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Is design delightful? An examination of design students' emotions when designing

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Abstract: This research examines the emotional experiences of design students as they progress through a design project. The study presents how different emotions manifest themselves in the students' design processes, offering insights into whether the students' design experience is 'pleasurable' or otherwise, and beyond this, the spectrum of emotions that design students experience overall. Findings reveal a common positive emotional experience amongst students despite their very different backgrounds and cultures. The initial results show that positive emotions can be generated by the design project topic, which in turn has an important impact on the design process and the student's performance. The research suggests that the emotional aspect should be considered and improved as an influential factor in the design process. Also, exploring various emotions should be investigated in more detail in studies to enhance the design education experiences that support students' emotional well-being while designing.

Keywords: emotion; design process; undergraduate students; design education

1. Introduction

'*I feel ...*' is more than just a phrase. It is a critical element of expression that can foster progress and advancement in a designer's journey. Therefore, emotional input in the design process is required (Tang et al., 2021), and it plays a significant role in creative problem-solving (Sas & Zhang, 2010) and decision-making (Ho, 2015).

Emotions serve multiple functions that involve various purposes, including but not limited to managing processes, directing actions, evaluating objects and events, expressing behavioural intentions and reactions, and supervising a designer's inner state (Ho & Siu, 2012). Emotion is an essential component that impacts our feelings, behaviours, and cognitive processes, which is crucial in enhancing our intellect (Norman, 2004). Papanek (1972), in his definition of design, introduced the designer's sensing and feeling role while designing, assuring that any change will impact the design process. Emotions influence our thinking and actions and



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act as a perpetual compass for proper conduct (Norman, 2004). Since 1999, the inaugural Design and Emotion conference, the focus has sharpened on developing emotion-focus design processes, with numerous researchers actively contributing to this evolving area (Desmet & Hekkert, 2009). Emotion is being debated, especially in business, education, and design processes (Crossley, 2003).

Research suggests that emotion can enhance designers' abilities to optimise their decision-making and outcomes during design processes (Ho, 2015; Tang et al., 2021). Nonetheless, there is still a lack of research investigating the influence of emotions on the design process and how designers can understand their emotional impact on their processes (Ho, 2015).

This research includes an early stage of empirical research examining the emotional experiences of design students as they progress through a given design project. Two distinct student groups from different countries, Jordan and Scotland, are presented in this research, reflecting the diversity of different ways of exploring and experiencing design (Glanville, 2014). Jordan offers research into designers with contested identities, being the top refugee hosting country (De Bel-Air, 2016), which supports diversity and creates a unique backdrop for innovative experimentation. Scotland, on the other hand, is a highly innovative and research-intensive country, resulting in tangible improvements to society and people's lives, thus delivering significant public value (REF, 2023). When it came to instructing modern design methods, the focus shifted towards nurturing the thinking abilities and conceptual potential of design students, taking into consideration cultural diversity (Haddad, 2013). Focusing on a design education environment enables this research to involve active participants learning about the design process with fewer preconceptions. Hence, Understanding the nature of emotions and their diverse impact on students is crucial (Pekrun & Linnenbrink-Garcia, 2014).

The research will present how different emotions manifest themselves in the students' design process stages, offering important insights into whether the students' design experience is 'pleasurable' or otherwise, and beyond this, the spectrum of emotions that design students experience as they progress with their design project. Hence, *otherwise* refers to any emotional state that is not categorised as pleasurable. It encompasses a range of emotions beyond pleasure, such as discomfort, displeasure, neutrality, or any other non-pleasurable state. State here reflects the overall emotional experience, which can be influenced by various internal and external factors (Ho, 2010) and can be conceptualised as combinations of varying degrees of positivity or negativity (Russell, 1980). The research begins by reviewing previous studies that support the importance of emotions (James, 1948; Overbeeke & Hekkert, 1999; Plutchik, 1965; Reizenzein, 2018; Sreeja & Mahalakshmi, 2017) and their influences on design and designers' processes (Desmet & Hekkert, 2009; Dorst & Cross, 2001; Forlizzi et al., 2003; Ho, 2014). A design probe tool was designed and employed to capture students' experiences (Marji et al., 2024) by documenting their emotions and their intensity as a self-documentation tool (Mattelmäki, 2006). Through the analysis, the researchers articulate findings about the shared emotional experiences of both student groups. Hence, the research discusses the findings in relation to the design project topic and students' design

process experiences. Therefore, this suggests the importance of creating an emotionally balanced experience while designing to enhance design education experiences that support students' emotional well-being while designing.

2. Why emotions while designing?

2.1 Emotion, design, and design processes

Research on emotion topic has explored the nature of emotions and provided different perspectives on how they arise and manifest in human beings (Sreeja & Mahalakshmi, 2017). One of the significant states of emotion definition with which we agree is by Izard (2010) "Emotions have multiple and quite significant functions in motivating and focusing individual endeavours, social interactions, and the development of adaptive and maladaptive behaviour" (Izard, 2010, p.368) As a result, emotions are a complex psychological process that consists of different component (Harmon-Jones et al., 2017). Emotions are an essential component that impacts our feelings, behaviours, and cognitive processes, which are crucial in enhancing our intellect (Norman, 2004). However, emotions are complex to define, and they include various contributions of cognitive, physiological, and subjective components in which the interaction between them creates emotional experiences (James, 1948; Scherer, 2005). Furthermore, emotions have evolved as adaptive responses to different situations and challenges, which may lead to the universality of certain emotional experiences (Plutchik, 1965). Hence, emotions can differ in the stimulation events, appraisals, behavioural responses, and physiological responses (Ekman, 1992). On the other hand, designers possess a set of cognitive skills and processes that enable them to approach problems creatively and find innovative solutions using iterative processes (Cross, 1982).

Previous studies have explored the relationships between emotion and design. Crossley (2003) explained that being emotionally attuned during the design process can enhance the empathetic approach and reinforce the design vision. Hence, designers employ emotions to reshape and assess the design process using them as a tool and method (Dybvik, 2022; Ho, 2014). In addition, emotions enhance the design process management by integrating more personal experiences and strong emotions during the process (Van Aken, 2005).

Researchers have developed various approaches to comprehend the part played by emotions in the different stages of the design processes. These processes undergo alterations and changes over time due to the designers' emotions being affected by internal and external factors (Ho, 2010). The effect of emotions on the design process includes fostering stronger relationships among team members, developing a deeper understanding of our own and others' experiences, and establishing a solid foundation for creating shared design goals (Crossley, 2003). Also, designers' emotions and personal experiences significantly impact the structure and function of the design outcomes, in which the reflective emotional responses influence decision-making during the design processes (Ho and Siu, 2012). Research indicates that experienced designers with high emotional intelligence exhibit signifi-

cant emotional involvement through the design processes, which contributes to their effective design process management (Sas & Zhang, 2010). In addition, Dorset and Cross (2001) refer to "creative insight" as an important turning point where designers experience a highly emotional and impactful moment that transforms complex problems into simpler ones. In addition, studies showed that emotions could help make decisions by rechecking what kind of emotion was felt in a particular phase and revising if the solution was given to ensure it was the right one (Utriainen & Valtonen, 2022).

The field of design and emotion explores the connection between design, emotions, and user experiences, focusing on emotional responses, experiences, and relationships connected to the users (Demir, 2008). Most studies focus more on the users' experiences with little attention to the designers' emotional experiences during the design processes (Tang et al., 2021), leaving the subject with numerous challenges in improving our comprehension of how emotions intersect with design (Forlizzi et al., 2003).

2.2 Positive and negative emotions while designing

The emotion mechanism involves releasing neurochemicals that flood specific brain regions, resulting in alterations in perception, decision-making, and behaviour and modifying cognitive thinking (Norman, 2004). Thus, two basic neurophysiological systems underlie all emotional states: valence ranges from pleasure to displeasure emotions, and arousal pertains to the level of excitement ranging from activation to deactivation (Posner et al., 2005; Russell, 1980). This proposes that emotions can be thought of as mixtures of valence (positive vs. negative) and physiological arousal (high vs. low) (Pekrun et al., 2007). Meaning that emotions come from specific patterns in these brain systems that regulate our physiological responses (Posner et al., 2005). Pleasure, derived from the French *Plaisir* meaning to please and pleasurable, can be described as the satisfaction of a desire (Anderson, 2007).

Individuals modify their behaviour in response to the emotions they experience, striving for positive experiences and avoiding negative ones (Patulny et al., 2019). Positive emotions act as a vehicle of personal growth, enhancing individuals and expanding their capabilities (Fredrickson, 2001). Students experience diverse emotions that influence their processes and engagement in relation to academic activities and outcomes (Zhang et al., 2020). Positive emotions work as a tool to highlight the cognitive content and improve creative problem-solving (Um et al., 2007). In a study by Alaniz and Biazzo (2019), participants found inspiration and increased confidence in expressing their ideas through the Emotion Driven Innovation (E-DI) process, which validated the method's effectiveness in generating more profound ideas with deep emotional significance. Consequently, the designer's emotions will play a pivotal and influential role in the design process and its functions in response to both external and internal factors (Ho, 2010).

Designing has an apparent relationship to the designers' emotional experiences (Forlizzi et al., 2003). Research has placed emphasis on investigating the impact of emotion in relation to the design process. For instance, positive outcomes can be generated by maintaining pleasant emotions during the design process (Ho, 2014). A study by Utriainen and Valtonen

(2022) demonstrated that positive emotions, such as contentment and joy, can enhance innovation by promoting divergent thinking and facilitating personal initiative. In addition, experimental studies have indicated that positive emotions, such as happiness, can create a positive valence that helps generate innovative ideas, and negative emotions, such as anxiety, can lead to being stuck and unable to generate ideas (Isen et al., 1987). Therefore, positive emotions are no less important than negative ones and should be taken into consideration while researching (Pekrun et al., 2002). In contrast, negative emotions can hinder innovation by narrowing the mindset, although they may also lead to creativity in certain circumstances, such as challenging the current situation. In that case, it may require special conditions and higher emotional sensitivity (Utriainen & Valtonen, 2022).

Previous studies demonstrated how emotions play an important role in different phases of the design process and their impact on the designers' behaviour, including information processing and decision-making processes (Ho & Siu, 2012). Thus, understanding these experiences will create awareness of each phase's challenges and increase emotional management during the whole project. Yet, there is still little research building an understanding of how emotion is manifested in the design processes, how they can affect the entire process (Ho, 2015), and how task-specific appraisals relate to the student's emotional experiences (Ahmed et al., 2010).

Studies include those investigating practitioners or students from different disciplines who detail their journey through the design process. Yet, there has been a lack of investigation into design students' experiences across different cultures, which can provide insight into their emotional experiences and highlight new approaches in design education, pinpointing pain points and their implications for design educational objectives. To build a complete understanding, this research area would benefit from understanding different design projects assigned to students from different cultures and educational backgrounds.

3. Research methodology

3.1 Participants and research settings

The research study was organised in two public universities in Jordan and Scotland as part of an elective university course. 29 undergraduate participants (aged 18-23) with a minimum of one year of experience participated in the study. The students were assigned a design project, and a multidisciplinary team of four academics helped implement the EmotionProbe throughout the project duration. The design project was developed as part of the product design class.

Students were provided with a design brief at the beginning of the class. This project was integrated as part of the course syllabus, and the instructors were responsible for assisting and giving feedback to students in case needed and evaluating and assessing the final outcomes. The researchers had the opportunity to attend two sessions (face-to-face in Scotland and online in Jordan) during the data collection process, enabling a comprehensive observation of the students' reactions and the probe's usability.



Figure 1 The EmotionProbe design tool (Marji et al., 2024).

The design brief for the project was to *design and prototype a paper/card fruit bowl only using cutting and folding manufacturing techniques and processes*. The project underscored students' creative idea generation, emphasising thorough research on the topic, utilisation of available tools and materials, application of specific techniques, and limitations in the design and production processes. Students worked during classes and at home to achieve and submit the results. The class met for four-hour sessions on four separate occasions over four weeks. More details on these sessions can be viewed in Table 1. A design probe tool, the *EmotionProbe* (see Figure 1), was distributed among students to collect the data in two different sessions in both countries (see Table 1).

Table 1 Sessions, Processes, and Activities (Marji et al., 2024).

Sessions	Design Process stages	Activities
Session One	Design project brief introduction and research	Introducing the task to students, the students start researching and drawing concept and sketching.
Session Two	Design concept and design details	Students working on prototype, feedback, filling the <i>EmotionProbe</i> -first session reporting
Session Three	Design development	Developing the final concept, feedback in case needed
Session Four	Production	Submitting the final design of the fruit bowl, filling the <i>EmotionProbe</i> -second session reporting

The design project followed the iterative design research process for the product design framework by Milton and Rodgers (2013) as a reference, consisting of six stages: design brief and specification, research opportunity (identification), concept design, design development, detail design, and production. This framework was chosen due to its flexibility, allowing iteration at each stage, and its detailed stages encountering clarity, allowing deeper exploration during each stage. In addition to the six stages, it incorporates seven methods and tools (looking, learning, asking, prototyping, testing, evaluating, communicating) which can be utilised during the process.

The *EmotionProbe* was employed as a tool for gathering emotional data with minimal disturbance (Milton & Rodgers, 2013) and exploring new opportunities (Mattelmäki, 2006), and the structure followed the same design process framework. This tool data consisted of the *emotion wheel*, *the sentence to complete*, and *the intensity scales* (Marji et al., 2024).

3.2 Data collection and method of data analysis

This research aims to uncover the emotional states of undergraduate design students during the design process stages. Permission from each university was approved and emotional data was collected during the design project. The analysis focused on answering the following questions:

- Q1: What range of emotions do design students identify when designing?
- Q2: How do different emotions manifest themselves in the students' design processes?
- Q3: Is the students' emotional experience pleasurable or otherwise?

The primary data consisted of 58 emotional probes from classroom sessions two and four (see Figure 2). The data contained information about the emotions and their intensity during the design project. The researchers arranged and analysed the data using Excel to create the diagrams and graphs.

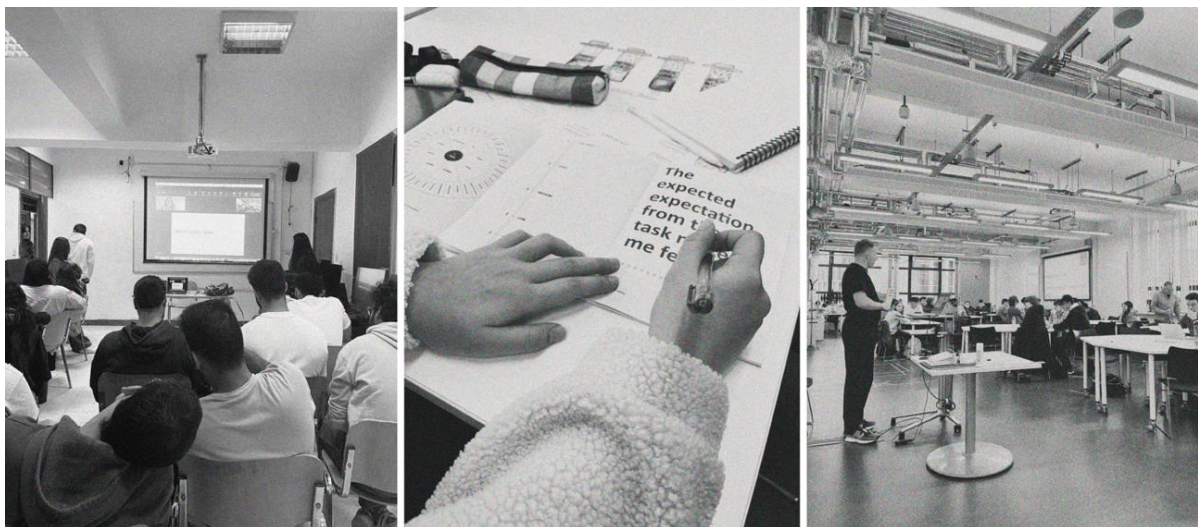


Figure 2 Student receiving the design brief and instructions for completing The EmotionProbe.

The data analysis process consisted of two phases. Phase one presented a quantitative analysis which illustrated the diverse spectrum of emotional experiences at each stage of the design process. Phase two applied the framework proposed by Pekrun et al. (2007), which revealed the state of the students' emotional experiences. In this framework, the emotions considered are tied to achievement activities (e.g. studying) and achievement outcomes (e.g. success and failure) (see Table 2). Achievement emotions are not only some of the most common emotions experienced but also hold significant functional relevance in the realm of education and contemporary society, extending to late modern times (Pekrun et al. 2007; Pekrun & Stephens 2010).

Table 2 A Three-Dimensional Taxonomy of Achievement Emotions (Pekrun et al.,2007).

Object Focus	Positive*		Negative**	
	Activation	Deactivation	Activation	Deactivation
Activity	Enjoyment	Relaxation	Anger Frustration	Boredom
Outcome	Joy, Hope, Pride Gratitude	Contentment Relief	Anxiety, Shame Anger	Sadness Disappointment, Hopelessness

*Positive, pleasant emotion; **Negative, unpleasant emotion

5. Research findings

In general, students from both countries demonstrated a positive emotional experience during the design project given, considering emotions as adaptive responses to different situations and challenges, which may lead to the universality of certain emotional experiences (Plutchik, 1965). Creating emotional responses in design requires a meticulous focus on the active involvement of individuals throughout the design process (Crossley, 2003). This section will address the three previously presented questions, accordingly, followed by an overview of the common patterns that led to these answers.

5.1 Question one: What range of emotions do design students identify when designing?

Findings regarding the emotion ranges showed a huge spectrum recorded by students. Both groups recorded 50 different emotions during two sessions for the same design project (see Figure 3). However, Figure 4 shows the spectrum of emotions during each specific stage of the design process. Notably, the charts reveal that three positive emotions - *excitement, relaxation, and satisfaction*- overwhelmingly characterised students' emotional experience through the design process. Additionally, the data illustrates that students initially began with heightened emotional states, which gradually decreased as the process unfolded,

reaching its lowest point during the Design Development stage, and subsequently increased as they progressed towards the Production stage.

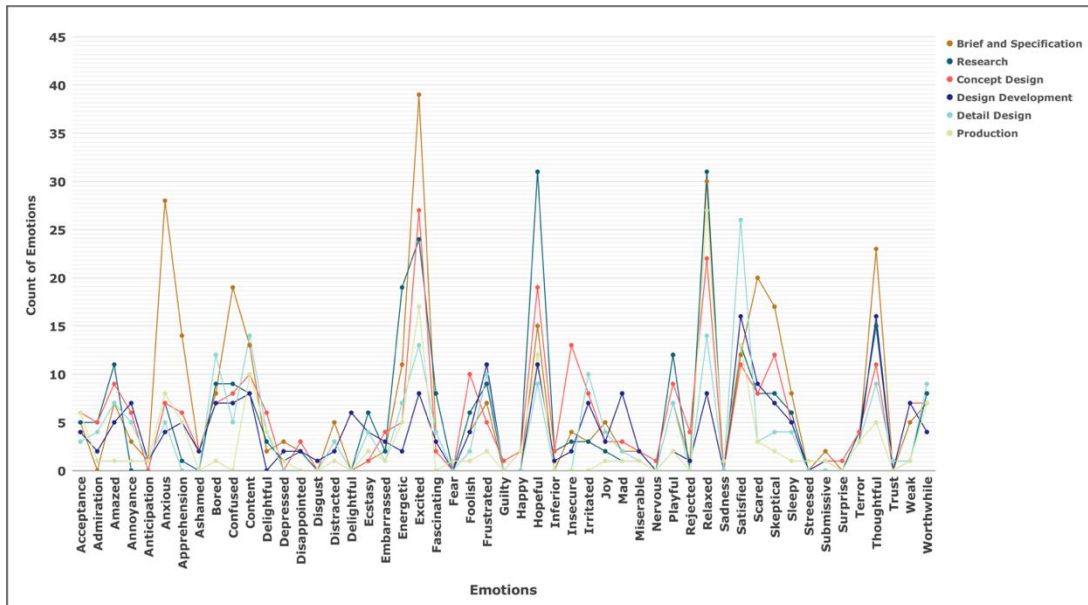


Figure 3 Emotional experiences in the design process: a comprehensive approach (Marji et al., 2024).

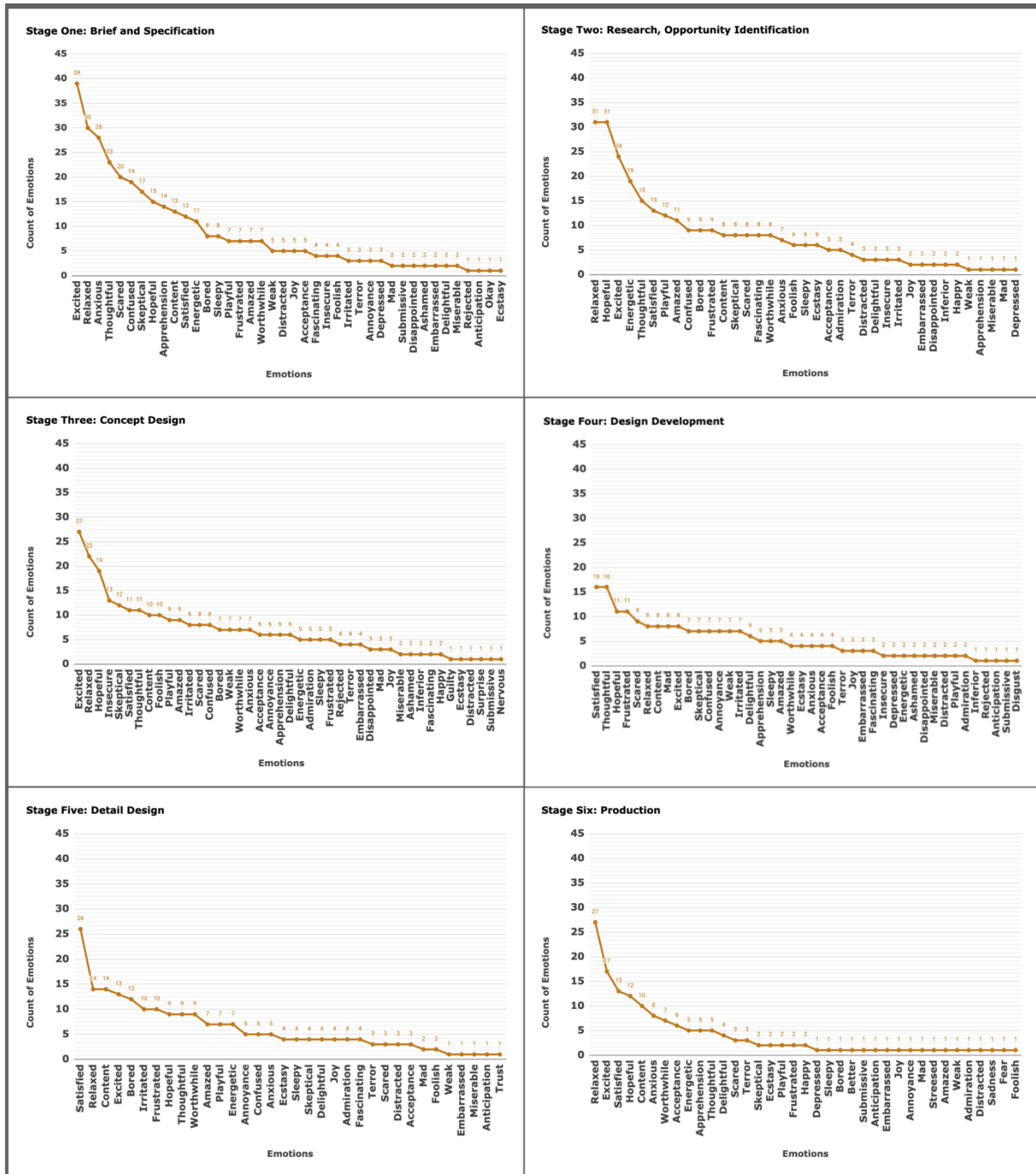


Figure 4 Emotional representation at each stage of the design process.

Consistent with the findings at each stage, the data encompassing the entire process for both design student groups combined once again indicated that the predominant emotions were positively related to *relaxation, excitement, and hope* (see Figure 5).

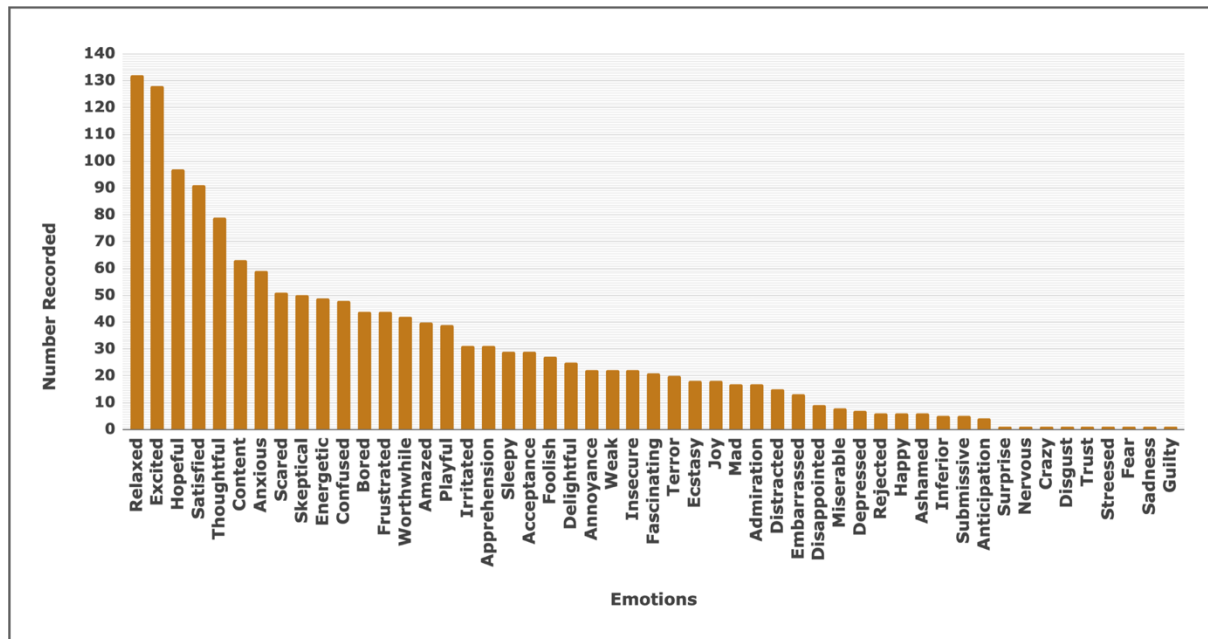


Figure 5 Emotions range while designing.

5.2 Question two: How do different emotions manifest themselves in the students' design processes?

The answer to this question is grounded, as previously mentioned in the framework presented by Pekun et al. (2007). The analysis involves evaluating students' experiences by examining the intersection of emotion used within the *EmotionProbe* and the emotion specified in the framework, which encompassed *enjoyment, joy, hope, relaxation, contentment, anger, frustration, anxiety, shame, boredom, sadness, disappointment* (see Table 2).

Figure 6 presents how emotions manifest themselves during the design process, showing a pattern of being tuned to positive emotions that affect the student experience during the process. Relaxation is the most prevalent during the Brief and Specification stage and Research-Opportunity Identification stage. However, anxiety is highest at the Brief and Specification stage also. Hope tends to peak during the Research-Opportunity Identification stage. Content appears relatively stable across different stages. Bored is highest during the Detail Design and lowest during Production. Frustration is highest during Design Development. Joy is relatively low but slightly higher at the start of the process. Shame and disappointment occur in very low frequencies (see Figure 6).

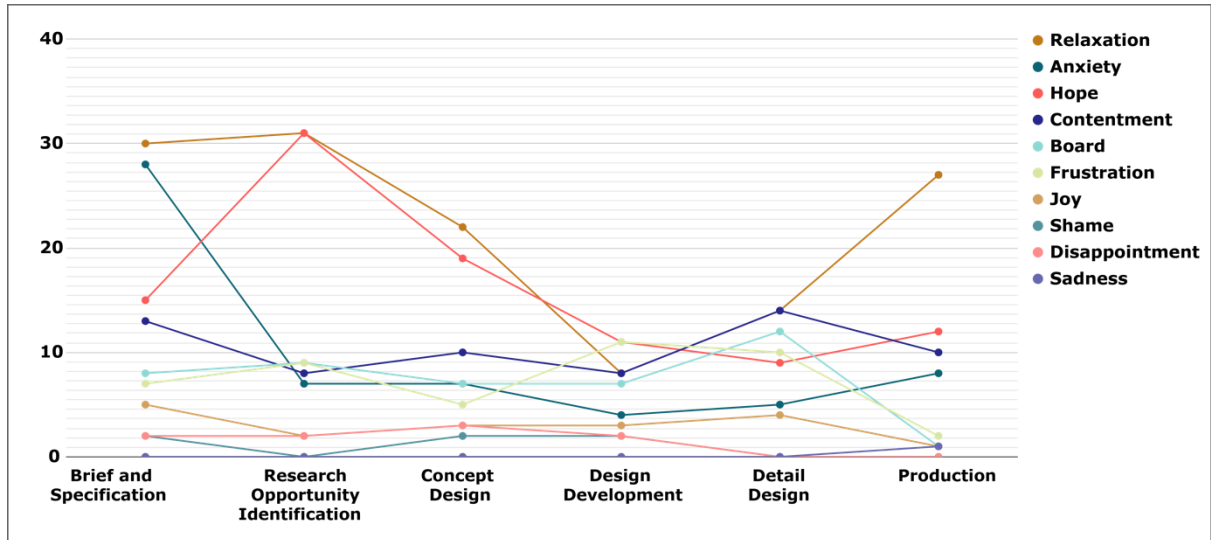


Figure 6 Emotional presentation across the design process.

The data in Figure 7 highlights students' emotional experiences throughout various stages of the design process, particularly focusing on feelings of relaxation and anxiety. During the Research-Opportunity Identification stage and the Concept Design stages, relaxation and hope are prominent emotions. However, as the Design Development stage progresses, hope and frustration are experienced at a similar level, indicating the potential challenges in this phase. In the Detailed Design stage, students expressed emotions of relaxation and contentment, suggesting a more positive outlook. Finally, during the Production phase, relaxation remains a dominant emotional theme. This data provides insights into how emotions fluctuate across the stages of the design process, revealing the interplay between relaxation and various other emotions (see Figure 7).

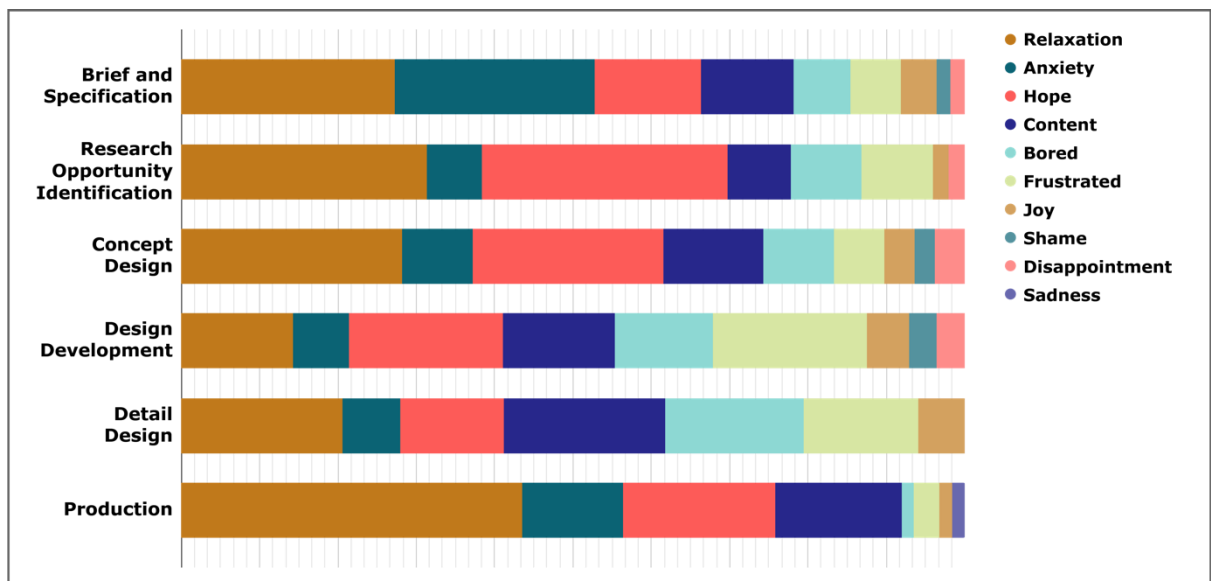


Figure 7 Design process stages in relation to the emotion recorded.

5.3 Is the students' emotional experience pleasurable or otherwise?

Interestingly, the answer to this question revealed that students from both groups had remarkably similar positive emotional experiences and highly pleasurable experiences throughout the design process (see Figure 8).

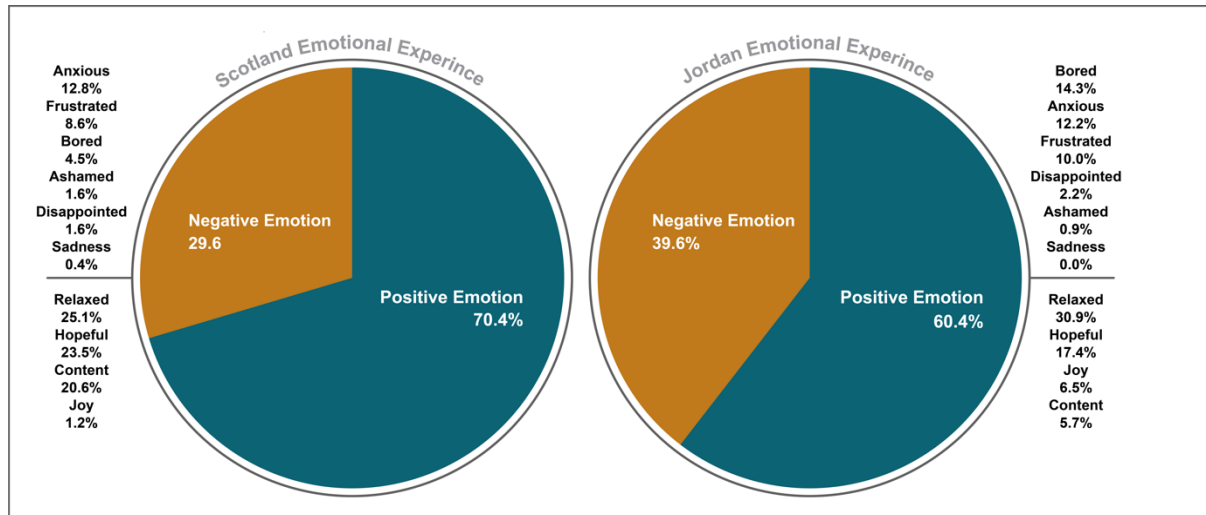


Figure 8 The emotional experience in Jordan and Scotland.

Similarly, the predominant level of intensity consistently falls within the medium to high range across the various stages of the design process (see Figure 9).

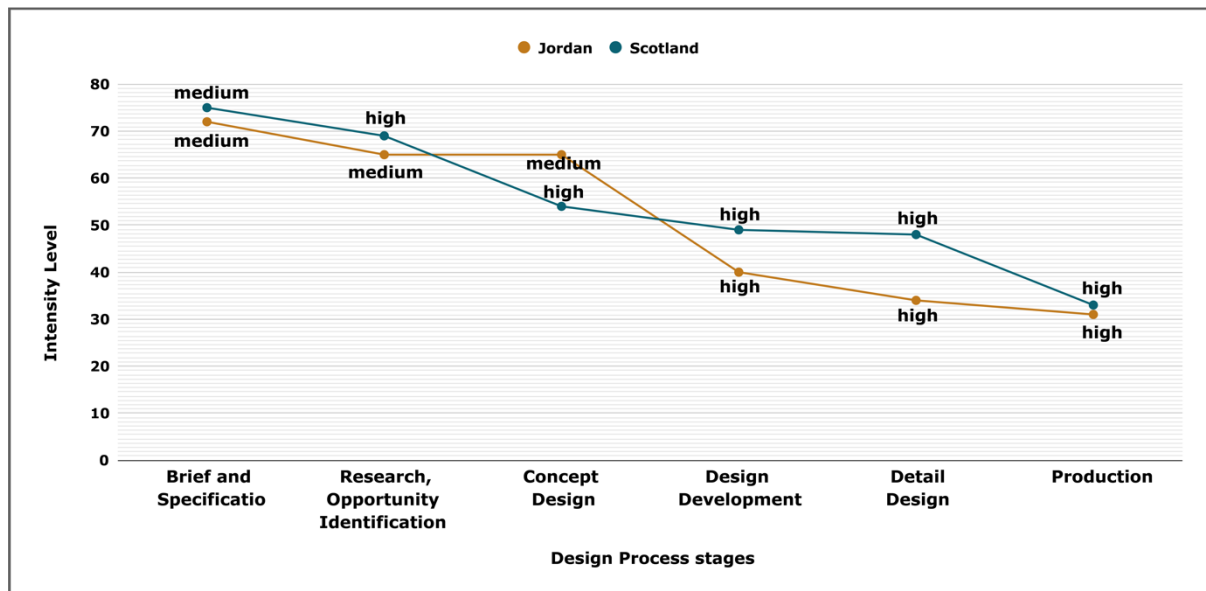


Figure 9 Peak intensity level throughout the design process.

This parallel in emotional responses (see Figure 10) implies that the two groups, despite potentially differing cultures and backgrounds, encountered comparable levels of pleasure and other positive emotions during their engagement with the design process.

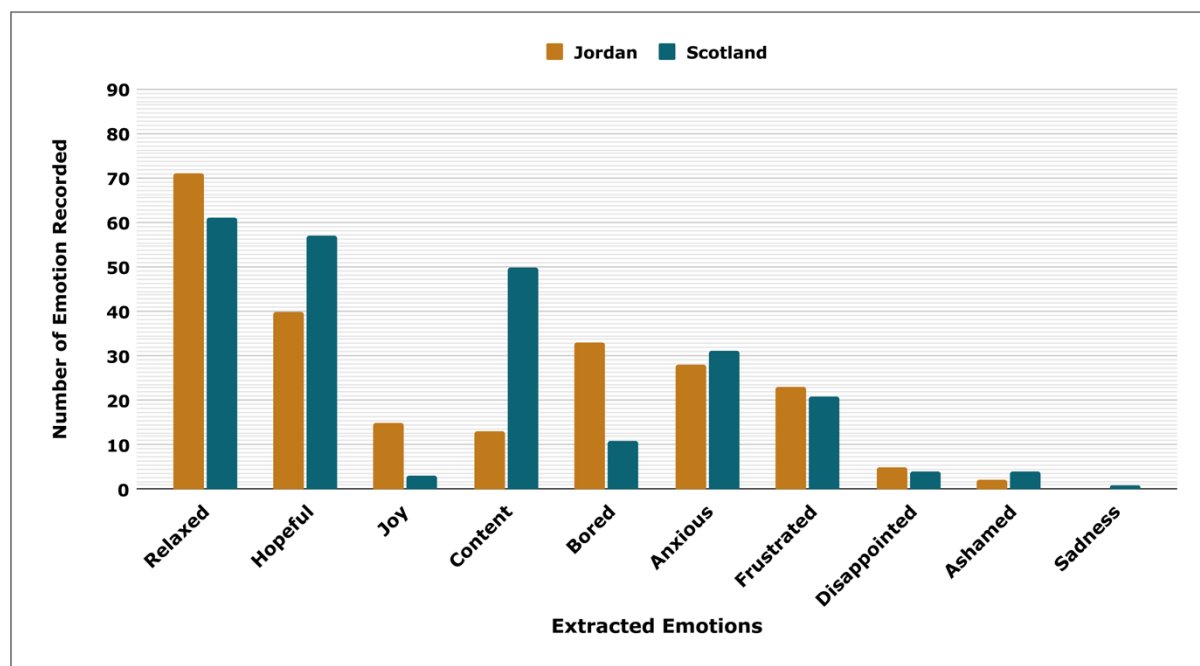


Figure 10 Comparison of identified emotions in the research study.

6. Discussions about the research findings

The findings of this exploratory study suggest that design students could share the same emotional experience during design processes despite their cultural and background differences by working on the same design project. Notably, experiencing positive emotion in the initial stage of the process of Brief and Specification can foster additional positive emotion in the subsequent stages. Consequently, the students generated diverse approaches to the design project. Positive emotions help enhance affective experiences, such as creativity, problem-solving skills, and motivation, by influencing the cognitive process (Um et al., 2007). An increase in positive affect supports a holistic processing state (Park, 2004).

The research findings support Tang et al.'s (2021) study of the factors influencing the designer's emotions in the design process. First and foremost, the definition and explanation of the project topic play a pivotal role in shaping positive emotional experiences. "The clearly defined requirements and smooth communication provide positive emotional feedback for designers, therefore helping enhance design efficiency and outcomes" (Tang et al., 2021, p599) and "The lack of information related to the design project will provoke negative emotions in designers" (Tang et al., 2021, p599). Secondly, the project duration, with a span of four lectures, provides students with a balanced and manageable timeframe, which contributes to reduced anxiety, enabling the cultivation of positive emotions. Inconsistent time management can lead to variations in the designer's emotional state; also, suitable time management enhances the decision-making process (Ho, 2010; Tang et al., 2021). Lastly, the project difficulty level allows students to navigate challenges without feeling overwhelmed, fostering a positive emotional atmosphere. "Designer emotions are directly affected by the level of difficulty and fun of their tasks" (Tang et al., 2021,599).

These findings uncover the design project's direct impact on the students' emotional experiences throughout the design process. They also highlight how positive emotions can trigger further positive emotions during the design process. The criteria of the design project collectively play a significant role in fostering and nurturing positive emotional experiences among students throughout the design process.

This research's findings show, for the first time, that design students from very different cultures and backgrounds can encounter the same emotional experiences while designing, regarding how positive and negative (pleasant/unpleasant) they are when working on the same design project-specific topic.

7. Conclusion

In the 21st century, studies have increasingly focused on the emotional challenges that arise during the design processes. However, there is still relatively little research addressing the dynamics of emotional changes at each stage of the design process and how these changes impact the overall trajectory (Ho, 2010). Specifically, there is a notable gap in our understanding of how design students experience and navigate shifting emotions during their process journey. It is essential to raise awareness of emotional experiences and integrate them into design education preparation, as these emotions profoundly influence the entire process and enhance the design education experiences that support students' emotional well-being while designing (Pekrun et al., 2007; Pekrun & Stephens, 2010).

Consequently, the primary objective of this research is to unveil the emotional states of design students as they navigate various stages of the process and to explore how these emotions manifest themselves during these processes. The context of the design project has a notable impact on designers' emotions as they navigate the design process and make decisions. Consequently, the design process undergoes alterations. This underscores the substantial influence of the design project context on the experience of positive emotions, underscoring the potential for generating positive emotions when considering the project's various aspects.

As this study represents part of a research endeavour, another empirical investigation is planned to gather both quantitative and qualitative data for future in-depth analysis and interpretation. This forthcoming research will encompass an extended timeline and encompass a different project topic with distinct criteria, broadening the scope of inquiry into the shades of emotions experienced. This expansion aims to provide additional insights into how the emotional landscape of design students shapes and influences their design processes and, subsequently, the outcomes they achieve.

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