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DESIGN EDUCATION | AFRIKA | 4TH INDUSTRIAL REVOLUTION

Critical design futures: Challenging the gender data gap through pedagogy

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Abstract

As we enter the era of the fourth industrial revolution (4IR) faced with potential ethical and security risks, ensuring sustainable and inclusive innovation within the design industries will be essential. However, this proves unlikely when the design industry itself has inherent biases and inequalities.

Historically, student enrolments in design institutions reflect notions of gender socialization whereby women are connoted to the decorative and aesthetic and men to technology and invention. As a result, women are underrepresented in fields such as industrial design, digital design, and architecture and men are underrepresented in the fields of fashion, textile, and jewellery design. Gender inequity within design disciplines at a professional level, not only perpetuates gender stereotypes but creates a gender data gap whereby the products and services we create are designed according to male data, resulting in markets that are underdeveloped concerning the specific needs of users.

While student enrolment gender ratios (in some disciplines) seem to show significant levelling out over the past 20 years, the same transformation does not reflect in the design industry. A study conducted by The British Design Council in 2018 identified that although 63% of all UK Art and Design graduates are female, the UK design workforce reflects a 78:22 male to female gender split, in comparison to the 53:47 gender split of the wider UK workforce. While some studies looking into the gender gaps within design industries exist, further research is required to develop an understanding of why a large percentage of female graduates are leaking out of the pipeline that carries them from university to industry. In light of these points mentioned, a research project unpacking issues of gender in design was initiated.

Funded by the Global Challenges Research Fund, the Unequal Stories research project between two universities in the United Kingdom and South Africa is a three-year cross-national comparative study that aims to investigate gender equality, diversity, and representation in the design disciplines in higher education and industry. This pilot project investigates gender in design across the two countries through developing a website to collect qualitative and quantitative evidence for those studying and working in design, as well as creating a pedagogic intervention in the form of a student project toolkit.

Driven by 4IR, this project was facilitated by digital technologies such as an interactive website, asynchronous lecture videos, and online teaching and learning methodologies. Guided by ethnographic research methodologies and critical design thinking, specifically speculative design and Afrofuturism, students were invited to deepen their understanding of gender equality and critically respond to their findings using the research and design conventions provided in the

Unequal Stories Toolkit. These critical design outcomes were then shared and showcased via an online gallery ultimately enabling discussion on design and gender inequality in the design disciplines from a cross-national perspective.

The authors, two young female South African academics from contrasting disciplines of Industrial and Fashion design, each conducted this project in their respective departments. This paper unpacks and describes the pedagogic intervention that was applied in the development of the Unequal Stories Toolkit project for students, and reflects on the project outcomes in both contexts, and subsequently aligns to the conference focus on design education, Afrika, and 4IR.

Keywords: 4IR, critical design, design education, design futures, gender

Introduction

Gender is commonly defined as a social construct based on the social, cultural, psychological, and behavioural influences and characteristics of masculinity and femininity (Wienclaw, 2021). Based on these influences, one's gender identity is realised (Wienclaw, 2021). Gender and the practice of traditional gender roles are an intrinsic part of social interaction and community. The observation of gender roles in various industries is broadly accepted. However, with initiatives progressing the rhetoric of gender equality and gender representation, notions of traditional gender roles and gender bias are being questioned and challenged. According to Sellers (2017) "women have always been, and remain, a significant part of the design profession as practitioners, commentators, educators, and commissioners". Yet, although having gained entry into the design industry in the late nineteenth century, women have been historically and institutionally marginalised by it, and their achievements have been the silent story of history for too long (Toksvig, 2004; Sellers, 2017).

Ensuring end-users are at the forefront of the design process has become increasingly valorised over the last decade as evidenced by the growth of approaches such as user-experience design and human-centred design. Hearing diverse stories is vital to ensure fair access to the industry, and to ensure that its outputs are a true representation of society. To do this, the design discipline itself needs to be diverse (Moseley & Campbell, 2019). When this is not the case, the lack of tacit insights required in the design process leads to underdeveloped products and services which do not meet the nuanced needs of the identified market. Prejudices and assumptions in the sphere of design exacerbate social inequalities and the results can be divisive, discriminatory, or even fatal (Criado-Perez, 2019).

'Design' is a broad sector encompassing numerous sub-disciplines such as graphic design, industrial design, digital design, advertising, architecture, and fashion. "The concept of 'design' came to maturity in the twentieth century and, as such, inherited that era's prejudices" (Sellers, 2017). Historically, men and women have been grouped into different categories of design education and employment through gender socialisation whereby women are commonly connoted to 'soft' design fields such as fashion and interior design, where the perceived design focus is on the decorative and aesthetic, and men are associated with 'hard' design disciplines such as industrial design and digital design, focusing on invention, functionality, and technology (Clegg & Mayfield, 1999; Lockhart & Miller, 2015; Lockhart, 2016; Reimer, 2016).

Within higher education, the student enrolment gender ratios, in most disciplines, have shown significant levelling out over the past 20 years, yet the same transformation is not yet reflected in the design industry and one cannot ignore that the design industry as a whole, remains, "irrefutably patriarchal" (Sellers, 2017, p. 7). Not only is this a problem, but it is an issue that is relatively under-researched, with a quantitative and qualitative data and awareness gap due

to a paucity of research on gender equality in comparison with STEM disciplines that face similar gender bias and pipeline and retention issues (Reimer, 2016; Lockhart & Miller, 2015). In response to this, the Unequal Stories project seeks to contribute to this area of research and stimulate dialogue that advances the exploration of possible solutions to issues of gender within design fields.

Unequal Stories is a third-year collaborative, Global Challenges Research Fund (GCRF) funded research project between universities in the United Kingdom (UK) and the Republic of South Africa (RSA). Guided by Sustainable Development Goal #5 (gender equality), this cross-national comparative research project explored gender diversity, equality, and representation across various design disciplines within higher education (HE) and industry. Prompted by an analysis of statistical data around gender and diversity (or lack thereof) in design disciplines, the Unequal Stories project aimed to assess and explore attitudes and perceptions towards gender diversity, equality, and representation across different creative disciplines in HE and industry in the UK and RSA, and compare findings cross-culturally, and to respond to these findings through a pedagogic and/or industry intervention/s.

This paper describes the pedagogic intervention - where postgraduate students were invited to explore gender equality and critically respond to their findings using research and critical design thinking conventions- and reflects on the project outcomes in both contexts.

Contextualisation

According to Reiners (2021), bias exists in every aspect of our lives as our brains are hardwired to categorise things to make sense of the complicated world around us. However, biases can cause us to form prejudices which allow for inequalities to form (Reiners, 2021). Gender bias is a form of unconscious bias whereby one unconsciously makes evaluations and/or assumptions of another person or group based on gender-based stereotypes (Madsen & Andrade, 2018; Reiners, 2021). Ely, Ibarra, and Kolb (2011, pp. 475) define gender bias as "the powerful yet often invisible barrier to women's advancement that arises from cultural beliefs about gender, as well as workplace structures, practices, and patterns of interaction that inadvertently favour men". Gender bias is a term often used to refer to the preferential treatment men (specifically white, heterosexual males) receive, and is most prevalent within professional settings (Reiners, 2021). The design industry has numerous inbuilt biases and inequalities, and unconscious bias not only manifests itself in the design workplace but filters into the products and services we design (Kemp, 2019; Moseley & Campbell, 2019).

The leaky pipeline metaphor attributes the lack of female participation in the design industry to the 'leaking out' of women from the pipeline that carries students from school through university and on to a job in the industry (Moseley & Campbell, 2019; Blickenstaff, 2005). "It is evident that there exists a leaky pipeline in the design disciplines" (Moseley & Campbell, 2019). While female students now generally outnumber their male counterparts in design education globally, the same cannot be said about the workplace (Sellers, 2017). Gender biases in the workplace have contributed to the creation of a glass ceiling in design disciplines acting as an intangible hierarchical barrier that prevents women and minorities from reaching upper-level roles in leadership (Reiners, 2021). As a result, the farther along the pipeline, the fewer women are present, with a disproportionately small number of women in leadership roles (Sellers, 2017; Moseley & Campbell, 2019).

The Design Council (2018) Design Economy Report revealed that although 63% of all UK art and design graduates are female, the UK design workforce comprises a 78:22 (male to female) gender split, compared to the 53:47 gender split of the wider UK workforce. In RSA, although

data specific to gender diversity or equality in design disciplines is patchy or difficult to obtain, the data that is available shows similar trends. For example, only 21% of registered Architects in RSA are women (Property24, 2016) and the industrial design industry comprises a 74:26 (male to female) gender split (SABS Design Institute, 2008). A 2017 study of the world's 100 biggest architecture firms across the world indicated that only three of the 100 firms are headed by women and only two have management teams that are more than 50% female (Fairs, 2017). Even more shockingly, sixteen firms showed to have no women at all in senior positions (Fairs, 2017). The Visual Arts is an umbrella term for several artistic disciplines, including ceramics, drawing, painting, sculpture, printmaking, and photography (Spencer, 2019). A stereotype that exists in the Visual Arts is that women are perceived as muses, rather than creators, and the contemporary art market is dominated by men (Spencer, 2019). Although women constitute 70% of the workforce in museums and galleries, female artists are underrepresented in both settings representing only 13.7% of living artists showcased by galleries in Europe and North America (Spencer, 2019).

Designers shape the world around us through the built environment, the digital world, and the products and services we use (Design Council, 2018). Designers' gender and cultural background influence the products and services they create (Dietrichson, 2017). Diversity within design teams is therefore important to arrive at suitably diverse, appropriate, and innovative outcomes that accommodate for as many as possible (Dietrichson, 2017; Moseley & Campbell, 2019). The underrepresentation of women in design at a professional level creates a gender data gap which is both a cause and a consequence of the mindset that perceives humanity as almost exclusively male (Criado-Perez, 2019). The data gap results in 'gender blindness' and a 'one-size-fits-men' design approach (Criado-Perez, 2019) which not only perpetuates gender stereotypes and clichéd concepts of masculinity and femininity but at a professional level, ultimately renders many experiences unaccounted for contributing to the proliferation of products, services, and markets that do not meet the specific needs of women and are inaccessible to billions of people across the globe (Kemp, 2019; Ely, 2015).

Numerous examples of how such an approach negatively affects female users exist. According to Ely (2015) women are stereotypically assumed to be less "handy" than men. Building and fixing things has culturally and historically been considered men's work. Consequently, hand tools are often designed around male data, in a way that makes these tools more difficult for women to use (Ely, 2015). In many office buildings, the algorithms that determine temperature settings were calculated for the average male. Women, with smaller frames and less muscle mass, naturally feel a bit colder than men do and as a result, many women feel uncomfortably cold in the workplace (Ely, 2015). The consequence of unconscious bias can have far more severe safety implications. For example, car safety tests don't account for women's measurements (Criado-Perez, 2019). For many years, the requirement for car safety tests was a single crash test dummy based on a 50 percentile male (the average man). As a result, women are 47% more likely to be seriously injured, 71% more likely to be moderately injured, and 17% more likely to die when involved in a car crash, and it's all to do with how the car is designed and for whom (Criado-Perez, 2019; Ely, 2015).

Although some data and research exists on this topic and is increasingly gaining traction, further research is required to deepen our understanding of why a large percentage of female graduates are leaking out of the pipeline between university and industry and identify how this can be addressed and combatted. The first step is raising awareness of the issue, particularly at a HE level. To contribute to this discussion, a pedagogic intervention, in the form of a project toolkit, was developed and subsequently tested with students in the UK and RSA, as part of the larger Unequal Stories research project.

Methodology

Design education is shifting where teaching and learning methods are becoming more concerned with ethnographic methodologies and approaches like critical design thinking, fostering an awareness of social, cultural, and ethical issues to consider design solutions effectively and inclusively (Allen, 2019). Ethnographic research is a qualitative research approach that investigates cultures and societies through exploring aspects related to cultural or social phenomena (Shagrir, 2017). Critical design refers to a kind of design practice that seeks to use critical and/or fictive design to increase the awareness of social, cultural, philosophical, or ethical issues and bring these into an everyday context in a novel yet accessible way (Allen, 2019). Speculative design and Afrofuturism are concepts that branch off from critical design. Speculative design is a multidisciplinary approach that derives practical methods from disciplines such as graphic design, industrial design, and fashion design to conceptualise and materialise alternative futures (Dunne & Raby, 2013). Speculative design encourages and thrives on imagination to create new perspectives on socio-political situations. The premise of imagining, conceptualising, and materialising speculated future scenarios aims to act as a catalyst for "discussion and debate around alternative ways of being" (Dunne & Raby, 2013, p. 2). Afrofuturism is a term used to define various media, artistic genres, and philosophies rooted in reimagining speculative futures that represent the advancements of Black people and social culture (Woodrow, 2018). Afrofuturism incorporates African ideologies and aesthetics of pre-colonial Africa and a contemporary techno-genesis of Black identity influenced by technological advances in the current digital age (Woodrow, 2018; Anderson & Jones, 2016).
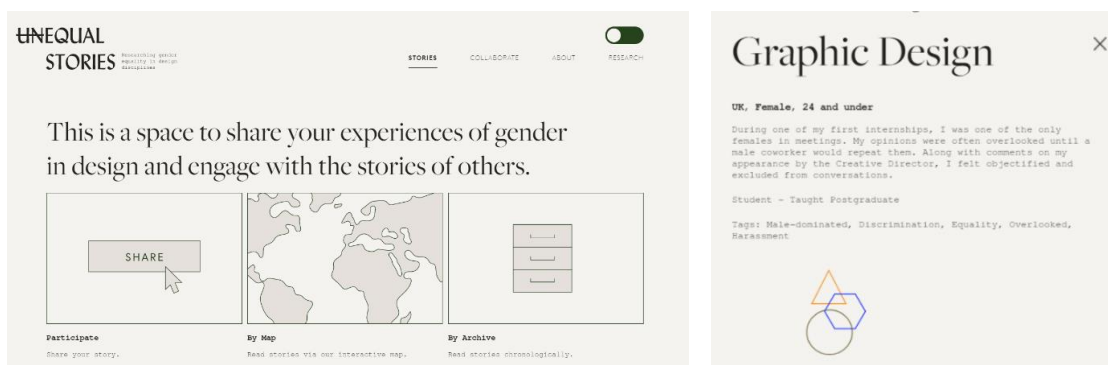

Figure 1: Unequal stories website (2021)

The first phase of this pedagogic intervention included the development of an interactive online platform. The transnational nature of the project required that a blended approach to teaching be followed. The content had to be accessible to students in the UK and RSA and thus, a website was best suited. Moreover, the current COVID-19 pandemic has accelerated the need to align teaching and learning methods to that of a blended approach. Using this website, participants from HE and industry were invited to share their stories and experiences related to gender bias, anonymously. This data was then mapped through data visualisation, allowing viewers to compare and contrast the stories according to tag, location, and discipline.

In the second phase, a student project was designed with the intention that it be facilitated by design lecturers using the provided Unequal Stories Toolkit. The toolkit is a comprehensive teaching and learning tool and resource, available for download from the Unequal Stories website (available via this link). Provided with this Unequal Stories Toolkit, students in RSA and UK were tasked to use ethnographic methodologies to deepen their understanding of gender equality and respond to the data provided on the Unequal Stories website using a critical design approach. A selection of students' findings, insights, and responses was then shared on

the online gallery, as a way of enabling discussion around gender inequality in the design disciplines from a cross-national and cross-disciplinary perspective towards addressing industry bias.

The resources in the Unequal Stories Toolkit included a brief (project requirements, structure, and schedule), a series of four asynchronous theory lectures, a reading pack, and a list of additional resources. Students were encouraged to refer to the website for supporting data. The four asynchronous lectures were between ten to thirty minutes long and introduced the underlying theories guiding the project and brief. Lecture one provided background and contextualisation of the project. Lecture two introduced students to existing research and statistics around gender and design. Lecture three introduced critical design thinking and the design approach of speculative design. Lastly, lecture four provided an introduction and discussion of key concepts related to Afrofuturism. The incorporation of Afrofuturism to the project toolkit offered inclusivity and representation to the discourse of gender in design disciplines outside of Western rhetoric and literature. Gender is a nuanced area that intersects with culture, race, and class, and it was necessary for the project to reflect this reality. The five readings in the reading pack supported and expanded on the content of these lectures.

Discover
Readings
Lectures
Website
Observations
Interviews
Document analysis

Define
Key Insight
Design Brief

Develop
Brainstorming
Prototyping
Experimenting
Testing

Deliver
Realisation of
the design idea
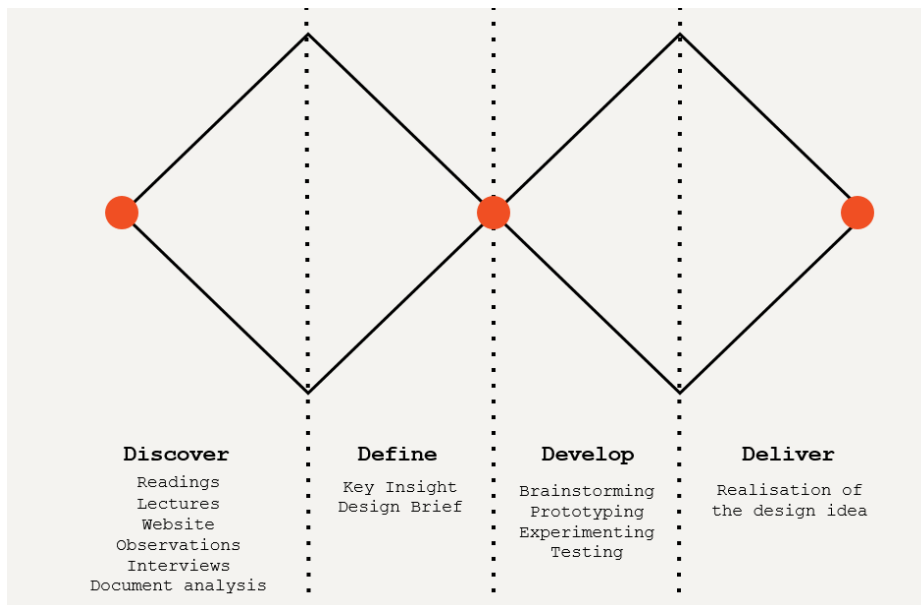
Figure 2: Double diamond model (2021)

Every design discipline has unique approaches and ways of working, however, there are some activities common to all designers. The project structure was designed according to the four phases of the Design Council's 'Double Diamond' model: discover, define, develop, and deliver. In the Discover phase, Students were required to apply ethnographic research methods in exploring gender in design through identifying a related research problem to probe either through observation, interviews, document analysis, and subsequently articulating the research findings (Alpert, 2016, pp. 9). In the define phase, students are required to analyse and compare the data to develop a clear critical design brief. A brief template was included in the Unequal Stories Toolkit to assist students in writing this up. During the Develop phase, critical design responses are imagined, conceptualised, prototyped, tested, and iterated through brainstorming, prototyping, experimenting, multi-disciplinary working, visual design, testing. Finally, the deliver phase involves the realisation of the design idea. As a transdisciplinary project, this could include any number of design outcomes such as photographs, 3D objects, publications, concept drawings, and/or videos. The structure of the Unequal Stories Toolkit was designed to be as open and flexible as possible. By structuring the

project according to the four phases, rather than defined timelines, the project could be run as a design sprint across four days or as a longer brief over four weeks (or any variation). This flexibility allowed for a range of approaches, suited to the varying needs and schedules of each institution, department, or module. It also allowed for educators and students to pursue cross and transdisciplinary work, as well as group or individual projects.

For this paper, the researchers observed ethical considerations by assigning non-gendered code names such as 'student A' to the selected students discussed in the findings. The students' confidential information such as names, surnames, and student numbers are eliminated from any included images.

Findings and discussion

To test the efficacy of the Unequal Stories Toolkit, the project was facilitated in three design departments in the UK and RSA in the form of a pilot study. In RSA, the project ran for four weeks in a postgraduate Industrial design department with 11 students, and for six weeks in a postgraduate Fashion Design Department with eight students. In the UK, the project was facilitated with 13 MA Communication students, over four weeks.

Ethnographic research methodologies were applied by students in various ways. Some of the students in the fashion department used the secondary data provided on the website of the data mapping to inform their speculative design, and Industrial design students used social media polls and personal reflections to inform their insights and responses. However, the majority of the students across all three departments sourced primary data through interviews and discussions with design professionals and their peers.

The project toolkit aimed to be flexible – in that it could be integrated easily into varying modules and programmes, encourage multidisciplinary research and design, and incorporate nuances related to gender through the inclusion of Afrofuturism. Three projects -one from each participating department from RSA and the UK were chosen for discussion to illustrate the efficacy of the Unequal Stories Toolkit in achieving the above-mentioned aims.

Figure 3: Student A SA Department of Industrial Design: "Man-hand" (2021)

As the Unequal Stories Toolkit was designed to be facilitated, either over a sprint four days session or spanning over four weeks, the efficacy of applying an ethnographic approach may vary depending on the time allocated for the project. In the instance of the three departments, the projects were facilitated over multiple weeks and allowed students to adequately engage and apply the processes and methods of the discover, define, develop, and deliver phases. The longer duration of the project enabled students to conduct iterations of the discover, define, and develop phases, allowing students to reflect, discuss and refine their thinking. 'Man-hand' is an example of such a project and process, which lead to the realisation of a strong creative

response. Student A identified that the lack of inclusivity in design has major implications for women, often discouraging many women from pursuing certain career paths or doing certain tasks. Women are often made to feel incompetent and blame themselves for being unable to do certain jobs or tasks successfully, when in fact the products designed for that job have not been designed with female considerations in mind. The speculative design approach was applied in the creation of a product titled "man-hand". Man-hand speculates a dystopian future depicting the process that is followed when a girl is born, a male hand is stitched onto the girl's hand. The stitched man-hand will allow females to use most of the products in the world with ease because most products are designed from male data. Although these females will be able to use a smartphone with one hand, hold a brick comfortably, or use a power tool easily, the stitches, scars, and blood remain for life, symbolising the discomfort women have had to endure for years, simply because products were not designed with female considerations. The added piece of skin is a physical and striking mark that emphasises the adjustments women have to make to use products designed around male data for women. This is a strong visual statement to encourage dialogue and reflection on the importance of diversity and inclusivity in design.

The concept of Afrofuturism was not compulsory for students to explore. However, its inclusion contributed to the nuances and intersections that occur when gender is concerned. Through qualitative research and interviews, Student B created a campaign titled 'Intersect' that raises awareness about some of the microaggressions that women of colour face in the fashion design industry. Inspiration was drawn from popular culture, specifically from a meme titled 'show me the receipts', culminating in creating a literal receipt of some of the micro-aggressions and overt discrimination that women of colour face within the fashion design industry. Depicted in Figure 2, at the bottom of the receipt, a total amount is calculated representing the unconscious bias and micro-aggressions someone has expressed towards a BIPOC (Black, Indigenous, and Other people) woman. Intersect prompts people to confront their unconscious bias and creates a more significant conversation and awareness around gender disparity and the importance of intersectionality within design fields. The speculative scenario depicted in the project, emphasises developing a positive representation of black identities through provoking conversation around accountability and inclusivity. These objectives outlined in the project are synonymous with Afrofuturism and its core ideology.

Figure 4: Student B SA Department of Fashion Design: "Intersect" (2021)

The open, multidisciplinary approach of this project encouraged students to explore all design disciplines, not only their own, and allowed the freedom to produce design solutions that fall

outside the scope of their particular discipline. 'Impractical' is a good example of this, whereby a communication design student communicated their response in the form of a fashion design output. Through interviews and research with designers and creative directors, student C identified many glaring disparities within the design industry, precisely fashion. Research shows that less than 50% of womenswear brands are led by female designers (Pike, 2016), making it evident that women are significantly underrepresented in leadership positions within the fashion industry. The under-representation of women in leadership positions juxtaposes the statistics that reflect female consumers purchasing clothing more frequently than men (Brennan, 2013). This results in a data gap and the creation of less inclusive or impractical clothing for female consumers. From discussions that student C had with women from within and outside the design industry, similar points were raised repeatedly that women's clothing is restrictive and often reflects a definitive lack of practical consideration. Student C refers to designs showcased in fashion runway shows, as well as office wear. From the research done, student C created a garment capsule collection titled Impractical, which sought to translate the restrictive nature of women's clothing to the modern man. Focused on the inequality within the fashion industry, the collection is committed to encouraging a discourse surrounding the lack of female designers within the industry in leadership positions. The result of which is the imposition of limiting and impractical clothing by men, for women. The garments in the collection depict illogical and impractical pieces designed for men to highlight the disparaging data gap.

Figure 5: Student C UK Department of Graphic Design: "Impractical" (2020)

The GCRF funded Unequal Stories project established a method and model focused on gender in the UK and RSA. The project ultimately served as a pilot for a larger, expanded effort to raise awareness on this topic. The Unequal Stories Toolkit proved its efficacy within the pilot project among the three departments that facilitated the project. The pedagogic Unequal Stories Toolkit was created to be accessible to students in both the UK and RSA. With COVID-19 and the subsequent adoption of blended learning, the Unequal Stories Toolkit integrated successfully into each module's teaching and learning planning. The blended approach applied in the toolkit made facilitating and incorporating the project in one's teaching and learning possible as it had been designed to be open or flexible in how lecturers facilitated the project to students. This flexibility in facilitation may have assisted in curbing issues related to students learning remotely and barriers related to the digital divide. Students in RSA were encouraged to use resources available to them for conceptualising and developing their final project and resources in the respective departments were also available. The approach of blended learning and the application of interactive digital resources such as the Unequal Stories website and

project toolkit align with Industry 4.0 guidelines. Building on the successes of this pilot, the project team has since expanded to include industry and research partners in New Zealand and South Korea, and the team is currently applying for further funding to consolidate and expand the model into a holistic inclusive, intersectional, and global one.

Conclusion

While industry 4.0 offers exciting new opportunities, improved AI, and increased automation, it also presents potential security and ethical risks which threaten to amplify current inequalities. As we enter the fourth industrial revolution, design will have an important role to play in bringing about appropriate, sustainable, and equitable innovation, ensuring that new technology is human-centred and useful to an increasingly diverse population. Diversity within design teams is critical to arriving at suitably diverse, appropriate, and innovative outcomes.

Higher education has a crucial role to play in shaping the educational and societal transitions necessary to adjust to Industry 4.0 (Gleason, 2018, p. 5). Gender bias in design is a topic that design educators, researchers, and students need to engage with, not only to prepare our students for the workplace but also to begin to change the patriarchal dominance of the design industry (Moseley & Campbell, 2019).

The Unequal Stories Toolkit was successful in engaging students in this conversation and adding to it through provocative and insightful design outcomes that serve as catalysts for discussion and debate and can be shared and engaged with across the globe.

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