make the topic more meaningful – especially for indigenous learners. The *Curriculum and Assessment Policy Statement* (CAPS) for technology incorporates indigenous technology. A Grade 9 Technology teacher and 7 learners were interviewed. Each participant was interviewed individually at different intervals using semi-structured interviews. The teaching and learning of GD were also observed during 1 lesson. The collected data were analysed thematically. The findings reveal the teacher's limited understanding of CAPS and her lack of understanding that IK was incorporated into the curriculum. She incorporated IK only marginally in the teaching of GD. She understood indigenous technology but did not make GD relevant to learners' cultural knowledge and backgrounds. On the contrary, learners valued IK within their GD activities. Furthermore, the findings indicate that learners demonstrated their comprehension of IK and its alignment with their background knowledge, particularly within the context of graphics. Consequently, incorporating indigenous perspectives into Technology could transform the subject in line with the intentions of CAPS.

Keywords: culture; graphic design; incorporation; indigenous knowledge; technology

Introduction

Indigenous knowledge (IK) is experiencing a global resurgence after years of being marginalised (Inter-Agency Support Group on Indigenous Peoples' Issues, 2014; Schafer, Ezirim, Gamurorwa, Ntsonyane, Phiri, Sagnia, Salakana & Bairu, 2004). In South Africa, this revival has prompted the integration of IK into the school curriculum. Teachers play a pivotal role as key stakeholders in this process (Ronoh, 2017), motivated by the mandates of the Constitution of the Republic of South Africa, 1996 (hereafter the Constitution), which emphasises the importance of IK within the education system (Cindi, 2021; Schafer et al., 2004). That aligns with the generative curriculum model (GCM) in which it is argued that the inclusion of IK significantly impacts the lives of communities (Ball & Pence, 2001; Shizha, 2008). This belief holds significance as learners originate from communities entrenched in local cultural norms and values. As emphasised by Moges, Assefa, Tilwani, Desta and Shah (2024), IK forms the foundation of education, facilitating the establishment of meaningful social connections, effective communication, and the manifestation of everyday life experiences. GCM focuses on community-related sources of knowledge and develops new insights through reflection and dialogue (Ball, 2004). One of the GCM's strengths is that learning always occurs through diverse voices and cultural perspectives (Ball & Pence, 2001). Hence, it is imperative to acknowledge that learners are engaged in learning at all times, even within their communities, and that they bring this knowledge with them to school. In line with this perspective, Cindi (2021) underscores the necessity for active community participation in curriculum development to ensure the successful integration of IK into education.

GCM is mainly about creating a learning environment for learners to own their learning while engaging in various tasks (Ball & Pence, 2001). Hence, learners could contribute knowledge acquired at home if teachers were to create an inviting environment for that. Anderman (2010, cited in Chistella & Soekamto, 2017) states that GCM is a very active process for learners since they learn by linking new knowledge to previous information – we argue that learners can even link new knowledge to their home-based knowledge. The education and training that learners receive should, therefore, relate to their local knowledge. That would require teachers to design their teaching in such a way that learners feel that the knowledge acquired from their local cultural contexts is accommodated. Therefore, teachers should take CAPS as a starting point, since CAPS incorporates IK and other human-rights-related aspects in recognition of the Constitution. It is in that light that CAPS enshrines knowledge, skills, and values worthwhile learning about. Thus, CAPS recognises local knowledge while simultaneously embracing global imperatives (Department of Basic Education [DBE], Republic of South Africa [RSA], 2011).

The aims of Technology – not educational technology or technology integration in teaching – include perspectives on IK (DBE, RSA, 2011). The CAPS for Technology, Grades R to 12, specifies that the knowledge, skills, resources, and processes that learners are taught should include those of indigenous cultures (DBE, RSA, 2011). Moreover, it states that learners should learn the knowledge of the past to inform their understanding of new technologies (DBE, RSA, 2011). Some technologies, having been used for hundreds of years, could promote the incorporation of IK into the curriculum for the learning and teaching of Technology (Goosen, Kathan, Mlambo, Roebert, Sargeant, Scheepers, Smit & Walstra, 2013). Such technologies are important because they have sustained and continue to sustain indigenous communities. They are not limited to the past; their learning should not be confined to the past. We, therefore, think that GD is one of the core areas where IK could be incorporated successfully. The Mpumalanga province of South Africa, where this study was conducted, harbours rich cultural artifacts that could assist in achieving just that. For example, the different

Swati and Ndebele cultures/traditions found in Mpumalanga could contribute greatly to the teaching and learning of GD. The traditional arts and crafts of the Swati and Ndebele people include indigenous skills and practices that could be used in GD to improve learners' understanding. Examples include the geometrical patterns painted on Ndebele huts, cultural artifacts in open markets, and traditional attire. Brown and Vacca (2022) emphasise the significance of valuing diversity, fostering inclusivity, ensuring representation, and demonstrating respect for individuals, communities, and their respective material cultures. They highlight the role of craftsmanship in preserving and expressing traditional cultural heritage, which supports the importance of indigenous GD.

Despite the appreciation of IK in Technology, indigenous technology is still disregarded in the teaching and learning, limiting the scope of technology taught to learners at school (Cindi, 2021; Goosen et al., 2013; Ronoh, 2017). This gap also exists elsewhere. For instance, in their study on Ethiopian education, Yeseraw, Melesse and Kelkay (2023) noticed that although the new curriculum endeavoured to incorporate elements of IK into textbooks, their integration was lacking. Luna and Martinez (2013) contend that insufficient provision of bilingual and multicultural education, coupled with discriminatory practices, results in a disservice to learners. South Africa (passionately known as a rainbow nation) has diverse cultures that are expressed in learner profiles at schools, yet these cultures are still to be represented in teaching and learning – teachers should cover alternative knowledge and pedagogies such as oral, experiential, and observational learning, which are the bedrock of teaching in indigenous communities. In support of Luna and Martinez, code-switching should also be accommodated. Bilingualism could still be limiting. What is more desirable, is multilingualism that matches multiculturalism. Some concepts cannot be expressed easily in English, an example of which is the indigenous Setswana phrase *go taka.* Translated directly into English, it means to draw. However, it has a wider cultural meaning than merely drawing. Technology learners could find it difficult to learn GD without incorporating knowledge and skills from their cultural contexts. Yeseraw et al. (2023) contend that Western education prioritises secular intellectual development, which contrasts with indigenous education's emphasis on building relationships between different knowledge domains and the context-based IK of learners (Battiste, 2013; Castagno & Brayboy, 2008; Cherubini, 2010; Deloria & Wildcat, 2001). Therefore, we firmly advocate for the integration of IK in GD, as it has the potential to enhance learners' understanding and inspire them to create artifacts rooted in their cultural contexts. This assertion is supported by Herbawi, Chatterjee and Alvelos (2023) who argue that design now plays a pivotal role in shaping contemporary cultural experiences. Recognised for its ability to revitalise cultural traditions, alter perceptions, disseminate knowledge, and add value through carefully crafted experiences (Chandran & Chon, 2022), design holds promise as a tool for cultural rejuvenation and educational enrichment.

Theoretical Framework

The community cultural wealth (CCW) model was adopted as the lens for the study. The model addresses issues of colour and racism related to the education of learners of colour. According to Yosso (2005), cultural wealth is premised on the knowledge, skills, abilities, and contacts of indigenous communities. They use these for survival and to resist macro- and micro-oppressions. The strengths, cultural assets, and wealth of indigenous communities should be heeded in reconsidering social and racial justice. To do that, education systems and other social institutions should be restructured around a community's knowledge, skills, abilities, and networks (Luna & Martinez, 2013). This article is premised on the belief that such restructuring could be achieved through teaching that is relevant to the cultural backgrounds of learners. CCW is a collection of aspirational, navigational, social, linguistic, familial, and resistant capital assets which are presented as follows:

- Aspiration: The ability of a community to maintain its hopes and dreams to resist hindrances that are likely to confront it (Yosso, 2005; Yosso & García, 2007). Aspirations develop through storytelling and advice within social and familial contexts that make children dream of possibilities and achievement (Yosso, 2005; Yosso & García, 2007). The teaching of Technology should advance the academic aspirations of learners rooted in their cultural beliefs.
- Language: Acknowledgement that learners come to school with a variety of language and communication skills (Yosso, 2005) inherently representing resources that could maximise meaningful learning such as music, poetry and language. These could be used as forms of communication (Yosso, 2005) in learning. Hence, GD should incorporate IK for learners to express their design ideas using varied language skills.
- Society: People's connections within a society (Huber, 2009; Yosso, 2005) that correlate with social constructivism. In this sense, learners could contribute to one another's knowledge, skills, and tools in their learning. The teaching of Technology thrives on group/team/collaborative design activities that engage social capital.
- Family: Cultural knowledge cultivated and fostered within and among families and friends (Yosso, 2005; Yosso & García, 2007). It is built on community history, memory, and cultural intuition. Maintaining healthy community and resource connections and showing lessons about caring and coping help to develop a community's emotional, moral, educational, and occupational awareness and support (Huber, 2009). Learners could learn about graphics from their cultural backgrounds. *Ubuntu* could strengthen ties and teamwork in this regard.

- Navigation: Skills to navigate through social institutions (Yosso & García, 2007). These skills are natural talents that are not taught at school, such as the social and psychological skills used to create a culture of resistance during difficulties (Yosso & García, 2007). Learners could use skills from their cultural backgrounds to navigate their learning tasks together.
- Resistance: Knowledge and skills that are cultivated through behaviour of opposition to the challenges of inequality (Gumbo, 2020; Yosso, 2005). The incorporation of IK in the CAPS suggests the transformation of teaching and learning in Technology, allowing learners to learn about other cultures' technologies. In this sense, Technology teaching may be a liberating subject.

These tenets caused us to consider CCW in the learning of GD and illuminated our understanding of the issue at hand. The use of CCW is relevant for studies that promote the consideration of learners' cultural backgrounds in teaching and learning.

Research Methodology

The research questions for the study were the following:
1) What is the teacher's knowledge of the curriculum in terms of the incorporation of IK in the teaching of GD?
2) How does the teacher use her understanding of Technology to integrate IK into the teaching of GD?
3) How do learners view the teaching of GD with IK?

The postcolonial indigenous paradigm, which facilitates active, participatory, and co-construction of knowledge (Chilisa, 2012) connected well with the CCW framework in this study in which the incorporation of IK and skills into GD was considered. That is because learners would most probably be active when what they learn relates to their cultural knowledge and, as such, stimulates their interest. These aspects represent a perfect match with the idea of community learning in which learners can see themselves through the incorporation of their diverse cultures, as espoused by *Ubuntu*. *Ubuntu* demonstrates an accumulation of collaborative work (Yosso, 2005). Therefore, merging CCW with the postcolonial indigenous paradigm enhances our understanding of the teacher's attempt to integrate IK in GD and how it was received by learners.

We chose a descriptive case study to illuminate the intricacies of our experiences as they relate to the incorporation of IK in GD (Yin, 2003) in a real-life context (Baxter & Jack, 2008; Zainal, 2007). As such, we conducted our research at a school located in the Ehlanzeni district in Mpumalanga. A Grade 9 Technology teacher and seven learners from her class were selected purposively as the participants in our study. We decided on that teacher based on her extensive experience (see profile below). We also invited an indigenous expert to the school to collaborate with the teacher in demonstrating the basics of indigenous GD. The indigenous expert was well versed in IK and its practice, thus serving as a point of reference for IK. The indigenous expert played a meaningful role in the lesson by showcasing cultural artworks that would contribute to a more inclusive and culturally responsive learning environment which may be employed by the teacher. This activity took place after the classroom observation.

We collected data through individual semi-structured interviews and observation. The semi-structured interviews were conducted at the participants' schools, allowing for a familiar and comfortable environment. The interviews occurred at various intervals to capture a comprehensive understanding of the participants' perspectives and experiences. The semi-structured interviews allowed us to probe deeper to source the participants' responses through oral communication (Rubin & Rubin, 2005). Through observation, we recorded the aspects noted during teaching systematically as they occurred in the natural setting (Gorman & Clayton, 2005). Observation is a critical data collection method that augments methods (Urquhart, 2015) to boost a researcher's understanding of the investigated issue. We opted for non-participant observation to reserve active participation in class proceedings so that our case description would not be clouded by our interference (Urquhart, 2015). The non-participant observation was also used to heed the conditions of the permission granted for the study, namely, to be as least disruptive as possible. We aimed to allow as much exposure to the phenomenon under study as possible. The observed lesson was considered representative of the broader teaching approach toward IK integration in GD. This provided insights into the typical teaching practice employed by the teacher. Nonetheless, time limitations made it impractical to conduct multiple observations. However, the single lesson observation allowed for a more in-depth analysis of teaching strategies, learner engagement, and IK integration within GD. This enabled us to capture nuanced details and patterns that might not be apparent in a cursory observation.

Thematic analysis was used in the transcription of the data to make it more meaningful (Neuendorf, 2019). Codes were identified during the closer examination to ultimately develop salient themes (Neuendorf, 2019). The codes consisted of words or short phrases from the data. Adopting Neuendorf's (2019) analysis method, we 1) familiarised ourselves with the data and identified items that interested us in terms of the study; 2) generated initial codes that helped to identify the essential features from the data that assisted in answering the research questions, consistently segmented and tagged the data, and collated the codes across data segments; 3) identified themes, examined the codes followed by collating the data to identify the broader patterns of meaning, and reviewed the themes. We then applied the potential themes to the data to assess whether they answered the research questions and, where possible, refined, split,

combined, and discarded themes; 4) defined and named the themes, and analysed each theme in detail; and 5) produced a report on the findings, crafted the narrative of analysis and data segments, and finally related the analysis to the literature. Table 1 reflects the analysis from coding to the development of the themes.

Table 1 Theme building from the data

Codes	Organising themes	Global themes
Integration of indigenous technology, design materials, houses, and materials, reflects technology	The opportunity that CAPS presents to incorporate IK	IK in CAPS
time, constrained, does not allow	Incorporation of IK *vs* time	
resources, shortage, use it in their homes	Teaching materials	
knowledge from the past, graphics were taken from way back	Knowledge of technology	Knowledge of technology and pedagogies in relation to IK
using patterns and technology, Swati patterns	Applying the indigenous version of technology to transform pedagogy	
creative, critical, communication, design, drawing	Target skills for GD teaching	

To ensure the trustworthiness of the study, we reviewed the observation data and triangulated it with the interview data to deepen our understanding of the incorporation of IK into GD. All the learners were asked the same main questions in the interviews. The teacher was asked a different set of questions. While both sets of questions touched on similar themes of integrating indigenous graphics into GD education (see Table 2), the focus of the questions for the teacher was more on teaching strategies and problems, whereas experiences and exposure to indigenous graphics were the focus of the questions for the learners. We reserved our comments during the interviews to eliminate bias. Only the probing questions varied, depending on the participants' responses. The transcriptions were discussed with the participants to confirm their statements to ensure correct reflection during reporting. All the events of the fieldwork and our thinking were noted in a reflexive journal to ensure confirmability. We kept all the data records, which helped us to cross-check the data and the final report.

Table 2 Selected sets of questions for both the teacher and learners

Semi-structured interview questions: Teacher	Semi-structured interview questions: Learners
• Have you ever thought of including indigenous graphics or drawings or patterns in your teaching of graphic design? Why?	• Have you ever come across indigenous graphics or drawings or patterns in your learning of graphic design and if so, which ones?
• How do you make sure that learners' activities in graphic design are designed in a manner that reflects the integration of indigenous graphics knowledge and skills?	• Which indigenous cultures are represented in your Grade 9 class?
• How, then, can you engage indigenous elders or experts in the teaching of graphic design in Grade 9?	• What are the indigenous graphic designs you know of from the cultures that you mentioned?
• Are there any specific or general problems that you experience with the integration of indigenous graphic knowledge and skills in teaching graphic design?	• How could indigenous technology influence the learning of graphic design in a Grade 9 class?

Findings and Discussion

The findings were taken from the analysed data collected from the teacher and the learners. The learners were coded as L1 to L7 to conceal their identities as per the respect of their choices. In this section, we present the findings and discussion under the themes in Table 1. The teacher's and learners' biographical information is presented first.

Teacher's Biographical Information

The interviewed and observed teacher held an advanced certificate in education (ACE) and 11 years of experience teaching Technology in Grade 9, which was the most comprehensive experience compared with her colleagues. The teacher was initially trained for an ACE in Technology. She is a Swati who grew up in a culturally rich environment surrounded by elders possessing relevant knowledge and skills, including drawing.

Learners' Biographical Information

The seven learner participants comprised four boys and three girls. Only Swati learners were chosen to concentrate on that specific indigenous culture. The learners resided in townships and rural areas and were surrounded by elderly people and other holders of IK. That suggests that they found themselves immersed in Swati culture. In terms of

one to three, the learners' performance in Technology ranged between 60% and 70%.

IK in CAPS
Opportunities in CAPS for the incorporation of IK
Based on an analysis of the data, the interviewed Technology teacher claimed that the contents of CAPS do not outline the components of IK because it does not allow expansion of the content up to the integration of indigenous technology. She seemed not to have consulted the CAPS for Technology. However, consultation of the literature revealed that it does, indeed, incorporate indigenous technology. We subsequently referred her to the relevant sections of the document on the transformational principles underlying CAPS and the incorporation of indigenous technology in Technology as a subject. One of the reasons for teaching Technology is to prepare learners to be trained as engineers, and engineering design relies heavily on the graphical representation of ideas (DBE, RSA, 2011). There are civil engineering issues in local contexts that the learning of Technology should relate to. That provides an opportunity for the incorporation of indigenous technologies. Thus, IK could facilitate learners' learning by recognising what they know from their cultural environments and incorporating it into the drawings that they do at school. Examples include the design of cars, dwellings/shelters, and bridges that can be found in their surroundings. In support of the foregoing, L4 stated that Swati graphics contain patterns that can be used to help GD succeed. Thus, the Swati design materials like tables, chairs and bricks reflect technology. Freire (1968, cited in Ezeanya-Esiobu, Oguamanam & Ndungutse, 2021) argues that curricula in any educational setting should represent situations that individuals can relate to. For example, Herbawi et al. (2023) suggest that cultural heritage studies, including those on IK, can offer valuable insights into societal perspectives and sectoral strategies concerning creative practices and industries. Therefore, against this background, learners could engage in evaluating the interplay between technology, society, and the environment as part of their learning process, while also considering the impact of technological biases on society and the environment. According to Manabete and Umar (2014), there can be no successful discussion of indigenous technology without also discussing IK because IK is highly practical, and thus includes technology (Gumbo, 2019).

The teacher failed to realise what the CAPS for technology offers about the incorporation of indigenous technology (DBE, RSA, 2011). The CAPS for Technology emphasises the opportunity to offer content that would help learners demonstrate a grasp of the world in its related systems because problem-solving situations exist with one another (DBE, RSA, 2011). Furthermore, the CAPS states that Technology as a subject would teach learners how to employ realistic

contexts anchored in real-world circumstances outside the classroom (DBE, RSA, 2011). In that regard, L1 claimed that indigenous technology "*is easier than modern technology; hence, it will make it easier for us to understand in class.*"

It should be noted that indigenous technology establishes context during the teaching and learning of Technology. For instance, Cindi (2021) emphasises the critical need for South African education and the broader African continent to actively promote diversity. In alignment with this perspective, the DBE, RSA (2011) underscores the role of Technology in exposing learners to the use of materials and processes in indigenous cultures to address their needs and challenges. This exposure aims to cultivate learners' respect for the intellectual property rights of indigenous peoples. However, our findings indicate that a lack of understanding of teaching from an IK perspective results in inadequate learning outcomes in GD. Herbawi et al. (2023) underscore the significant role of design in reflecting society's points of view. Nevertheless, the observational data we gathered reveal that the teacher did not establish a responsive environment that enabled learners to explore the diverse knowledge and skills of indigenous cultures in GD.

If a teacher sees no benefit in executing this component of the curriculum guideline, the incorporation of IK into the subject will remain a mere statement on paper. That would deny learners the opportunity to learn indigenous forms of GD. According to Manabete and Umar (2014), a people's corporate survival and identity are tainted and jeopardised when their IK, experiences, precepts, customs, and histories are discarded in favour of foreign ones. This remains a significant issue in African education, despite the provisions outlined in the South African and Kenyan constitutions and education policy documents (Ronoh, 2017). Similarly, the study conducted by Yeseraw et al. (2023) reveals a lack of attention to the integration of local knowledge systems into the curriculum.

Incorporation of IK vs time
Our findings show that the teacher claimed that the time to incorporate IK in teaching and learning GD was insufficient because Technology is assigned only 2 hours per week. According to her, "*IK is a component that can be added when there is time.*" We think that had the teacher read and understood the CAPS, she would have realised that integrating IK in her teaching would not pose a time constraint nor curriculum overload, but would rather be a very versatile addition to the handling of the content areas in Technology, namely structures; processing; mechanical systems and control; and electrical systems and control (DBE, RSA, 2011). As a Technology teacher in South Africa, one should start with African IK and then proceed to global perspectives. The teacher should, therefore, note that it is rather about centring her teaching on IK

than her sense that policy does not allow one because of time. Indigenous technology has the potential to pique learners' interest in their learning process since they can learn about the contributions of their communities to Technology (Gumbo, 2015). L3 asserted thus: "*We can understand indigenous technology and how it works and* [that] *will assist* [us] *in interpreting drawings.*" Hence, exposing learners to, for instance, indigenous designers would be one way of getting them to identify with the designers and make content more meaningful. As such, IK could increase the learners' interest in GD. Herbawi et al. (2023) argue that incorporating heritage elements such as cultural context into GD can result in a more inclusive and impactful approach. This is particularly relevant in today's globalised landscape where designers are tasked with creating content that connects with multifaceted and diverse audiences. According to Gorjestani (2000), the incorporation of IK in teaching and learning allows the teacher to learn alongside the learners and the community. In that sense, learners should be prepared to contribute to the sustainable development of their communities; they should begin by designing technological solutions for local challenges/problems.

The findings from the lesson observation show that, when the teacher's lesson focused on orthographic drawing, she failed to incorporate reference to IK when she discussed the indigenous people's historical drawings of, for example, the Sudwala caves in Mpumalanga. That was an ideal opportunity for her to relate the historical realities to the present by making connections between the knowledge and skills applied to those drawings and orthographic drawing, for example, the line drawing and two-dimensional (2D) or three-dimensional (3D) presentation displayed in those drawings. This is informed by the fact that the learner participants in this study knew about 2D and 3D as L7 stated: "*graphic design is whereby we construct graphics using 2D and 3D to view the sides which are the front, top, and side, and use lines such as hidden details.*" The historical Sudwala caves drawings clearly show why Technology teachers should consider investigating indigenous technology in contexts that exhibit IK to use in their teaching activities. That would require them to dismiss the negative perceptions about indigenous technology that are rooted in colonial thinking/attitudes. According to Ezeanya-Esiobu et al. (2021), the contents of a curriculum should represent the actual life and lived experiences of learners in their contexts.

Teaching materials
Under this subtheme, the teacher claimed that no teaching materials such as guidebooks existed to promote the incorporation of IK. While we note the CAPS' deficiency in that regard, we think that, with proper guidance, teachers could search for resources in their surrounding environments to use

for the incorporation of IK. The teacher could be reminded to look at herself as a first resource as she is an indigenous person (Swati). However, the teacher did acknowledge that "*IK could address the problem of a shortage of resources.*" Africa is rich in indigenous materials that could aid in the design and Technology curriculum frameworks (Gaotlhobogwe, 2012). In fact, Gumbo (2020) challenges the claim that schools are poorly resourced. He points to the resources that exist in localities that are not considered because of the low status accorded to IK. Thinking about IK as inferior translates into regarding schools as being poorly resourced. However, Mpumalanga is rich in cultural diversity and IK holders such as Dr Esther Mahlangu could be invited to share their knowledge and skills about indigenous GD. Gifford and McEachern (2021) suggest that indigenous elders contribute a wealth of wisdom and life experiences to those in their community.

Furthermore, the learners' cultural background is also a resource for teaching GD. Learners had a strong belief that knowledge taught at home was relevant to their GD learning. L5 explained as follows: "*IK would trigger learners to want to know more; it can make learners improve in the learning of GD.*" Similarly, L2 indicated that some people still valued IK at home, which made it relevant in the teaching and learning of GD. According to L2, "*IK can improve learners' understanding of graphics, as some still use it in their homes.*" It is critical to align learning with the learner's cultural background. Dyson, Hendriks and Grant (2006) state in this regard that indigenous peoples have oral communication and storytelling traditions that are fundamental to their learning environment. Added to this is experiential learning, which is more practical in nature – it could point teachers and learners to rock paintings and other cultural artifacts.

Knowledge of Technology and Pedagogies in Relation to IK
Knowledge of Technology
The results of this study reveal the teacher's mixed understanding of Technology as a subject. According to her, technology "*has to do with knowledge from the past, which may influence GD learning.*" The teacher claimed that "*graphics was done by our forefathers; it has become modernised.*" Further probing in this regard resulted in the teacher stating that Technology is a subject that has been around for a long time, but it has gained prominence as a Western subject because it was not incorporated into formal schooling. We noticed that her narrative did not consider the fact that technology as a subject has only been introduced in the curriculum recently; only technology as a concept has been in existence for a very long time. Furthermore, the teacher's description limited technology to the past. Hence, her reference to IK in her teaching of orthographic drawing was based on that.

The teacher was aware of the discrediting of IK and the promotion of conventional technology. In this regard, Sefa Dei (2002) states that starting from whence one came entails knowing oneself as well as the history of one's social setting. That suggests that teaching learners about technology from a cultural perspective would benefit them in the continual process of knowledge formation. Thus, incorporating IK as it relates to their cultural backgrounds into the teaching of GD could boost learners' understanding of technology. In that regard, the teacher agreed that teaching graphics from an indigenous perspective would influence learners' understanding and assist them in solving technological problems. L4 agreed by stating that "*it can help children to be able to draw in GD and solve technological problems.*"

Applying the indigenous version of technology to transform pedagogy

Our findings reveal that the teacher could relate technology to indigenous culture. However, she did not provide the opportunity for her learners to learn about indigenous technology. That was confirmed during our lesson observation. Indigenous technology was mentioned once only when the teacher referred to the historical drawings of indigenous people. Swati, as one of the indigenous cultures, is rich in symbols and arts, as has been indicated in the introduction section. There are opportunities to use these as resources in GD. On the very matter, learners pointed out that Swati culture has patterns that could help them learn GD more easily. L6 stated: "*Swati culture is using patterns and technology is about drawings; those patterns use drawings. So, technology is involved, and we know our Swati patterns.*"

Ametordzi, Osei-Poku and Eshun (2012) acknowledge the impact of pedagogical situations and learning outcomes in GD in the sense that the combination of models and diversification of methods could make teaching and learning in GD an engaging and fascinating experience. Storytelling, demonstration, and experiential teaching and learning are some of the methods that are commonly used by indigenous people – learning about and adapting such methods would, therefore, be another strategy for relating learning to the learners' contexts. Passive learner participation, which was observed during the lesson observation, could transform into active participation when such methods are employed. According to Makgato and Khoza (2016), inadequate teaching practice is a concern in GD. Similarly, Meyer and Norman (2020) discovered that crucial aspects of a designer's perspective and process are often overlooked in educational curricula. Additionally, Lin, Wu, Hsu and Williams (2021) found that the discrepancies between engineering experts and novices in the design process do not always align with the emphasis that technology teachers place on their engineering design instruction. Drawing from the above,

Ellmers (2014) states that teachers should engage in a reflective practice which is vital in GD learning because it could provide learners with different possibilities to acquire GD abilities. We believe that incorporating IK into the teaching of GD in the way described here would create a plethora of options. In support of this, McGarr (2010:317) states that technology and society are "essential to the subject's identity." Similarly, Meyer and Norman (2020) argue that traditional human-centred design (HCD) approaches, which prioritise designer skills, must evolve into community-driven, bottom-up collaborations involving experts familiar with relevant domains. This shift represents a move towards community-driven co-design processes. Hence, relating technology to the society and environment of learners would enhance their learning experience.

Target skills for GD teaching

Technology as a subject develops numerous skills in learners through the learning activities designed for them. According to the teacher, these include "*creative, critical, communication, design, drawing and many more skills.*" Design, in particular, is a fundamental aspect of what it means to be human, as well as an important determinant of the quality of human life, which informs learners' creative ideas that combine art and technology to communicate ideas (Heskett, 2005; Singer, Doerry, & Buckley, 2009). Henriksen, Creely, Henderson and Mishra (2021) assert that creativity is a universally valued aspect of human cognition that transcends disciplinary and cultural boundaries. Therefore, we regard creativity as a critical aspect of the teaching and learning of GD. However, we noticed that the teacher did not consider the cognitive, personal, motivational, and social interactive approaches (Bull, Montgomery & Baloche, 1995, cited in Hokanson, 2007) to nurture the learners' creativity in GD. In line with the perspective mentioned earlier, Samaniego, Usca, Salguero and Quevedo (2024) argue that fostering creativity through teaching methods can serve as a means to motivate learners to participate in various scientific and artistic activities. They suggest that by nurturing creativity in education, learners can develop essential skills that are relevant to the demands of the contemporary world. Nonetheless, the findings reveal a lack of appreciation for creativity in GD. It would appear that the teacher did not plan the lesson to encourage creativity. It was noted that learners had little interest in generating orthographic drawings based on the tasks that the teacher gave. Their learning did encourage creativity that could result in methodical approaches that would encourage them to engage in creative GD ideas. According to Visser, Chandler and Grainger (2017), creativity plays a key role in developing ideas and products; resources should be handled and changed creatively. Thus, it is critical to establish a conducive atmosphere to provide

opportunities and motivation for learning (Alhajri, 2016).

Conclusion

In light of the findings of this study, the teacher's teaching of graphics lacked the proper background to support the incorporation of IK. That was despite the incorporation of IK in the CAPS – the teacher seemed not to know about that. The richness of indigenous contexts such as many rural areas in Mpumalanga presents opportunities to adopt an indigenous approach to the teaching of Technology. To ensure the transformation of education, IK should not only be mentioned in the CAPS document but should become an actual part of teaching and learning activities. Indigenous people's environments are endowed with a plethora of knowledge and practices that could boost learners' learning and make it relevant to their contexts and cultures. Teachers who recognise the richness of IK could change the teaching of GD in Technology and make learners feel accommodated in class. This finding was confirmed by the learners, demonstrating their comprehension and valuing of the concept of IK and its connection to their existing background knowledge, particularly in GD. The study reveals that integrating IK into GD has the potential to stimulate learners' interest, as such knowledge was found to be more easily categorised compared to limiting it to modern technological knowledge. These findings underscore the significance that learners place on IK – despite the lack of or limited integration in their GD activities. Therefore, this study contributes knowledge by showing a specific teacher's superficial knowledge of CAPS (many more teachers might be in the same situation) and recognising that IK should be incorporated into the teaching of Technology. Hence, we make the following recommendations:

- Training of teachers on how to incorporate IK in the teaching of GD. That would enable them to approach their teaching as a transformation project.
- Teachers should identify local resources that would promote the incorporation of IK. They could, for example, arrange learner tours to indigenous sites.
- Extended research on the incorporation of IK in teaching. Studies should be conducted about teachers' attitudes toward IK.

Authors' Contributions

PB wrote the first draft of the manuscript. MTG contributed the theoretical framework, reordered and fine-tuned the manuscript, and reviewed its final version.

Notes

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