

Unlocking the Potentials of Young School Leavers Through the Promotion of Makerspace for Entrepreneurial Skills Development in Nigeria

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Abstract

This study investigates the multidimensional nature of makerspace teaching and learning approach to understand the motives behind young school leavers choice of fashion design skills. The QUAN-QUAL approach was used to draw on quantitative and quantitative data from 113 Participants. The participants' responses were subjected to thematic analysis, which identified the underlying themes and ideas which was descriptively examined for frequency of occurrence. With the SPSS, exploratory, descriptive, and inferential analyses were performed. Then the statistical differences on factors influencing fashion design skill motives by gender at the alpha level 0.05 was tested using the Mann Whitney U Test. We then used the latent moderated structural equation modelling to examine the connection between cognitive apprenticeship in the formation of expectancy-value interactions. According to the qualitative analysis, five of six (6) themes were motivational. The gender aspect revealed that male and female participants showed significant differences in their altruistic and intrinsic impulses but that female participants were more motivated toward fashion design skills development than male participants due to intrinsic drives. On expectancy-value interactions, we find that expectancy-value interactions are related to students' fashion design choice motivation only through compensatory interaction instead of the synergistic interactions commonly found in the other context. Meaning that high study values could, to a certain degree, compensate for high expectancies. We addressed the gaps in the non-integration of cognitive-apprenticeship and Expectancy-values frameworks and explored how cognitive-apprenticeship influences the development of expectancies and value beliefs over time. Expectancy-values and cognitive-apprenticeship use has always concentrated in formal educational contexts. We investigated these applications in a non-formal learning setting - makerspace. While the significance of guided learning experiences in coursework is only emphasized by cognitive-apprenticeship and expectancy-values, we investigated skill choice motives. As cognitive-apprenticeship and expectancy-values have mostly been used in conventional fields like education, law, etc., we investigated how they are used in unconventional fields like entrepreneurship.

Keywords

Cognitive Apprenticeship, Entrepreneurship, Makerspace, Makerspace-based Mentoring, Value Expectation, Skills Development.

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Introduction

Anchored in two frameworks, this study first looked at how young school leavers could start their own business by seeking entrepreneurial skills in a socio-technical makerspace that places a high value on entrepreneurship. It

further looked at how our socio-technical makerspace can bring unique business growth possibilities for these aspiring young business owners by investigating what explains their behavior in a makerspace learning settings, why some learners appear to be more engaged in skill learning activities than others, what makes

some learners persevere more than others when facing difficulties and challenges and what their expectations in relation to career skill motives are. To achieve this, we critically examined several studies on motivation (Eze, et al 2022a, b, Wu et al. 2021, Wang et al., 2024); makerspaces (Silvia, Shaowen & Jeffrey 2016); and entrepreneurship (Hsieh & Pattaway 2024). This is because, an idea of these studies will not only help in understanding how these learners could start their own business through makerspace-based mentoring (MBM) program, but will help to solve variety of challenging research situations in our strategic abilities to ascertain whether makerspace-based mentoring program can forecast the mentored students' entrepreneurial oriented skill motivations; whether the expectations of the mentored students in respect to their success regarding the completion of their skill learning program can forecast their entrepreneurial oriented skill motivations.; and whether the subjective study values of the mentored students in respect to the extent to which they value their study skills can predict their entrepreneurial oriented skill motivations.

Studies have reported that seeking entrepreneurial skills through makerspace-based mentoring experience requires that students pick up skills through trial-and-error, constant experimentation with novel concepts, and practice in authentic social contexts (Bardales- Cárdenas et al 2024). In addition, students can also learn to observe instructors and competent peers through interpersonal interactions (apprenticeships), while completing activities because it helps to develop their skills and confidence in their own abilities to succeed as business owners. Apprenticeships, which entail learning new skills with an expert, have been identified to be one of the most successful options for experiential skills learning (Mark 2023). Because, most of the skills are often difficult to master just through written or verbal instruction (traditional) Wang et al. (2024),

cases of carpentry, scaffolding, and clothe making, etc, require to be taught regularly through accessible apprenticeship mentoring. Studies have shown that there is currently a dearth of makerspaces with accessible apprenticeship mentoring focus (Hsieh & Pattaway, 2024). The few that do exist are unable to mentor students as a result of absence of key training resources (Okojie & Okiy, 2019). For example, in some cases in most makerspaces, there are insufficient resources (money, material, men and time) for business professionals to mentor a large number of students to gain in-depth entrepreneurship skills, which means that the possibilities of these students to acquire relevant entrepreneurial skills or make choices about particular skills are limited. This presents a unique opportunity to investigate how apprenticeship style mentoring in a makerspaces are set up and managed to encourage students to make choices of skill to learn by offering them an alternative mentoring approach to entrepreneurial education and skill development.

There have not been interests in this important area of research because not much scholarly research has been done to determine the impacts apprenticeship mentoring has in terms of fostering entrepreneurial skill-oriented motivations of students. For instance, 11 results were returned when the search term "Apprenticeship mentoring styles and Entrepreneurial skill motivation" was entered into Google Scholar between 2020 and 2024. Based on what little was known about these spaces, it was found that researchers there primarily concentrated on the ways in which apprenticeship mentoring improves academic achievements (Breetzke & Bohndick 2024, Simoes and Alarca 2014); situated learning and cognition Burg & Pauca (2016); process-oriented skills (Mark 2023); civic and social needs Silvia, Shaowen & Jeffrey (2016); Sarah, Rachel, and Daniela (2015), Gabriela, Yasmin, Barrie & Orkan, (2015), and ignoring the discussion on accessible apprenticeship

mentoring focus that supports entrepreneurial skill choice motivation. Herein lies the difference between our study and others.

In this study, we investigate as a diagnostic technique an entrepreneur skill choice motivator based on the value of accessible apprenticeship mentoring approach that offers hands-on mentoring activities to students especially in their early stages of entrepreneurship skill development, when they usually operate alone and without guidance. This will be done to close research gap on mentoring strategies found in the literature on apprenticeship and to further research based on Dennen and Burner's (2008) suggestions for more thorough research to create standards for the successful application of apprenticeship-based mentoring in other contexts. Aside investigation of apprenticeship-based mentoring, we also derive inspiration from theories such as expectancy-value theory (Eccles & Wigfield 2020) to investigate if the expectancy-value interactions could predict the motivation of these students to pursue particular entrepreneurial skills.

Empirical research has shown that aspirations were correlated with expectancy value interactions, as well as the relationship between fundamental psychological needs of students (Miyamoto et al., 2020). Further empirical research also highlighted the importance of expectancy-value interactions in predicting secondary-school students' academic achievement (Breetzke & Bohndick 2024). However, because students' expectancies and values undergo significant changes as they transition to higher level, highlighting the need to broaden the application of expectancy-value interactions to this context by investigating the interactions between students' expectancies and their values in relation to students' skill choice motivation becomes clearer. So in the sequel we first introduce the theoretical frameworks and research objectives that

inspired this study in section 2. The study methodology and demonstration of the specification of the preliminary reports was treated in Section 3. We present the result in section 4. Section 5 presents the discussion of findings, section 6 discusses the theoretical and practical implications, section 7 comments on recommendations for further study, section 8 discusses the limitations of the study, and section 9 presents some conclusions.

Theoretical Framework and Research Objectives

The cognitive apprenticeship theory of Collins et al (1991) and the expectancy-value theory of Eccles & Wigfield (2020), have all served as inspiration for this work. The teaching concept known as "Cognitive Apprenticeship," developed by Collins et al. (1991), exposes students to their own internal thought processes and emphasizes knowledge that can be applied in real-world situations. Methods, Content, Sequencing, and Sociology are its four constituent parts. In order to provide a learning environment that promotes the transfer of experience from expert to student, these interrelated and essential constituent parts are required (Cakmakci et al., 2020). For instance, by giving students the opportunity to work with peers in a community of practice (sociology), the framework assists teachers in developing well-designed tasks (i.e., sequencing) and employing successful teaching techniques (i.e., Methods) to help students gain control over heuristic, learning, and control strategies (i.e., Content).

Cognitive apprenticeship is further broken into six instructional strategies of entrepreneurial skill development which include modeling, coaching, scaffolding, articulation, reflection, and exploration (Bruin, 2019). Every one of these instructional strategies completes a particular stage in the expert-to-student transfer of knowledge. For instance, the modeling context explains that students can watch and imitate an expert's actions by mimicking their performance, while the

coaching context describes the situation where the instructor provides feedbacks or advice to guide the learning process when necessary or as problems arise. Scaffolding context is when a teacher gives students projects that are just right in terms of difficulty and breadth so they can practice their abilities. Fading is a component of the scaffolding approach in which the teacher gradually removes the scaffolds so that students can finish assignments on their own. Articulation

context implies that students should clearly state their understanding, logic, and problem-solving strategies as they work on the assignment. However, while the reflection context describes when a student reviews their finished work to identify areas for improvement, exploration context describes the learning environment setting, which offers little to no support for skill learning. See figure 1.

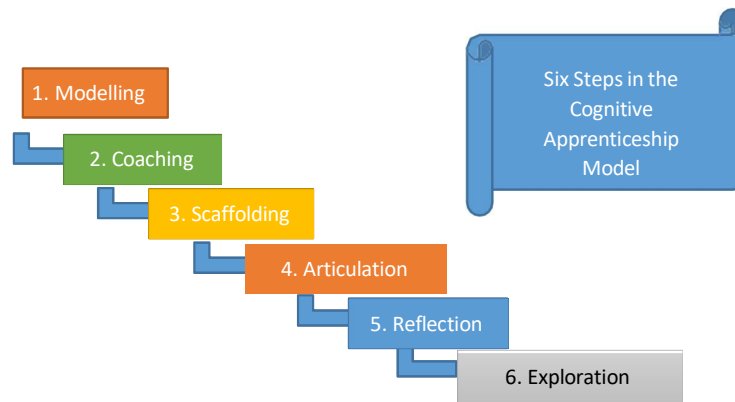


Fig. 1: illustration of the cognitive apprenticeship theory of Collins et al (1991) as a theoretical framework employed in this study

These instructional strategies fall into three categories (Walters-Williams 2022). Traditional apprenticeship models provide modeling, coaching, and scaffolding, while students can access and manage their own problem-solving techniques through reflection and articulation. Autonomy in problem formulation and problem solving on the other hand, is fostered by exploration. These processes together describe the various methods that can be applied to effectively offer apprentice-style mentoring.

The second paradigm is Eccles & Wigfield, (2020) expectancy-value theory (EVT). The

expectancy-value theory states that people's subjective task values in trade sectors interact with their success expectations to influence decisions related to achievement. In this study, EVT is a very well-established approach to investigate entrepreneurial skill choice decision-making. According to the theory, when it comes to entrepreneurial skill choice decision-making of students, two factors success expectancies (Students' expectancies for success regarding the completion of the skill learning), and subjective task values (students' subjective task values, describing the extent to which they value their skill of study are most closely associated with skills-related decisions (see fig. 2).

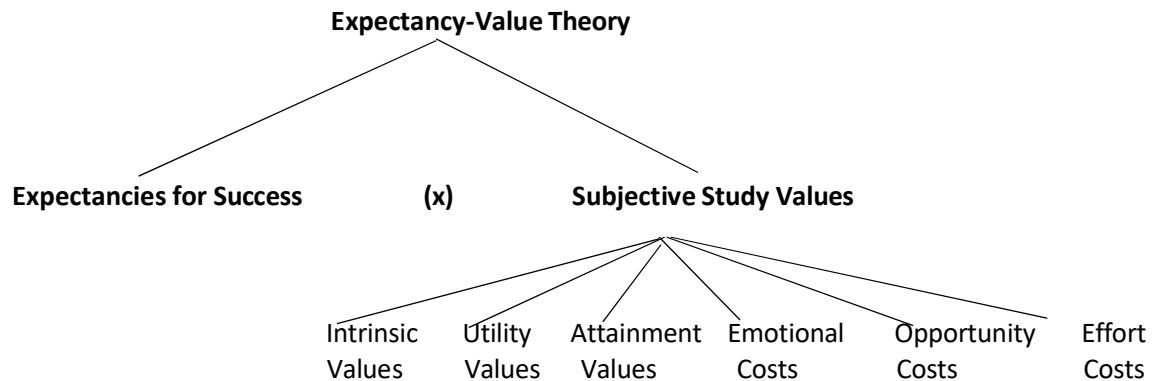


Fig. 2: illustration of the Expectancy-value theory (Eccles & Wigfield, 2020) as a theoretical framework employed in this study.

According to this approach, four theoretically separate components make up subjective task values, which are viewed as a multifaceted construct (Barron & Hulleman, 2015). These components include intrinsic values, utility values, attainment values and costs. First, the subjective interest and enjoyment connected to a specific vocation are addressed by intrinsic values. Second, utility values describe how learning a certain craft might benefit students' immediate and long-term objectives. Third, attainment values explain how important it is to each individual to succeed in their work. Fourth, costs collect the negative effects of a given activity, such as the amount of effort required (effort costs), the loss of valuable alternatives (opportunity costs), and the unpleasant emotions related to the job (emotional costs).

These multifaceted nature of study values are supported by empirical research, which shows that skill aspirations were correlated with intrinsic values, attainment values, and costs but not utility values (Wu et al. 2021). According to this author, both intrinsic values and attainment values significantly improved the involvement and skill aspirations of students.

Review of literature through the lens of cognitive-apprenticeship theory

One of the earliest methods of information transfer in human history is apprenticeship.

Experts in fields like blacksmithing and metallurgy have been teaching their trade to apprentices through observation and supervised practice for thousands of years. This method has also proven to be successful in helping students acquire vocational skills. However, the modern educational system, which attempts to prepare students for a variety of future occupations, has largely superseded this apprenticeship model today. In an attempt to introduce the conventional apprenticeship concept into the classroom, the Cognitive Apprenticeship (CA) model was put out (Collins et al 1991). Cognitive Apprenticeship, which was first introduced in 1991, offers a paradigm for how professionals in a complicated craft can teach learners about their domain knowledge, problem-solving methods, and learning strategies by letting the learner see how they think (Collins et al 1991). Methods, Content, Sequencing, and Sociology are the four components of cognitive apprenticeship (Cakmakci et al., 2020). According to Bruin (2019), cognitive apprenticeship is further divided into six instructional strategies for developing entrepreneurial skills: modeling, coaching, scaffolding, articulation, reflection, and exploration. Although Cognitive Apprenticeship was first used in the context of teaching reading, writing, and math to students in grades K–12, its methods have been used in a variety of fields and educational levels (Dennen & Burner 2008).

According to decades of study, the Cognitive Apprenticeship model have accurately depicted the way that teaching and learning typically take place (Dennen & Burner 2008). For instance, even though successful skill learning has not been documented, empirical evidence on cognitive apprentice-style teaching and learning has demonstrated that it facilitates the acquisition of pertinent knowledge across a range of skills, including programming and medical, among others (Dennen and Burner 2008; Vaughn & Fletcher 2021; Wang et al. 2024). Wang et al. (2024), for instance, looked at the impact of the stratified cognitive apprenticeship model on high school students' arithmetic performance and discovered no significant interactions between the groups or the performance test covariate. This was attributed to the issues with the one-dimensional teaching approach adopted, that would rather cause students to be undertrained. Making difficult choices might need to happen concurrently with using new teaching techniques.

However, the cognitive development of students may be hampered by the absence of efficient teaching strategies and communication expertise. Mentors are therefore held to high standards, necessitating the use of cautious school-based mentoring strategies. For example, in order to determine which apprentice-style mentoring models and dimensions were prioritized in graduate STEM teaching, Minshew et al. (2021) reports that coaching and scaffolding were considerably more important in graduate STEM teaching than articulation and reflection. In the Methods, Content, Sequencing, and Sociology dimensions, their findings showed that the method component had not received as much attention. This is probably because, most mentoring approach focused on situated learning and cognition Burg & Pauca (2016), as well as other aspects of cognitive apprenticeship, like the focus on process-oriented skills (Mark 2023).

Nevertheless, a two-wave experimental study design was further implemented in Simoes and Alarca (2014), to compare the school-based mentored ($n = 157$) and non-mentored students ($n = 160$) to assess whether satisfying basic psychological needs (BPN) in a Portuguese school-based mentoring (SBM) program improved the mentored students' well-being. The results indicate that school based mentoring that was associated with increased support for basic psychological needs was the most effective condition for promoting academic well-being, particularly in terms of improving the mentored students' perceptions of their school learning environment. This finding suggest that the balanced support of basic psychological needs was important in this particular school-based mentoring program. This support and enduring mentoring relationships can facilitate the general improvement of the mentored students' well-being in all context.

Also, Dennen and Burner (2008) carried out a thorough investigation of cognitive apprenticeship in educational practice. Their results demonstrated the empirical success of using cognitive apprenticeship mentoring styles in disciplines like teacher education, PhD programs, nursing, and engineering. The study came to the conclusion that cognitive apprenticeship accurately depicts the learning process after identifying strategies like modeling, scaffolding, and coaching across disciplines and educational levels. In conclusion, one of Dennen and Burner's last suggestions was for more thorough research to create standards for the successful application of cognitive apprenticeship-based mentoring that emphasizes more on reflection, articulation, and exploration. This is due to the fact that many authors have started to ignore the reflection, articulation, and exploration processes as incidental and less significant strategies ever since Collins et al. (1991) asserted that modeling, scaffolding, and coaching comprise the "core" of cognitive apprenticeship. Many research that attempted to use a cognitive apprenticeship

model only mentioned coaching, scaffolding, and modeling, without discussing the other three phases (Ehlenz, Leonhardt, et al., 2018). One such line of work is Xtreme Apprenticeship (Vihavainen & Luukkainen 2013). However, it is unclear from the articles' phrasing whether these interventions chose not to use these strategies or were not aware of them.

The challenge of applying such techniques for a big class size is a second possible explanation for the lack of emphasis on introspection, articulation, and exploration. For instance, Knobelsdorf et al. (2014) recognized that although it is crucial for students to express themselves and reflect, they were only able to use modeling and scaffolding techniques due to the large class size and constrained meeting times following their Cognitive Apprenticeship-motivated course redesign (Knobelsdorf et al. 2014). From a pedagogical standpoint, the absence of assessment work on the reflection, articulation, and exploration techniques may also be problematic. According to Collins et al., for instance, students must use the last three techniques in order to apply the tactics they have acquired in the first three ways in an open-ended environment (Collins et al., 1991). These results do not indicate that the broader literature on entrepreneurship does not place enough focus on contemplation, articulation, and inquiry, even though these strategies are underrepresented in the literature on cognitive apprenticeship. For example, the hameta cognition lens has been used to analyze reflection in a lot of work (Loksa et al., 2022). However, in order to properly assess the learning theory in the context of entrepreneurship, we urge future research to focus on reflection, articulation, and inquiry through a cognitive apprenticeship perspective.

However, one of the fundamental principles of cognitive apprenticeship, as stated by Collins et al. (1991), is to provide an authentic learning environment that reflects real-world

events. This was a recurring topic in theory testing publications (Larkins et al. 2013). In order to provide students a "authentic" entrepreneurship experience, several cognitive apprenticeship systems used active learning techniques, such as scaffolding, which featured hands-on exercises, and coaching, which involved frequent feedback from instructors (Ehlenz et al. 2018). The advantages we saw in the literature might be attributed in part to authenticity and active learning. For example, prior studies have shown that active learning strategies offer numerous learning advantages, including improved retention (Porter, Lee, & Simon 2013). Their results encourage further Cognitive Apprenticeship interventions by demonstrating how these teaching strategies can be successfully included into a course design that is motivated by the program.

However, students' enthusiasm for the course material and their self-reported motivation in pursuing an entrepreneurial career rose when certain techniques used a genuine learning environment where students collaborated and used their knowledge (Larkins et al. 2013). A successful cognitive apprenticeship strategy may result in fewer students asking the instructor for assistance because the goal of the scaffolding and fading method is to gradually remove scaffolds, hence reducing the students' reliance on the teacher. In fact, studies by Feldgen et al. and Murray et al. empirically showed that students' self-reliance improved and their support requests decreased (Feldgen et al. 2012; Murray et al. 2003). Nevertheless, even with these advantages, there is undoubtedly a "start-up" cost associated with creating, building, and putting into use such scaffolds. Thankfully, Feldgen et al. (2012) showed that these studies showed a long-term, enhanced ability to manage more students over a number of years of giving the same course, particularly in the case of Xtreme Apprenticeship (Keijonen, Kurhila, & Vihavainen 2013).

The original cognitive apprenticeship work by

Collins et al. was aimed at K-12 education for skills like reading comprehension, mathematical problem-solving, and writing (Collins, et al. 1991). However, studies have shown that it takes a lot of time and resources to provide students with an effective coaching experience, especially in upper-division courses (Knobelsdorf, Kreitz, & Böhne 2014). The differences between a K-12 environment and a university setting may explain the difficulty in scaling a cognitive apprenticeship approach, as universities typically have a higher student-to-instructor ratio and shorter meeting times. For instance, giving students an open-ended, somewhat ambiguous task to do would benefit from the exploration technique, but it might also lead to student confusion and an increase in help requests because of the assignment's ambiguity.

The utilization of online resources and learning platforms to offer individualized coaching and scaffolding was a noteworthy sub- theme in our review. Murray et al. (2003) envisioned a path for future research that seeks to scale a Cognitive Apprenticeship approach through intelligent tutoring systems and other customized tools, despite the fact that two theory testing studies that presented an online tool that utilized cognitive apprenticeship methods were Jin & Corbett (2011). Programming in IDEs offers special chances to allow individualized feedback for trainees, even though Dennen and Burner (2008) have long recommended the use of computer-mediated settings for cognitive apprenticeship. For instance, Hundhausen et al.'s suggestion to incorporate capabilities into IDEs that employ Cognitive Apprenticeship techniques could be a viable means of giving students large-scale programming feedback.

To sum up, cognitive apprenticeship theory offers a useful framework for comprehending how pupils pick up sophisticated knowledge and abilities. One of the possible research gaps in these studies, as determined by our

review of the literature, is that, in addition to the fact that the majority of the research on cognitive apprenticeship was carried out in formal, western educational settings, ignoring the need to investigate cognitive apprenticeship in diverse cultural contexts, such as non-western societies and informal learning environments, the studies also failed to acknowledge the fact that cognitive apprenticeship has historically focused on cognitive development and the growing recognition of the significance of motivational factors in learning. Our specific goals are to comprehend the empirical effects of Cognitive Apprenticeship approaches on the formation of motivations through the Expectancy-values frameworks and the degree to which these approaches are employed in the literature on entrepreneurial research. In light of earlier suggestions by Dennen and Burner (2008) to use Expectancy-values theory as a framework for educational motivational initiatives, this study clarifies the potential applications of Cognitive Apprenticeship in the literature on skill choice motivation and identifies areas for further research. In light of this, we propose the following research goal to direct this study:

1. To ascertain whether the makerspace-based mentoring (MBM) program predicts the mentored students' fashion design skill motives.

Review of Literature through the Lens of Expectancy-value Theory

An established method for examining motivation and decision-making in an educational setting is the expectation-value interaction (Eccles & Wigfield, 2020). Two elements influence study motivation, according to the expectancy value theory (EVT) - Expectations and subjective study values of students (Eccles & Wigfield, 2020). For the subjective study values, four theoretically separate components make up the its multifaceted construct - intrinsic values, achievement values, utility values, and costs (Barron & Hulleman, 2015). The

multidimensionality of study values is supported by similar empirical research, which shows that skill choice intention was correlated with intrinsic values, utility values, and costs but not achievement values (Wu et al. 2020). Similar findings were found in a longitudinal study of law and math undergraduates, which found that students' intention to choose a skill was correlated with intrinsic values, attainment values, and costs but not utility values (Schnettler et al. 2020). All things considered, all the various elements of subjective task values are significant determinants of students' skill choice intention, according to both theoretical and empirical studies. For instance, in one of those studies, there is a synergistic multiplicative relationship, between high subjective task values and high degrees of skill learning involvement and career aspiration in a long-term study of law and math majors (Schnettler et al. 2023).

Regarding expectancies, students' expectations for success are the most direct determinants of engagement, achievement, and decision-making (Eccles & Wigfield, 2020). Empirical research in this context in higher education supports the notion that student expectations are related to exam scores (Part et al. 2020), effort (Wu et al. 2020), grade point average (Breetzke et al. 2023; Robinson et al. 2019), skill choice and dropout intentions (Breetzke et al. 2023; Schnettler et al. 2020), and major retention (Robinson et al. 2019). Expectancy-value interactions predict a number of other behavioral variables in addition to the first-order effects already indicated, according to recent studies in higher education (Guo et al. 2018; Meyer et al. 2019; Song & Chung, 2020).

However, as students move from secondary school to higher education, their expectancies and subjective values shifts (Benden & Lauermann, 2022; Keyserlingk et al. 2022). The question of whether expectancy-value interactions in the context

of higher education show different relations to skills-related outcomes than expectancy-value interactions in the context of secondary school has been brought up by the significant differences between this two educational stages (Meyer et al. 2019; Nagengast et al. 2011; Trautwein et al. 2012; Breetzke et al., 2023; Kosovich et al., 2017; Schnettler et al., 2020). In the context of secondary education, students' expectations and values have often been highly correlated - e.g., 0.50 to 0.76 in Meyer et al. (2019); 0.58 in Nagengast et al. (2011);

0.48 to 0.75 in Trautwein et al. (2012). Meaning that values may be less firmly developed and more implicitly assumed when students expect to succeed in a particular skill. The correlations between the two constructs, however, are typically substantially smaller in studies conducted in the setting of higher education – e.g., 0.03 to 0.16 in Breetzke et al. (2023); 0.27 to 0.32 in Kosovich et al. (2017); 0.06 to 0.16 in Schnettler et al. (2020). This suggests that because values are more firmly established and closer to students, they may be less linked to their expectations.

Also, few studies have examined the latent expectancy-value interactions in the context of higher education, despite the abundance of research on secondary school context (Kim et al. 2022; Schnettler et al. 2023; Wu & Kang, 2021). According to Kim et al. (2022), expectations, emotional costs, and opportunity costs all significantly interacted to predict students' perseverance. Self-efficacy, task- effort costs, and outside effort costs did not, however, interact. Schnettler et al. (2023) discovered that (a) opportunity costs and expectancies had a small interaction impact that negatively predicted performance, and (b) emotional costs and expectancies had a small interaction effect that negatively predicted skill choice intention. Expectancies and effort costs did not interact, once more. The major flaws in these studies are that they are (a) been

narrowly focused, examining only one aspect of study values at a time and (b) been established as a distinct conceptual focus in terms of the methodologies employed and the subjects examined.

It is interesting to note that further research has highlighted the necessity of addressing the entire range of value dimensions proposed in EVT. For example, Wu and Kang (2021), examined the interactive relationship between expectancies for success and attainment values and how they affect students' skill choice motives via behavioral engagement using LMS. Findings revealed a compensating interaction. In this context, high attainment values were able to partially offset low expectations. Expanding on these findings, we observe support for both the compensatory and synergistic interaction with respect to skill choice intention in the setting of higher education and we can boldly conclude that situations with high values but low expectations for success, produce the lowest skill-related choices. The same may apply to the reasons behind students' skill selection in higher education. For example, as complexity, depth, and volume of coursework increases when entering higher education, students may realize during their studies that they are unlikely to succeed and may be particularly frustrated with their situation, so they may be the most likely to deviate from their skill choice (McGhie, 2017). However, in order to pick their learning strategies and safeguard their self-esteem, students may modify their expectations for success and even reduce the values they attach to studying as they adjust to these increased academic demands (Fredricks & Eccles, 2002). In this way, students' values are likely to evolve when they are at their right choice of skill learning and may become more distinct (Eccles & Wigfield, 2020), significant (Keyserlingk, et al., 2022), close, and solidified, allowing them to freely select and pursue the study area or talent that they value most. Stronger and more distinct values for students should result from having the

freedom to select the discipline or skill that is most significant to them, as demonstrated by the stark disciplinary variances (Breetzke et al., 2023). In other words, students should have a clear understanding of their future career paths and the job-related skills utility of their studies. They should also have clearer career skill aspirations and perceive their skills as important and proximal to their future careers (Breetzke et al. 2023).

In conclusion, expectancy-value theory is a well-known concept in motivation research that contends that people's expectations of success and the values they attach to the result influence their actions, accomplishments, and decisions. The main shortcomings of all of these models based on the reviewed related studies on expectancy-value interactions, are that they are domain-specific because they all concentrated on particular domains like, effort (Wu et al. 2020), grade point average (Breetzke et al. 2023; Robinson et al. 2019), exam scores and academic achievements (Part et al. 2020), cognitive processes and retention (Robinson et al. 2019), as well as grade point average (Breetzke et al. 2023). This disregards the potential impact of behavior and motivation on other domains like skill choice intentions. Once more, all of the research based on the reviewed related studies on expectancy-value interactions is focused on formal learning environments. We do not know in any empirical way the generalizability of existing findings to other domains. In order to comprehend how learners' expectations and subjective task values interact to predict skill choice motives, it is necessary to extend the applicability of expectancy-value interactions to non-formal learning settings like makerspace for generalizability. To this end, we suggest the following research objective for inquiry to guide this investigation:

2. To investigate the interactions between young school leavers' expectancies and their subjective study values in predicting fashion

design entrepreneurially oriented skill motivations.

Research Gap and Study's Contributions

Despite the fact that cognitive apprenticeship and expectancy-value interactions have been demonstrated to be significant predictors of learning success and entrepreneurial skill choice motivation and behavior, many studies acknowledge that their findings are context-specific, limited by the use of short (and sometimes relatively unreliable) instruments, and have called for more research to examine their interaction effects across other outcomes and domains, (Guo et al. 2018, Elphinston et al. 2021). In response to these recommendations for more research with a bigger collection of items and multiple value sides, we employ a measure with 18 items and two distinct study objective dimensions such as measures for mentorship style, and subjective task values. The idea that these metrics have been overlooked in empirical research is addressed by this. This study could ascertain whether the past findings are generalizable and, therefore, represent a generalizable outcome prediction by looking at these connections in the context of makerspace. Secondly, our research can help us gain a deeper understanding of motivation of students who are considering pursuing entrepreneurial skills. Gaining a better understanding of these issues may make it easier to determine the needs of students and may lead to new opportunities for the creation of focused interventions and cognitive instructional strategies.

Thirdly, this study addresses the constraints noted in previous research on cognitive apprenticeship and expectancy-value interactions in relation to students' learning and desire to choose entrepreneurial skills, and we take into account new findings. For example, as expectancy-values and cognitive apprenticeship use has always concentrated in formal educational contexts, this study investigated these applications in a non-formal learning settings - makerspace. Also as

the significance of guided learning experiences and social interaction is only emphasized by cognitive apprenticeship and expectancy-values, this study investigated motivation as a role player in skill engagement. Again, cognitive apprenticeship and expectancy-values have mostly been used in conventional fields like education, law, etc. However, this study investigated how they are used in unconventional fields like entrepreneurship. Other constraints refer to the fact that the majority of cognitive apprenticeship and expectancy-values research has also concentrated on immediate results. This long-term study investigated how they affects learners' entrepreneurial and professional growth over time. Again, feedback is a critical component of cognitive apprenticeship, but its role in shaping expectancies and values beliefs is not well understood. This present research has explored the relationship between feedback, expectancies, and values. Studies have demonstrated that career expectancies, and values may vary significantly throughout educational specialties. This study concentrate analysis on various creative training areas for young school leavers (who have demonstrated equivalent value profiles) in order to account for disciplinary disparities in students' value profiles. By addressing these literature gaps, this present study can advance our knowledge and understanding of cognitive apprenticeship and expectancy value theory, ultimately informing the design of more effective learning environment.

The Present Study

Given the foregoing, the goal of this study is to first promote the makerspace library for the development of entrepreneurial skills in Nigeria. Second is to investigate whether certain variables predict the entrepreneurially-focused motivations of young school leavers. To reflect the complex nature of our study values, we draw on the theoretical frameworks depicted in Figs. 1-2 (Collins et al., 1991; Eccles & Wig-field, 2020)

and expand upon cognitive apprenticeship theory and expectancy-value theory. For this study, we looked at N = 113 mentees who received training in our makerspace at the University of Nigeria and based our investigation on the following research questions:

1. Do makerspace-based mentoring (MBM) program predict the mentored students' fashion design skill motives?
2. Do the interactions between young school leavers' expectancies and their subjective study values predict fashion design entrepreneurially oriented skill motivations?

Methods

departments at the university to join them



Research design

We undertook a 5-month design, participant observation, and training in our university library-based makerspace from January to June 2024 in order to meet our research concerns. At the makerspace, which first opened its doors in January 2024, information was gathered from participants at the point of admission. The makerspace was designed to provide a learning environment with the tools and connections necessary to prepare young school leavers to gain entrepreneurial skills and become successful business owners upon graduation. In contrast to many other makerspaces, our makerspace encouraged entrepreneurship and was originally intended to be a five-month trial to see if it would be possible to open a makerspace permanently. **Fig. 3:** illustration of our makerspace with its open nature.

Participants

The third week before the makerspace was formally opened, the researchers invited interested students from their various

through a small-circulation self-published flier that documented the programmes of the university makerspace. These students represented a wide range of skill sets and creative interests. By promoting a vocational program of training, resource persons from the University of Nigeria, Nsukka's Center for Technical and Vocational Training and Research (CETVETAR) and outside specialists were invited as trainers. Among those invited were industrial garment designers, wood work/ carpentry experts.

At the end of the three weeks, through a well-publicized Kickstarter campaign, 113 participants -77 of them women were added to the email list as potential trainees in the space. Of the 113 participants, 56 females attended the training area at least once, and 35 females visited more than twice, according to a daily attendance sheet. 21 male participants only attended for the entire 5 months. However, there were five to fifteen participants learning in the area at once. Every new participant received a personal tour from the researchers, but there was no

formal orientation procedure since it was assumed that participants would get in touch with one another with any inquiries if needed. Then, in exchange for a stipend, three female university security officials worked as "interns," organizing the space, taking attendance, and keeping an eye on the facility when the researchers were away.

The researchers have wealth of experiences starting businesses and assisting aspiring entrepreneurs. They invested the N1,500,000 first grant to buy various tools and equipment for the space. The researchers were in charge of managing press relations, scheduling events, giving tours, opening and closing the facility, and managing its facilities (such as power, water, and wi-fi).

Instruments

We have two table-top mills, four 3-D printers, three sewing machines, drill presses, plotters, soldering irons, laser cutters, table saws, cabinet saws, and other common tools (like needles and threads) in our maker facility. Thanks to the researcher's connections and reputation within the university community, as faculty members from other departments, including Vocational Technical Education, agreed to lend equipment when needed.

Social and Web Technologies

The researchers wanted to promote community participation and exposure, so they set up a Facebook page, Slack account, and group email list. Notifying people about events in the space was the primary goal of the email list. The Slack account, which has 14 channels, was used more often for group socializing. Every channel had a distinct function and let users subscribe to various kinds of discussions. Researchers also encouraged participants to post photos of their activity on social media with the UNN hashtag included and with a note about the location of our maker facility. The community obtained publicity through the Kickstarter page and the social media posts.

Data Collection

We collected data in order to determine whether our makerspace's social-technical component encouraged entrepreneurship skills development generally and what drives young school leavers to pursue particular entrepreneurial skills. We paid particular attention to the mentorship method and the tools that instructors used, participants' interactions with instructors, and how participants' interactions impacted their entrepreneurship skills choice and development, what explains students' behavior in our makerspace learning settings, why some students appear to be more engaged in learning activities than others, and what makes some students persevere more than others in skill learning. We also paid attention to students' expectation in relation to choice of skills. After that, we spoke with each of the 113 participants in an interview through a semi-structured interview questions, as well as structured questionnaire focused on the above and what skills participants wanted to acquire, how they found us, how learning in our makerspace will advance their development of entrepreneurial abilities, and what factors motivated them to pursue this skill acquisition path. Depending on the respondents' availability, the interviews took place over the phone and in-person and lasted an average of thirty minutes. Also, questionnaires were distributed in-person. Every interview was captured on tape and Tran-scripted.

Data Analysis

A thematic analysis was used to examine the data generated from interview from three coding rounds, following the methodology outlined by Eze et al. (2022a). After reviewing the field notes and interview transcripts, the researchers performed a preliminary analysis of the data. They then put together a list of the fundamental themes that emerged. At originally, this produced a list of 14 codes. In the second round of coding, the researchers were able to identify more accurate codes, which allowed them to undertake a more

detailed examination of each theme. We used the categories from the theory of cognitive apprenticeship to identify skill acquisition mechanisms and the expectancy-value theory to identify decision motive mechanisms in a third round of coding. We took this action to verify our research question 1. With the Statistical Package for Social Sciences (SPSS) version 19.0, exploratory, descriptive, and inferential analyses were performed. To confirm any missing data patterns, an exploratory study was conducted. A straightforward group mean replacement was used to address any missing data because it was random and small (<2.2%). After that, the two sets of results were compared and examined. Then the statistical differences on factors influencing entrepreneurial skill motives by gender at the alpha level 0.05 was tested using the Mann Whitney U Test, to verify our research question 2, we estimated a structural model using the latent interaction terms using the LMS technique to correct for measurement error in the predictor variables. In this model, expectancies, values, and expectancy-value interactions predicted

intentions to choose an entrepreneurial skill (Model 2). For both models, the six aspects of subjective study values were computed separately. We employ the MLR estimator in Mplus, which uses non-normality-resistant standard errors and test statistics. All models included age, gender, first-generation status, and grade as control variables, allowing them to correlate with latent predictors and with each other.

Setting

The setting was a makerspace that was influenced by the exercises outlined in Collins et al (1991) theoretical framework, a summary of which is given in table 1. Essentially, our makerspace is housed in the basement of the University of Nigeria's main library. This site was chosen with the intention of making it accessible to all categories of students on campus. It is a 4,300-square-foot, open makerspace (Figure 4) set up to better support coaching, modeling, scaffolding, and exploration. It features a redesigned open concept with a nice storage room.

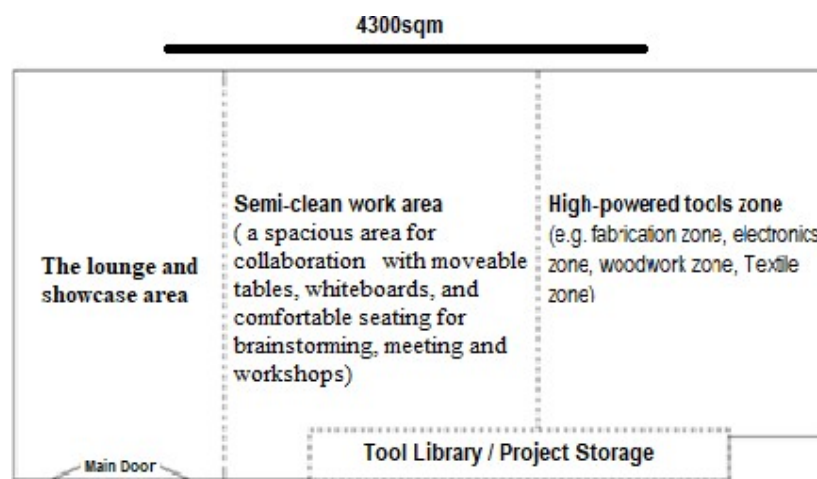


Fig. 4: Illustration of the Open layout of our makerspace facility

Here is a description of our ideal open layout makerspace setting:

Open Layout Description:

Our makerspace spans approximately 4,300

square foot, open-floored basement of the Nnamdi Azikiwe Library at the University of Nigeria, Nsukka. Previously, the space was utilized as a warehouse to bundle used computers. The area had been vacant for

several years, so the researchers—who doubles as the university's makerspace founders—convinced the University librarian to provide permission for the experimental pop-up workshop to inhabit it. During information collection, the library was typically open seven days a week from 10 a.m. to 4 p.m. the facility has high ceilings and ample natural light pouring in through large windows. The open layout allows members to move freely and work on projects in various areas.

Zones:

The space is divided into distinct zones, each equipped with specialized tools and equipment as follows: the fabrication zone which houses 3D printers, laser cutters, and CNC machines for rapid prototyping and manufacturing. Electronic zone which features workbenches equipped with soldering stations, oscilloscopes, and other tools for electronics prototyping and development. Woodworking zones which features a variety of woodworking tools, such as table saws, drill presses, and sanders. Textile zone which offers sewing machines, embroidery for textile design and production. Collaboration zone which is a spacious area with moveable tables, whiteboards, and comfortable seating for brainstorming, meeting and workshops. Additional features in the makerspace include the tool library which is the centralized storage area for hard tools, power tools, and specialized equipment. Project storage area which are the designated areas for members to store their ongoing projects. The lounge area, a cozy space with comfortable seating, snacks and beverages for relaxation and socialization. The classroom which is a dedicated space for workshop, classes and tutorials. Showcase area which is a display space for showcasing members' projects and creations. There are some safety features like fire extinguishers, first aid kits, and safety glasses which are readily available throughout the space. The ventilation system is a state-of-

the-art ventilation system that ensures good airflow and minimizes dust and fumes accumulation. This open layout makerspace facility is actually designed to inspire creativity, foster collaboration, and provide members with the resources and tools needed to bring their ideas to life.

Preliminary Reports of qualitative data Interview

We investigate our social-technical makerspace's entrepreneurial values on young school leavers using the cognitive apprenticeship model (Collins et al 1991). We use this framework to understand how young school leavers combined peer- and instructor-led instruction to experience modeling, coaching, scaffolding, and exploration to explore how cognitive-apprenticeship framework influences the development of skills choice motivation over time.

Modeling

The open floor plan, transparent and exploratory nature of our maker facility, created opportunities to develop entrepreneurial skills through learning by observing. In cognitive apprenticeship, learning a task by observing an expert accomplish it is referred to as modeling. Young school leavers get the opportunity to try out new skills and learn from the works of expert instructors by observing them perform. For instance, a self-made fashion designer described how being actively involved in our maker facility introduced him to new, unexplored techniques for making clothes and he has this to say:

'It's hard to find people who teach like you. So, it was an opportunity for me to interact with you. I have gained useful knowledge by your method of teaching that I might not have considered to obtain through conventional channels'.

Another participant, Uchendu, who has launched over four successful Kickstarter campaigns, also wanted to get better at prototyping fashion designs. She co-participated using the sewing machine with a home economics instructor with vast experience with prototypes. She approached the instructor who offered to help her as needed while working with the sewing machine. She eventually created a clothing product prototype, which she used to successfully raise over N40,000 on Kickstarter. In return, the home economics instructor witnessed directly how an experienced businesswoman turned her own concepts into a viable product. She has this to say when interviewed:

'Modeling allowed me to observe more experienced people. Being among other creative people was interesting...'. Scaffolding

Supporting these young school leavers to accomplish new activities outside of the confines of physical space is known as scaffolding. Scaffolding in our makerspace provided thorough instructions in an environment that at times seemed chaotic, which aided in the development of entrepreneurial skills. Using Slack, entrepreneurial gurus with different schedules could impart information to young school leavers asynchronously. Through these virtual channels, participants could also share exclusive insights and heuristic tactics even when they were not in the same place at the same time. Scaffolding was also given in a traditional way by providing step-by-step instructions, providing practice projects, and allowing people to perform skills on their own with as-needed support. Young school leaver participated in the process to develop new skills needed to carry out own businesses. One participant has this to say during interview:

'I cut a piece of cloth, and by observing the settings on slack with similar materials, I was able to visualize the settings I would employ in the area'.

Coaching

Furthermore, we saw numerous instances of instructors giving advice and criticism on incomplete work to learners and serving as mentors to them. For those new to our makerspace who had little experience with product development and marketing, the willingness to lend a hand was immensely helpful. Despite the fact that some participants were known to have more skills than others, they nevertheless saw reciprocal mentoring. One example is a five-week project where a professional instructor from business education and a student collaborated to build a graduation gown, which was successfully funded through a Kickstarter campaign. Likewise, a first-year student in the program shared how he developed his knowledge and skills in production, through meeting with more entrepreneurially minded individuals.

"I have gained a great deal of knowledge from my peers, especially experts in business. I now know how to introduce myself and give guests a tour of the whole area. No matter how small or large, it is a fact that everyone who comes through this door leaves with some knowledge."

Exploration

Our makerspace facility encouraged skill development through exploration in addition to coaching. This is the process of using existing tools and knowledge to do a task with minimal assistance. Because there are always not many options for developing entrepreneurial skills, especially for people with financial means. The researchers established the university-based makerspace. Participants expressed that originally, they would not be able to work on new projects after graduation since they would not have access to the skills and finances required. However, they talked about how our makerspace gave them a cheap and easy option to test out ideas and finance the purchase of materials to establish their

businesses. In just five weeks, one participant turned his small business idea into a medium-sized enterprise and described how our makerspace enabled him to produce a first low-run of his things for customers:

'We are unable to collaborate with manufacturers because of their high standard. As such, I think that using machinery and equipment and skills learnt from the university makerspace, with a very short run-time is the most beneficial use of them.'

Development Type	Mechanism	Examples from our Maker facility	Impacts on our Makerspace Design
Entrepreneurial Skill Development in our maker facility	Modeling	Offline: Seeing how other individuals use particular gadgets.	- Open space layout maintained
		Online: viewing other people's Slack project processes.	- Encouraged social media channels for project sharing - Public offline or online project "journaling" to be encouraged
	Scaffolding	Offline: Attending trainings provided by experts	- Further workshops to be held on entrepreneurial-focused topics (e.g. crowdfunding)
		Online: Reading community-provided tutorials over the internet	- Work area organized in order of most to least approachability (e.g. laptop area to table saw) - Open space layout maintained
	Coaching	Offline: Serving as mentor to one another	- Loudest machine tools kept farthest away and sound-dampened from conversational work areas
		Online: Submitting questions and suggestions to other members using online platforms for advice and criticisms	- Social media use still encouraged for Q&A - Membership marketed to soon-to-graduate and recently-graduated artists, designers, and engineers
	Exploration	Offline: Manufacturing small amounts of products in support using existing tools and knowledge	- Partnerships being developed with other entrepreneurial education non-profits
		Online: Using social media platform to promote business	- Designated photo and video production area added to support publicity efforts - Social media use for marketing encouraged

Table 1. an illustration of the entrepreneurial skill development in our maker facility using the cognitive apprenticeship theory of Collins et al (1991)

Result Presentation

The results of data analysis are done with reference to the research questions formulated. The order of presentation is as organized below.

RQ1: Do makerspace-based mentoring (MBM) program predict the mentored

students' fashion design skill motives?

Table 2 provides a qualitative analysis of the data obtained from interviews in order to address our specific objective 1 by identifying the cognitive apprenticeship teaching method that induced entrepreneurial decision-making underlying young school leavers' choice of seeking entrepreneurial skills. According to our data, *inspiration from former instructors*

was the main source of motivation for the majority of participants ($M = 4.23$, $SD = 0.724$). The participants' desire to become firm owners after graduation and their perception of acquiring practical entrepreneurial knowledge and abilities through *learning among other creative and more experienced people* ($M = 4.27$, $SD = 0.675$) were among their top reasons. The 2013 Enhanced Basic Education Act, however, has requirements for instructions to be passed to students virtually, an introduction which was incorporated into Nigerian universities teaching. Our findings imply that *the new education law may have an*

effect on participants' motivations to gain marketable skills ($M = 4.35$, $SD = 0.736$). The results also show that *instructors willingness to teach through giving advice and criticism on incomplete works, and serving as mentors was immensely helpful* ($M = 4.13$, $SD = 0.737$), *ability to use machinery and equipment from the university makerspace, with a very short run-time is the most beneficial* ($M = 4.14$, $SD = 0.643$). However, the table shows that the participants' justifications for being forced to learn came in last ($M = 2.31$, $SD = 1.247$).

Table 2: Result of apprentice-based mentor on entrepreneurial skill motives

Measures	MS (n = 113) M(SD)
Inspiration by my former instructors	4.24(.724)
learning among other creative and more experienced people	4.27(.675)
Virtual teaching may have an effect on participants' motivations to gain marketable skills	4.35(.736)
mentors willingness to teach through giving advice and criticism	4.13(.737)
Use of machineries and equipment from the university makerspace even after graduation,	4.14(.643)
Forced to learn	2.31(1.247)

Meanwhile, the quantitative analysis in table 3 reveals certain similarities, such as social support and peers (16.72 (3.02), which is in line with learning among other creative and more experienced people, Satisfaction of mentorship style (33.97 (6.65) which also

explains mentors' willingness to teach through giving advice and criticism, perceived competence in gaining marketable skills which explains (18.47 (4.45)) virtual teaching may have an effect on participants' motivations to gain marketable skills.

Table 3: Mentored students (MS) descriptive statistics for the independent and the dependent measures

Measures	MS (n = 113) M(SD)
Satisfaction of mentorship style	33.97 (6.65)
Psychological well-being	27.74 (4.81)
Social support and peers	16.72 (3.02)
School environment	14.63 (3.13)
Hope	26.11 (5.75)
Perceived competence in gaining marketable skills	18.47 (4.45)

***MS mentored students

We further looked at the statistical differences in apprentice-based mentoring in relations to fashion design skill motivation by gender at the alpha level 0.05 by adopting the Mann Whitney U Test. As can be seen in Table 4, there is a statistically significant difference

between the male and female participants, with the exception of being inspired by my former instructors (0.376), learning among other creative and more experienced people (0.073), virtual teaching may have an effect on motivations (0.826), instructors' willingness to teach through giving advice

and criticism (0.632), the freedom to use machineries and equipment from the university makerspace even after graduation, (0.247). All of the obtained significance levels are lower than $p > 0.05$. The remaining criteria which is *forced to learn entrepreneurial skills*, (0.032)," do not significantly differ from one another. The mean rankings of the two groups, however,

showed that female participants had higher mean scores than their male counterparts in all reported entrepreneurial skills motivations. This unequivocally supports the gender research hypothesis by showing that female participants were more attracted toward entrepreneurial jobs than male participants due to extrinsic, altruistic, and intrinsic drives.

Table 4: Non-parametric results of differences on entrepreneurial skills motives based on gender

Motives	Group	Mean Rank	Sum of Ranks	Mann-Whitney U	Z	P
Inspiration by my former instructors	Men	58.87	1895.5	1430.5	-0.805	0.376
	Women	67.55	6687.5			
Learning among other creative and more experienced people	Men	56.71	1770.5	1305.5	-1.57	0.073
	Women	68.80	6812.5			
Virtual teaching may have an effect on motivations	Men	65.41	2031.5	1566.5	-0.006	0.826
	Women	66.17	6551.5			
<i>instructors willingness to teach through giving advice and criticism</i>	Men	63.02	1960.0	1495	-0.408	0.623
	Women	66.89	6623.0			
Freedom to use university's machineries	Men	59.17	1844.5	1379.5	-	0.247
	Women	68.06	6738.5			
<i>forced to learn entrepreneurial skills</i>	Men	53.06	1661	1196	-2.18	0.032*
	Women	69.91	6922			
	Women	69.60	6891			

* $p < 0.05$.

RQ2: Which of the students' expectancies and their subjective study values predict fashion design entrepreneurially oriented skill motivations?

Following general guidelines Maslowsky et al. (2015) and previous studies on expectancy-value interactions in the context of skill

learning Meyer et al. (2019), we employed a two-step estimation technique for latent moderated structural equations to explore research question 2. First, we estimated a structural model that did not include the latent interaction component, in which expectancies and values predict intentions to choose an entrepreneurial talent (Model 1).

Table 5: Sample item, mean, standard deviation and cronbach's alpha of the measurement instruments

Instrument	Sample item	M (SD)	A
Intrinsic values	I enjoy being in my skill area.	4.76 (0.88)	0.87
Utility values	The content of my skill area will aid me later on in my working life.	3.97 (1.02)	0.94
Attainment values	Being successful in my skill area is crucial to me.	4.77 (1.03)	0.96
Opportunity costs	To succeed in my skill area, I have to sacrifice a lot	3.39 (1.14)	0.88
Emotional costs	I really feel burdened by my skill.	2.52 (1.09)	0.88
Effort costs	I find learning for my skill to be very draining.	3.58 (1.07)	0.89
Expectancy	I think I'm capable of succeeding in my skill area	5.03 (0.71)	0.80
Skill choice motive	I frequently consider changing my skill area or quitting my current course of study.	1.87 (0.98)	0.82

We then estimated a structural model using the latent interaction terms using the LMS technique to correct for measurement error in the predictor variables. In this model, expectancies, values, and expectancy-value interactions predicted intentions to choose an entrepreneurial skill (Model 2). For both models, the six aspects of subjective study values were computed separately (per Meyer

et al. 2019). We employ the MLR estimator in Mplus (Version 8.5; Muthén & Muthén, 1998–2017), which uses non-normality-resistant standard errors and test statistics. All models included age, gender, first-generation status, and grade as control variables, allowing them to correlate with latent predictors and with each other.

Table 6: Intercorrelation of all variables of interest

	1	2	3	4	5	6	7	8
1. Expectancies								
2. Intrinsic values	0.472*							
3. Utility values	0.218*	0.358*						
4. Attainment values	0.278*	0.326*	0.206*					
5. Opportunity costs	-0.268*	-0.228*	-0.047	0.078*				
6. Emotional costs	-0.484*	-0.630*	-0.302*	-0.201*	0.407*			
7. Effort costs	-0.389*	-0.459*	-0.178*	-0.075*	0.591*	0.687*		
8. Skill choice motive	-0.425*	-0.528*	-0.321*	-0.193*	0.206*	0.561*	0.374*	

Note: The columns show Pearson correlations coefficients; * $p < .05$

The results regarding the main effects of expectancies and subjective study values supported our second research question: the intention to choose an entrepreneurial skill was positively correlated with effort costs ($\beta = 0.075$), opportunity costs ($\beta = 0.047$), emotional costs ($\beta = 0.630$), expectancies (ranging from $\beta = -0.139$ to $\beta = 0.472$), intrinsic values ($\beta = -0.472$), and utility values ($\beta = -0.218$). While expectations were a larger predictor of entrepreneurial skill choice intention in the model for utility values, attainment values, opportunity costs, and effort costs, emotional costs and intrinsic values were the greater predictors in their separate models. Attainment values did not correlate with the intention to choose an entrepreneurial skill, which goes against our original research question.

2. Discussion

The study's main finding was that the best way to encourage increases in students' acquisition of academic-related skills was to implement an apprentice-based mentorship program. Due to a complex interplay of elements influencing the mentor's actions, relationship style, and mentoring focus,

apprentice-based mentoring was probably successful in upholding high standards of skill-based learning (Karcher & Nakkula 2010). According to Chu et al. (2010), apprentice-based mentorship programs are a significant source of assistance for students' skill development. Indicators of academic well-being including increased school engagement and improved employable skills have generally been linked to the skill development provided by mentors (Roorda et al. 2011). Giving more vulnerable students a school mentor has also been associated with greater academic performance (Herrera et al. 2011), reduced disciplinary referral rates (Converse and Lingnugaris/Kraft 2009), and increased views of learning competency.

However, if mentors are seasoned instructors, as demonstrated in (Dubois et al. 2002), the skill-related efficacy of apprentice-based mentoring is positively moderated. As a result, the mentors may have viewed mentoring as a chance to enhance their mentees' attitudes toward education and skill development because they were themselves mentees. The regular pursuit of academic activities, such as helping with homework, studying together, or exam preparation,

conducted in one-on-one and group mentoring sessions, may have resulted from this focus. This interpretation is supported by the findings of exploratory studies on the same program, which depict apprentice-based mentoring sessions as being dominated by learning concerns (Simões and Alarcão 2013b), as well as similar findings published in the literature (e.g. Herrera et al. 2011). Deficit reduction was likely the primary focus of the relationship type that arose from this emphasis on apprentice-based mentorship (Lavigne et al. 2011). Based on the program's activities and the traits of the children they supervised, the mentors may have restricted the research of alternative goals because they thought that apprentice-based mentoring was primarily a chance to alter a poor school trajectory.

However, what truly drives them is their genuine passion and resolve to better society, even though some cite the influence of their mentors and the current high demand for individuals with skills as justifications for pursuing entrepreneurial skills (Eze et al 2021). The study's report, for example, revealed that the participants thought about how much they valued being an entrepreneur and how much demand there was for them. This study confirms the findings of Skaalvik and Skaalvik (2018), who discovered that higher levels of well-being and motivations to choose a vocation were more moderately predicted by resources and job demands.

However, while previous research ignored the gender component, the current study examined the differences in the driving factors of students who were male and female. According to mean rank, the non-parametric findings demonstrated that, across all motivational components, female participants were more motivated than their male counterparts to hone their entrepreneurial skills and start their own company after graduation. This is in line with research by Muhonen (2004) that found male students were less motivated than female

students in the "entrepreneurial" Competence and Learning Styles category. Maliki (2013) and Sharif et al. (2014) state that aspiring female students fulfill their obligations with passion, accountability, and commitment.

The second conclusion on expectation-value interactions have been shown that skill choice motivation was positively correlated with the primary effects of opportunity costs, emotional costs, and effort costs, expectancies, intrinsic values, and utility values. This is consistent with the findings of Alexander et al. (2020), who discovered that intrinsic values can be linked to practices that affect students' choice of skills. The associated response surface models also suggest that expectations and values interact in a compensatory way. More specifically, low expectations might be slightly counterbalanced by low expenses and high study values. High expectations could also lessen the negative effects of low values and high expenditures. However, when both expectations and values were low (or expenses were high), students' intents to select a learning skill much outweigh the impact of any of the two criteria alone. Similarly, Wu and Kang (2021) found that when predicting behavioral involvement, which was associated with skill choice, high attainment values might partially counteract low expectations. Additionally, Schnettler et al. (2023) found a compensatory link between emotional costs and expectancies in determining skill choice intention. Contrary to our original goal, we find no significant relationship between skill choice intention, attainment values, and the associated expectancy-value interaction.

Given that several empirical investigations (Breetzke et al. 2023; Wu et al. 2020) find comparable results regarding the primary effects, it appears that attainment values (connected to achievement) may be a less significant factor for students' intention to choose a learning skill. When combined, our

results broaden the scope of expectancy-value interactions in higher education, which has significant academic and practical ramifications.

Implications

Theoretical implications

The results of the study illustrate the theoretical implications for practice and society. Young school leavers who choose different entrepreneurial pathways in our makerspace facility exhibit specific motivating features which is in contrast to most historical and modern approaches to human motivation, which treat motivation as unitary and controlled where one exhibits more or less motivation (Han et al., 2016; Ryan and Deci 2017). Our study's conclusion has focused on autonomous motivation to predict outcomes like performance, engagement, vitality, and psychological needs. This theory has a major influence on the study of human motivation and well-being because it provides a framework for understanding the motivational foundations of personality and social behavior as well as the relationship between basic psychological needs and psychological flourishing, well-being, and a high quality of life. Whether due to intrinsic motivation or well-internalized (autonomous) forms of extrinsic motivation, hundreds of research have shown that autonomously motivated people show higher levels of curiosity, enthusiasm, energy, and confidence. This leads to improvements in performance, creativity, persistence, well-being, and the overall influence on society (Ryan & Deci 2017, Eze et al 2022a,b).

On makerspace setting, Eze et al. (2021) suggest that the ecological circumstances of socio-technical makerspaces and instructional contexts related to entrepreneurship may have an impact on the motivations of young school leavers who are autonomously motivated. Thus, the findings of this study also supports the ecological system theory (Steffensen & Kramsch, 2017;

Mohammadabadi et al., 2019), which postulates that ecological factors at different levels, including social cultures at the macrosystem, coaching context at the exosystem, and entrepreneurial skill specialization at the mesosystem, may influence young school leavers' desire to choose a career skill. Young school leavers' motivation may therefore be "a product of a constellation of various distal and proximal factors within their learning groups" rather than "a result of a limited number of aspects" (Mohammadabadi et al., 2019, p. 765). However, the implications of this study are yet hypothetical, and more investigation will be necessary to gather more evidence. The current study contributed to the body of evidence that supports the use of cognitive apprenticeship theory Collins et al., (1991), Ryan and Deci's self-determination theory (2017) and expectancy-value theory (Eccles & Wigfield, 2020).

Practical implications

The study's practical ramifications for research, practice, and society are evident from its conclusions. As for the research implications, this study aims to close the gap between theory and practice from the current intermediaries and give academics a fact-based research of how cognitive apprenticeship can influence the development of expectancy-value framework towards motivating student learning and the modification of entrepreneurial skill choice behavior. Also, by drawing on state-of-the-art research, the findings of this study can guide future study paths and open the door for further studies on fostering creating and literacies on the reflection, articulation, and exploration processes in cognitive apprentice studies. By carrying out this study, we offered the data that would allow for the development of efficient motivational techniques to improve students' motivation for entrepreneurial skill choice. By closely observing and analyzing several case studies, our study which focuses on the factors that

influence entrepreneurial skill choice showcases how research and practice may assist teaching and producing in a range of contexts.

The study also provides students with the skills necessary to create and maintain makerspaces in formal and informal settings using a sophisticated, engaging approach by defining and demonstrating five essential STEM literacies: recognizing, organizing, and integrating information; creating and traversing representations; communicating with others for help and feedback during making; documenting processes; and communicating finished products. Educational policy makers can as well create policies that can improve the entrepreneurial skills development of these young school leavers by enforcing these requirements for STEM skill programs that can improve the status of the students and draw in highly qualified graduates who may be able to choose a career path or even launch their own businesses during and after their studies. By actively pushing students to participate in STEM (skill-building) courses that require them to explain why they want to adopt a certain career or start their own business, this could help ease Nigeria's shortage of skilled labor.

In terms of real-world applications, the study's conclusions can be used in a number of knowledge fields, broadening the scope of education and helping students try out various approaches to problem-solving and assess what works and what doesn't. By using this method, students can also learn how to investigate, accept failures, and grow, as well as how to be resilient enough to keep pursuing successful entrepreneurial commercialization. However, the intermediate outcome of the learning logic is that our makerspace must improve the knowledge similarity between entrepreneurial activities that use similar prototyping equipment. The local setting of our makerspace alone, promotes this

homophily, which fortifies social ties, according to the study's societal consequences. Our makerspace can achieve this by establishing a communal fabrication hub that can effectively unite people from diverse backgrounds and encourage knowledge exchange and social interaction-based learning. Through a social facilitation channel, this can help students improve the quality of their ideas and lower their failure rate. For students with entrepreneurial purpose, makerspaces can significantly lower the technological barrier to kick starting a business by providing them with affordable access to the fabrication tools and materials needed to create prototypes.

As per the commercial and economic implications of the study, makerspace materials can reduce startup costs and time, as well as ongoing costs and experimentation time. Entrepreneurs may benefit from this resource provision avenue, which can aid in product iterations to better address client pain points and increase the likelihood of successful commercialization. Additionally, the tangible working prototypes created may serve as a sign of readiness and increase the impact of pitches made during fundraising and purchase commitments. To reiterate, if manufacturers see a market for their goods, they may find opportunities in these sectors that would otherwise deter them from launching their own business.

Recommendations

Improving motivation is suggested as a means of encouraging makerspaces for the promotion of entrepreneurial skills, thereby unlocking the potential of young school leavers. Policymakers in technological education groups or institutions should focus on the influencing factors that could demotivate these young school leavers in various situations. They should also take the required actions to establish an atmosphere that will motivate them to learn entrepreneurial skills in order to pursue their

own business or lucrative employment while still in school or out of school. Because of the limited scope of the current study, the strategies for resolving these impacting components are not discussed in detail. Once more, the motives of young school leavers should be identified and investigated at the pre-enrollment stage of acquiring entrepreneurial skills, as we have done in this study. The information acquired and compiled will eventually form a national and regional profile of likely student motivation.

Even though the relative importance of altruistic and intrinsic drive is seen favorably, it is still important to look into the extrinsic motivation of possible young school leavers because it sheds light on their whole mindset and perception of entrepreneurship. More focus should be placed on developing skill-based programs based on empirical research on the dearth of qualified skilled graduates in Nigeria in order to assist close the skill gap in the country (Hassan, 2023). Since the majority of young school leavers will almost certainly launch their own enterprises when they graduate, they should act as ambassadors for entrepreneurship while in school. That is to say, the students' natural and altruistic motivations for choosing to pursue entrepreneurship education and become entrepreneurs must be sufficiently supported and nurtured during their time at the training facilities.

Limitations

Future research could overcome some of the shortcomings found in the current study. The first drawback is that inferences are troublesome because the study employed a qualitative research approach that exclusively relied on interviews to examine the reasons behind young school leavers' desire to learn entrepreneurial skills and launch their own business. Taking into consideration the advantages and disadvantages of qualitative research, future studies utilizing well-structured questionnaires could be carried out to thoroughly comprehend the

underlying causes of the similarities and differences in young school leavers' motivation to pursue entrepreneurial skills and become entrepreneurs. On the other hand, the study used self-report measures to respond to interview questions, which could introduce a significant amount of bias. The study's population was another flaw. However, the results of the study should be applied with caution outside of the original context. This is because it was suggested that a more extensive study be carried out in a similar manner to increase the report's generalizability and offer more direction for the operations of the participating institutions. Again, it is well recognized that motivation changes throughout time (Richardson et al., 2014; Han and Yin, 2016); however, this study only looked at the motivation of young school leavers at this early stage. Subsequent research may look at how their objectives changed as they went from being students to becoming business owners.

Conclusion

The study's findings have advanced our understanding of what an entrepreneurially-focused makerspace should look like as well as what motivates young school leavers to pursue entrepreneurial skills and become entrepreneurs by not only establishing a relationship between our entrepreneurially-focused makerspace and entrepreneurial skills development, but also advanced our knowledge on the types and ratings of motivation that these young school leavers share with those of full-fledged entrepreneurs, thereby providing a new perspective when comparing these individuals' motivational uniqueness to that of a full-fledged entrepreneur.

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