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DESIGN EDUCATION | AFRIKA | 4TH INDUSTRIAL REVOLUTION

## **Masking-up with 4IR fashion design education: A retrospective analysis**

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### **Abstract**

*For decades, studio-based pedagogy, grounded in socially-engaged, constructivist learning spaces dominated design education (Crowther 2013; Shreeve, 2015). However, the global pandemic forced design education to align with the fourth industrial revolution (4IR) and move towards interactive digital technologies and online teaching and learning methodologies. Positioned in the space of 4IR, the move to digital technologies is required to digitally streamline and integrate human-centred opportunities for inclusivity guided by technological advancements (Chuo 2019, pp. 107).*

*Globally, fashion design education had to rapidly move practice-based teaching and learning from the studio to digital spaces. Although this move presents challenges in its own right, for first-year fashion design students with minimal vocational teaching and learning exposure, pedagogical questions emerged in terms of: 1) how can practice-based teaching and learning move to remote platforms; 2) how can learning outcomes transform; 3) how can theory integrate with practice; 4) what interactive digital technologies and teaching and learning methodologies can be applied to ensure students remain engaged; and 5) how do educators interact with students? Given the novelty of shifting practice-based teaching and learning to digital spaces, the lack of scholarship posed a research problem in guiding and addressing these pedagogical questions.*

*Embedded in these pedagogical questions and research problems, this paper serves a three-fold aim. The first aim is to contextualise a COVID-19 mask project, which was designed for implementation with first-year fashion design students with the purpose of integrating and applying theory-based knowledge on human-centred design to co-design, prototype and make a wearable COVID-19 mask in response to user needs. This COVID-19 mask project culminated in a digital design journal as the assessment instrument. The second aim is to draw on selected first-year students' digital design journals to contextualise and juxtapose past scenarios with the COVID-19 mask project. Against the backdrop of reflection-on-action, the third aim is to reflect on challenges, educators' lived experiences and their retrospective analysis.*

*To achieve these aims, the methodology employed comprised collecting artefacts in the form of selected students' digital design journals as empirical evidence for contextualised narration. In the same light, retrospective analysis is drawn from the educators' reflection-on-action. From an Afrikan lens, in relation to accessible digital resources and unilingual communication, the findings reveal that students may have experienced challenges but that, on the other hand, a hidden curriculum, for example, the development of independence and self-directed innovation, emerged. In the same light, students are digital natives and therefore the digital design journal is a way*

*forward for fashion design education. As such, this paper aligns with and contributes to the conference focus on design education within the context of Afrika and 4IR digital technologies.*

**Keywords:** 4IR, digital technologies, fashion design education, online teaching

## Introduction

For decades, design education predominately grounded itself in studio-based pedagogy. Crowther (2013, pp. 19) argues that studio-based pedagogy is a constructivist approach. Studio-based pedagogy is student-centred in that educators become facilitators who walk around conversing with students, posing questions to facilitate decision-making, contemplate alternate design opportunities and think about a course of design action (Shreeve, 2015, pp. 85-88).

However, in March 2020, the world found itself in the midst of a COVID-19 pandemic (World Health Organization, 2021), which prompted design education to align with the fourth industrial revolution (4IR) thus requiring a shift to interactive digital technology and online teaching and learning approaches. Moving to digital technologies is essential to digitally streamline and integrate human-centred inclusivity guided by technology breakthroughs in 4IR (Chuo, 2019; Xing, Marwala & Marwala, 2018).

Globally, fashion design education had to move rapidly to practice-based studio teaching and learning to digital spaces via, for example, video conferencing tools and digital learning management systems such as Blackboard (Bb) and Fronter, which provide access to learning materials (Kini-Singh, 2020; Unwin, et al., 2010). The rapid curriculum changes for online offerings notably focused on moving information to online platforms but not necessarily to remote pedagogy (Crawford, et al., 2020, pp. 10). This move presents challenges for first-year fashion design students with minimal vocational teaching and learning exposure. Hence, pedagogical questions emerged in terms of: 1) how can practice-based teaching and learning move to remote platforms; 2) how can learning outcomes transform; 3) how can theory integrate with practice; 4) what interactive digital technologies and teaching and learning methodologies can be applied to ensure students remain engaged; and 5) how do educators interact with students? However, given the novelty of shifting practice-based teaching and learning to digital spaces, the lack of scholarship posed a research problem in guiding and addressing these pedagogical questions.

Embedded in these pedagogical questions and research problem, this paper serves a three-fold aim. The first aim is to contextualise a COVID-19 mask project, which was designed for execution with first-year fashion design students. The second aim is to draw on selected first-year students' digital design journals to contextualise and juxtapose past scenarios with the COVID-19 mask project. Against the backdrop of reflection-on-action, the third aim is to reflect on challenges, educators' lived experiences and their retrospective analysis.

## Literature review

### *Constructivist learning space*

In opposition to orthodox university lecture or classroom settings, which hones on information deliverance and transference, constructivist, studio-based pedagogy is widely accepted as being student-centred (Brandt, et al., 2013; Cennamo, et al., 2011; Taylor, 2009). Hence, the studio is a socially-engaged, constructive and cultural learning environment and a workshop

(Crowther, 2013; Lawson & Dorst, 2009; Muratovski, 2016; Tovey, 2015). In this learning environment, students interact with peers thus fostering an ethos of socially-engaged learning experiences, critique and imparting design ideas (Lawson & Dorst, 2009; Tovey, 2015). Facilitator and peer access construct prospects for student learning via conversation, demonstration and design critique (Brocato, 2009, pp. 141). With design critiques, students pose design ideas and prototypes to facilitators and peers in support of reflection, knowledge acquisition and learning about and to design (Brandt et al., 2013; Kuhn, 2001). The global COVID-19 pandemic challenged the constructivist learning space in fashion design education.

#### *Remote teaching and learning opportunities and challenges*

The COVID-19 global pandemic impacted on many elements of modern society, including education, resulting in a transformation of human life (Benito, et al., 2021, pp. 52). Globally, tertiary education students experienced varying levels of on-campus access ranging from complete closure, during high-risk pandemic spread, to a combination of on-campus and remote learning (Benito, et al., 2021, pp. 52). Friedman and Escano (2020, pp. 27) claim that art education, particularly in fashion design, have characteristics suitable for remote learning due to substantial reliance on visual demonstration and the fact that, traditions of teaching online art and design processes exist. However, the transition to fully online and blended learning has not been smooth and has thus been described as ‘emergency’ and ‘lighter distance’ environments (Suhartini, et al., 2020, pp. 654). Although opportunities exist for educators to apply online teaching and learning to guide, mentor, and encourage students to experiment with technology, the benefit seems to be reserved for the select few who have access to digital resources. As such, structural inequalities in terms of socio-economic status, race, and resource access are evident (Suhartini, et al., 2020, pp. 654). The digital divide is a concept used to characterise the disparity between those who have Information and Communication Technology access and those who do not (Gudmundsdottir, 2010, pp. 3).

In Afrika, although the use of computers and the internet for teaching and learning is still in its infancy, sub-Saharan Afrika has one of the fastest-growing mobile phone subscription rates worldwide and the use of mobile phones to support learning in resource-challenged educational environments has gained momentum (Isaacs, Roberts & Spencer-Smith, 2019, pp. 1). The use of language apps, virtual tutoring, video conferencing tools and digital learning management systems such as Bb and Fronter to provide access to teaching and learning materials coupled with open-source software such as Moodle, KEWL.Nextgen and Sakai/Vula are evident (Kini-Singh, 2020; Unwin, et al., 2010). A recent study found that digital teaching and learning can enhance learning experiences for both educators and students alike, particularly in situations where peer learning and collaboration are encouraged but uncertainty exists (Rambe & Chipunza, 2013, pp. 331). Although this might be the situation within the South African context, the digital divide reveals a divide between those who can and those who cannot access local content, websites and language. Students with English, as a home language, are at an advantage since most content is presented in English (Gudmundsdottir, 2010, pp. 10). The language challenge may possibly present a challenge in terms of 4IR interactive digital technologies.

#### *4IR and interactive digital technologies*

4IR requires industries to digitise or digitally streamline operations to create or realise a fully integrated system (Chuo, 2019, pp. 107). Characterised by merging digital, biological, and physical worlds, 4IR has introduced new technologies such as artificial intelligence (AI) (Ndung’u & Signé, 2020, pp. 61). AI refers to replicating human intelligence in machines and technology to apply traits of the human mind in learning and problem-solving (Frankenfield,

2021). Examples of AI technologies that individuals interact with include, for example, smartphone assistance such as Siri on Apple iPhone devices or Alexa, developed by Amazon, and email spam filters (Built In, 2021). The differentiation of new 4IR technologies, compared to previous industrial revolutions, focuses on how such technological developments can best assist users of such technologies, as well as consideration in terms of the level of interaction and user engagement. 4IR is thus synonymous with innovation and creating digital technologies that integrate human-centred opportunities that are socially inclusive (Xing, Marwala, I & Marwala, T, 2018, pp. 187).

Interactive digital technology or media refers to various approaches people use to process and share information (Dhir, 2021). Examples of interactive technologies include social media, WhatsApp, virtual reality and smartphone applications (Dhir, 2021). Many sectors, including higher education (HE), incorporate interactive digital technologies in disseminating and teaching curricula. Literature highlights that “the use of the internet and dependency on digital gadgets has transformed the learning and knowledge sharing approaches” implemented in the HE sector (Habib, et al., 2021, pp. 518). As most sectors begin to digitise and streamline practices and systems to 4IR processes, an integrated and digitally-driven structure becomes instrumental in learning activities (Dhir, 2021).

### *Contextualising the COVID-19 mask project*

To move to remote pedagogy, the authors considered five pedagogical questions to guide the design of the COVID-19 mask project, namely 1) how can practice-based teaching and learning move to remote platforms; 2) how can learning outcomes transform; 3) how can theory integrate with practice; 4) what interactive digital technologies and teaching and learning methodologies can be applied to ensure students remain engaged; and 5) how do educators interact with students? Against this backdrop, this section responds to the first aim, to contextualise the COVID-19 mask project.

The COVID-19 mask project was designed for execution with first-year fashion design students over a duration of seven weeks at the commencement of the second semester. The mask project was designed to integrate a theory and practice-based module by way of remote pedagogies. The theory-based module consisted of two units, namely, basic research and human-centred design (HCD). These units were important to incorporate and inform the practice-based module. The practice-based module consisted of three constituents, namely, design, patternmaking and garment construction (the ‘making’ aspects).

As such, the overall aim of the mask project was to integrate and apply theory-based knowledge about the HCD principles and basic research to co-design, prototype and make a wearable COVID-19 mask in response to real-world user needs and problems. To engage with co-design activities, the authors drew on Harvey and Smal’s (2021, pp. 33) framework known as *The Generative Tool* comprising seven activity modes namely 1) needs, goals, preferences and context of design use (what to design), 2) define design criteria and constraints (requirements), 3) idea (brainstorming), 4) action plan, 5) concept, 6) prototype, and 7) product. In other words, the activities associated with research, design processes and, finally, product development.

However, the authors were mindful that these first-year students were only exposed to seven weeks of first-semester, contact teaching, and learning. Hence, they had limited vocational exposure to the usual studio-based pedagogy and socially-engaged, constructivist learning space. Therefore, learning outcomes transformed in four fundamental ways.

Firstly, in a contact teaching and learning situation, to achieve learning outcomes, activity tasks were designed in a way to adopt a role-playing strategy where one student assumed a user role and another that of designer, culminating in a two-member co-design team. For the mask project, students were required to select a real-world user such as a family member or friend, to form part of the co-design team.

Secondly, the first and second modes in *The Generative Tool*, namely to identify needs, goals, preferences and context of design in order to define design criteria and constraints, required empirical conversations. Contact theory allowed opportunity to design activity tasks in a way that students could practice the art of conversation and probing were essential to gather empirical information, user feedback and engagement in a co-design process. However, remote pedagogy removed this socially-engaged learning experience in that, to gather and analyse empirical information to define design criteria and constraints, a qualitative open-ended questionnaire was designed for students to apply as a research instrument, as opposed to conversations. The rationale for this particular research instrument considered that some students may be living alone or even in self-isolation.

Thirdly, in contact teaching, the practice-based studios are equipped with discipline-specific tools, equipment and specialised machinery to accommodate for human-size prototyping and product development. However, remote pedagogy could not accommodate this situation. Therefore, the tangible product of a mask. In addition, the authors acknowledged that in a remote learning situation, students may not have access to specialised machinery. For this reason, the outcome and activity tasks were flexible to accommodate for hand-sewing techniques or the application of discipline-specific machinery depending on students' unique situations. Similarly, the mask project design activities required experimentation with fabrication techniques such as fabric dyeing but regulations meant that students may not be in a position to purchase materials. Therefore, experimentation required the use of natural dyeing techniques that were easily available at home. Likewise, recycled materials were required to make the mask.

Fourthly, the authors questioned how students would submit a tangible product and document the design process activities against the backdrop of *The Generative Tool*. Previously, design process activities were documented in a hard-copy design journal and tangible products were physically submitted on campus. To accommodate this, a digital design journal template was generated to align with *The Generative Tool*. As such, students were required to document the design and product development process and user feedback by applying computer-aided design (CAD) software packages. To support engagement with activity tasks and develop a digital design journal, for each of the seven activity modes presented in *The Generative Tool*, detailed step-by-step guidelines were posted on Bb with hyperlinks directing students to online video tutorials. To obtain and document user feedback, depending on individual situations, students could apply any preferred communication tools such as face-to-face or virtual conversations or digital applications.

The mask project culminated in the submission of a digital design journal as the summative assessment instrument. For both theory and practice-based modules, teaching and learning materials were offered via Bb. Remote teaching methodologies included hyperlinked video tutorials, pre-recorded, compressed audio recordings used in conjunction with PowerPoint slide decks, which were converted to PDF format as a means to reduce student data costs. The authors were of the view that students may well be 'digital natives' and prefer interactive learning materials to remain engaged as opposed to only textual. In the same light, regular Bb collaboration sessions were held to ensure constant interaction between students and educators, as well as for the purpose of formative assessment. Bb discussion forums were set up to support learning-on-the-go question and answer opportunities. As a further support

mechanism to interact and remain engaged, WhatsApp and email tools were implemented as additional communication strategies. The summative assessment digital design journal was submitted via a portal created on Bb.

## Methodology

The methodology employed secondary data collection in the form of artefacts comprising selected students' digital design journals. Artefacts include, for example, documents, photographic and film materials, objects and drawings (Banks 2009; Flick, 2018; Silverman, 2014). Prosser (2011, pp. 479) states that visual images are employed for comprehensive empirical purposes to structurally link visuals and contextualisation. As such, in this research endeavour, selected students' digital design journals were not analysed but rather used as comprehensive evidence to support contextual narration in order to juxtapose past scenarios with pedagogic reflection on the COVID-19 mask project. Aligned to the third aim of this paper, the educators' retrospective analysis is drawn from reflection-on-action.

Ethical considerations were observed by requesting ethical consent from the Department Higher Degrees Committee to use selected students' digital journals in this paper. In addition, student confidentiality and anonymity are ensured by eliminating any personal information such as names, surnames, and student numbers. For that reason, when citing the work of selected students, non-gender-specific pseudonyms (Eden and Morgan) are used.

## Findings

### *Digital design journal: juxtaposing past practice with the COVID-19 mask project*

In response to the second aim, this section draws on selected first-year students' digital design journals to contextualise and juxtapose past scenarios with the COVID-19 mask project. From retrospective analysis, three fundamental juxtapositions emerged.

Firstly, in the past, students captured research conversations, data analysis, design and product development process activities and user feedback in hard-copy design journals. However, through educator reflections, students engaged with the design journal in an unorganised manner whereby documentation occurred in various notebooks or paper-sheets and prior to summative submission, students would attempt to cut, paste and collate disorderly material into a hard-copy design journal. In the same light, although in the past, activity tasks required that hard-copy design journals be structured to align with *The Generative Tool*, on submission, it was confusing for educators to decipher which activities corresponded to which of the seven activity modes in *The Generative Tool*. With the design and implementation of a digital design journal template, most students excelled in producing well-organised, coherent and well-planned digital design journals that demonstrated design thinking, action, reflection and iterative cycles of refinements. In addition, students were found to be 'digital natives' and applied software packages to compile the digital design journal, which seems to have eradicated the challenge of last-minute attempts to cut, paste and collate a hard-copy design journal.

Secondly, in the past, research, by way of conversations, was documented via field notes, analysed in a systematic manner and recorded in hard-copy design journals. Although rich in information and data analysis strategies, the move to digital design journals showed deeper rigour and engagement with research in a planned and systematic manner that led to design

criteria and constraints. Figure 1 is a graphical image of the research analysis stemming from the data collected from the respective user regarding the problems and proposed solutions in terms of comfort, practicality, fit, environment or context of design use, and style of the COVID-19 mask. Data analysis continued, as shown in Figure 2, to develop a set of design criteria and constraints emanating from the research. These design criteria and constraints acted as a framework for designing the COVID-19 mask.

From a third aspect, although hard-copy design journals demonstrated engagement with experimentation and exploration, the digital design journals revealed deeper participation, on the part of some students, with brainstorming, experimentation and exploration of multiple design solutions to best align with user-generated design criteria and constraints. In the same light, digital design journals included detailed photographs as a strategy for documentation. Some students surpassed expectations in applying innovative digital applications to obtain user feedback and capture such feedback in digital design journals. The possibility exists that because students were engaging with design process activities remotely, those students who took the initiative might have had more time for experimentation and exploration. Figure 3 represents concept stage activities that include detailed sketching activities with supporting narratives to demonstrate thinking, motivation, and action. In the same light, given the emphasis on user participation, Figure 3 shows user feedback to support refinement. Figure 4 depicts experimental fabric dyeing techniques as part of the concept stage activities. As such, Figure 4 demonstrates the practical, experimental testing process before product development.

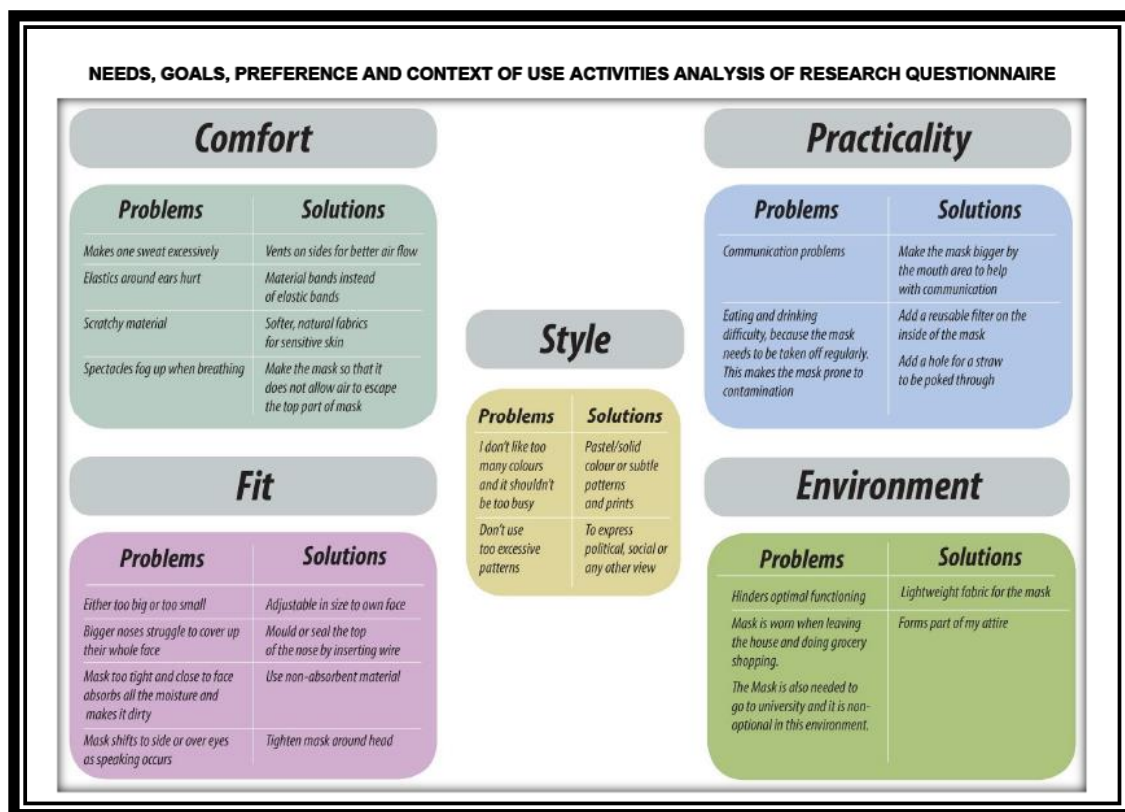


Figure 1: Analysis of research. Developed by Eden (2020)

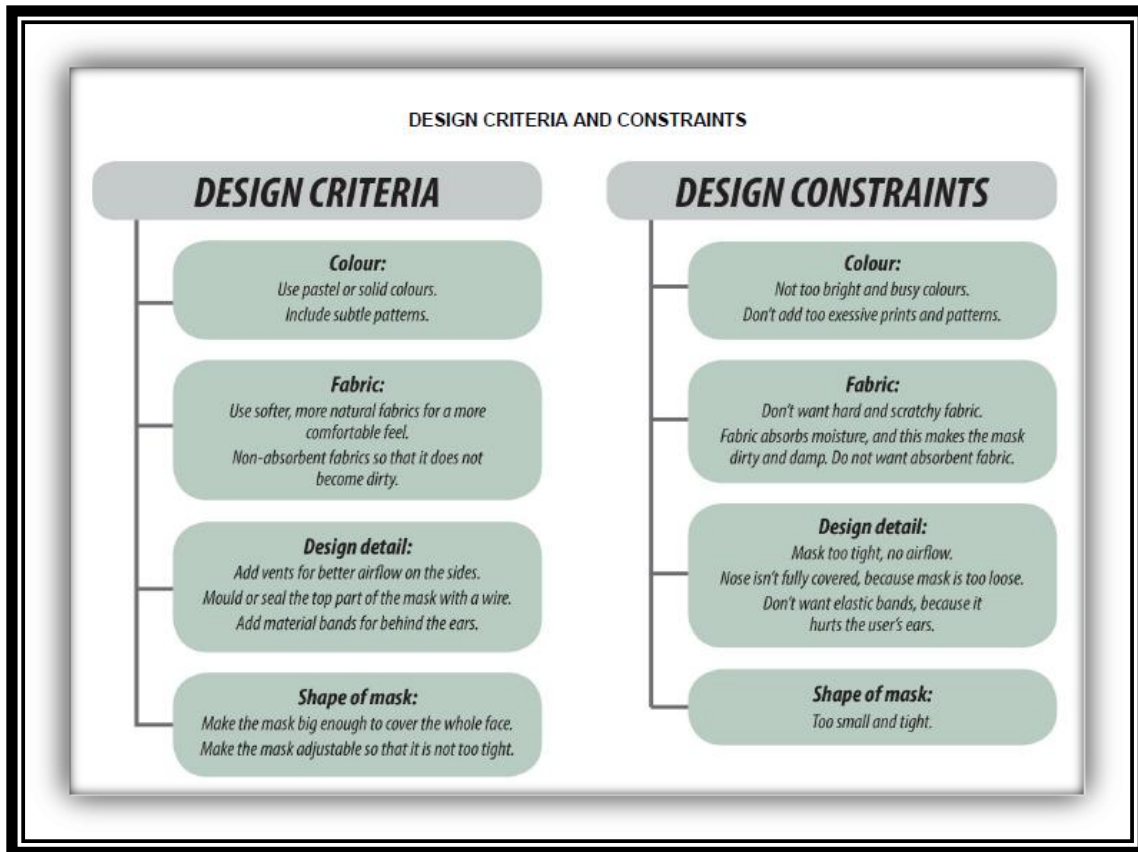


Figure 2: Design criteria and constraints emerging from research analysis: Developed by Eden (2020)

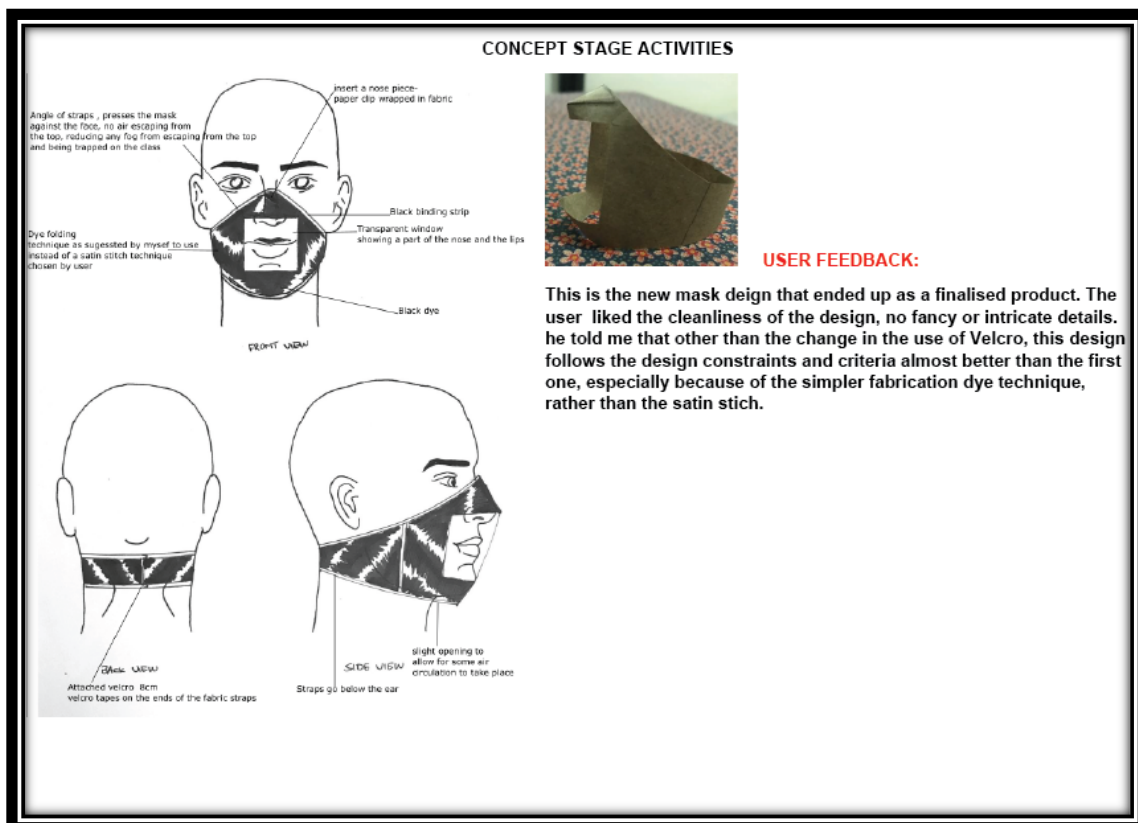


Figure 3: Concept stage. Developed by Morgan (2020)



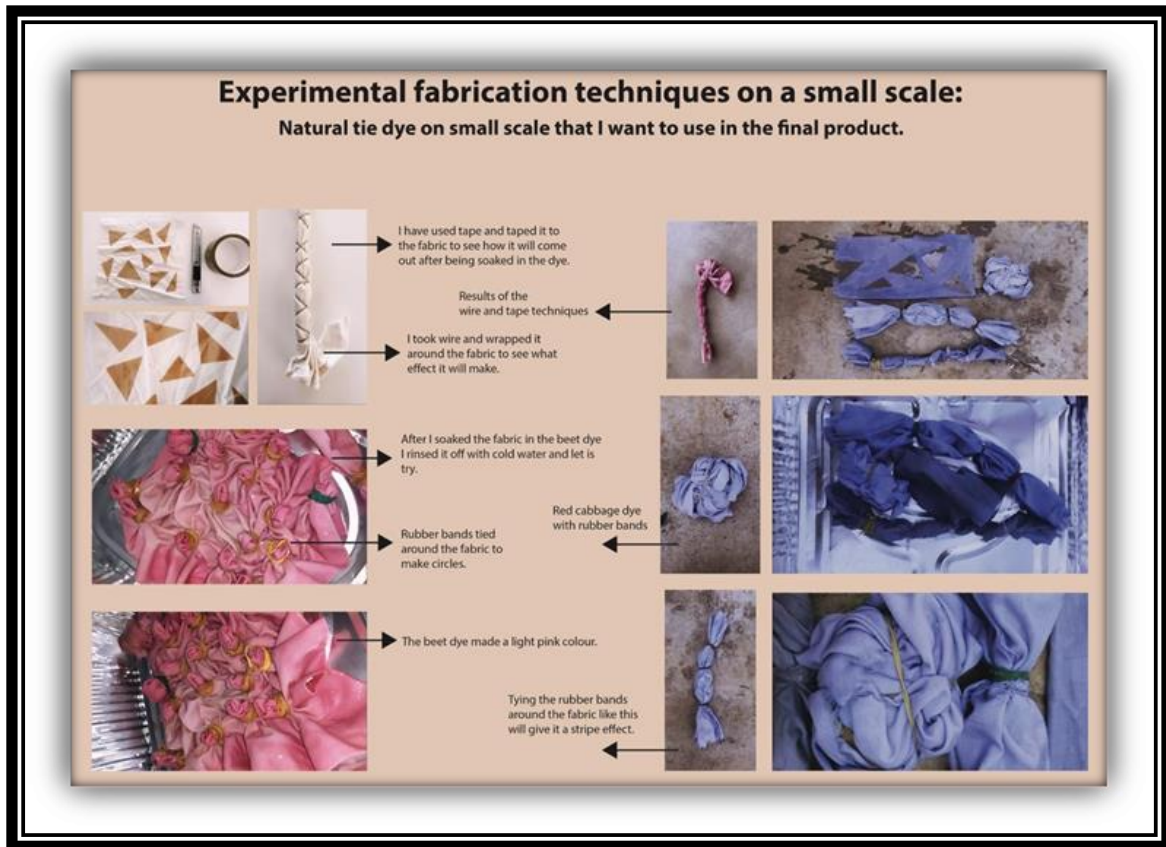


Figure 4: Experimentation. Developed by Eden (2020)

### *Educators' retrospective analysis*

Against the backdrop of reflection-on-action, this section links to the third aim and narrates the challenges, the educators' lived experiences, and their retrospective analysis.

The online teaching experience is vastly different from the conventional, studio-based approach, which posed limitations for educator-student interactions. The challenge experienced with the 'making' aspects in terms of patternmaking and garment construction is that students' individualised designs raised difficulties in addressing each student's distinctive design specifications to assist with divergent various construction methods. The educator-generated video tutorials consisting of construction methods relating to four general designs for a three-layer mask and three fastening methods. However, students presented specific queries relating to their masks, and addressing all student queries electronically was challenging. Often, some students did not follow through with electronic formative feedback but some took the opportunity to interact and gain meaningful feedback.

The importance for students to be self-driven, motivated, and experimental became evident in an online environment. Usually, in a studio-based setting, students are encouraged to experiment with a variety of fabric manipulation techniques with provided materials, workspace, and guidance to do so. However, with remote learning, some students did not experiment with a variety of fabrication techniques. Instead, they chose what appeared to be the easiest or simplest fabrication technique. On the other hand, for some students, a hidden curriculum of, for example, independence, motivation, and self-directed innovation emerged under remote conditions. In such situations, the experience was extremely rich and outcomes innovative.

Unilingual communication posed another challenge. The studio space provided frequent opportunities to communicate with students via Afrikan languages but in a digital environment, this was not an easily accessible communication strategy because the English language dominates the internet. Likewise, of South Africa's eleven official languages, English is the only available language on Bb and also the language used to prepare student learning materials. The haste with which migration to digital learning occurred did not allow sufficient time to be more inclusive in using Afrikan languages which may have disadvantaged some students.

### *Challenges around computer-aided design*

Still linking to the third aim, this section narrates on the challenges, the educators' lived experiences and their retrospective analysis pertaining to CAD.

The digital design journal required that students use any accessible CAD software packages, such as Adobe Creative Suite or open-source software. Although the licenced Adobe Creative Suite was accessible in departmental computer studios, national lockdown regulations coupled with institutional phased-in student reintegration plans posed challenges for on-campus access. Off-campus access to licenced software became temporarily available during the course of the year but these first-year students had no exposure to CAD software. As such, educators and students pursued alternative, open-source software packages such as Inkscape and Gimp for more accessible access. Although these alternative software packages solved the problem of temporary inaccessibility to CAD resources in departmental computer studios, students had to be remotely taught how to use open-source CAD software packages. Online video tutorials were created and shared with students for remote, independent learning and practice. In the same light, educators were required to fully understand the open-source CAD packages, from a technical aspect, due to student technical-related queries about the software. Learning and using alternative software packages required more preparation, as well as educators and students first understanding the software before beginning with the project which impacted on the time allocated for activity tasks.

Software compatibility with laptops, desktops, and hand-held devices was another challenge that required investigation through online tutorials or guidance found in website forums. Challenges regarding student experiences emerged as some students did not have remote access to laptops or desktops; hence CAD compatibility on phone devices posed challenges. To accommodate such challenges, students could apply hand-drawings, photograph them and insert them into the digital design journal. However, students could produce digital design journals through availability and access to open-source CAD packages and various other access methods.

## Conclusion

This paper shows that despite the swift move to remote methodologies, the design and implementation of the COVID-19 mask project to integrate theory and practice-based modules at a first-year level is possible. However, it required educators to be responsive and consider the diversified, Afrikan student body, critical thinking, transformation of learning outcomes and application of interactive digital technologies to ensure students remain engaged. Educators cannot expect students to deliver historical learning outcomes and offer conventional teaching and learning methodologies in a unique Afrikan remote environment.

From an Afrikan lens, the findings reveal challenges in terms of unilingual communication which may have disadvantaged some students. Although English is the official language of

instruction, the recommendation is further research to explore the barriers to Afrikan languages in a remote teaching and learning environment.

In addition, students are certainly 'digital natives' and therefore the digital design journal is a way forward for fashion design education. Then again, in relation to accessible digital resources, although the findings reveal challenges, educators and students alike demonstrated dexterity and adaptability in applying open-source software to compile digital design journals. The situation of open-source software access changed from the commencement of the 2021 academic year with remote accessibility to off-campus, licensed software packages. However, further research is required in two areas. The first is the feasibility and functionality of licensed software packages in comparison to open-source. The second is to explore the challenges of accessing licensed software packages for off-campus use.

Although student challenges are real, educators' retrospective analysis allowed for a hidden curriculum, for example, independence, motivation and self-directed innovation, to emerge among some students. This paper did not set out to measure these aspects. Hence, the recommendation is to explore and measure this hidden curriculum as further research.

Despite the lack of research and innovation associated with repositioning practice-based teaching and learning within digital spaces, this paper makes an original contribution to 4IR scholarship of teaching and learning in fashion design education. As such, this paper aligns and contributes to the conference focus on design education within the context of Afrika and 4IR digital technologies.

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