

DOES IT TRANSLATE? A CASE STUDY OF CONCEPTUAL DESIGN OUTCOMES WITH U.S. AND MOROCCAN STUDENTS

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ABSTRACT

High globalization in the world today results in the involvement of multi-discipline, multi-cultural teams, as well as the entrance of more economic powers in the market. Effective innovation strategies are critical if emerging markets plan to become economic players in this increasingly connected global market. The current work compares the design processes of designers from emerging and established markets to understand how design methods are applied across culture. Specifically, the design decisions of designers from Morocco, one of the four leading economic power in Africa, and the U.S. are investigated. Concept generation and selection are the focus of the current study as they are critical steps in the design process that can determine project outcomes. Previous studies have identified three factors, ownership bias, gender, and idea goodness as influential during concept selection. The effect of these three factors on designers in the United States is well established. The current study expands upon previous findings to examine the influence of these factors across two cultures—U.S. and Morocco. The results of this study, although preliminary, found that U.S. students had a higher idea fluency than Morocco students. It also found a significant difference in idea fluency between genders in the U.S. but not in Morocco. In addition, it was found that overall, participants exhibited ownership bias toward ideas with high goodness.

Keywords: design decision making, design theory and methodology, design methodology, design education

INTRODUCTION

In the United States (U.S.), more than 500,000 new businesses are started each month [1]. This growth is supported by the increased emphasis on entrepreneurship in U.S. universities [2], where students are frequently taught the fundamentals of entrepreneurship and entrepreneurial thinking as effective problem solving techniques. However, this rise in entrepreneurship is not isolated to the U.S alone, as similar

trends in entrepreneurship can be found in countries around the world [2–5]. For example, China has been promoting a partnership between industry and academia to encourage the establishment of new enterprises [4], and Morocco has become one of the top four economic powers in Africa as a result of a new wave of entrepreneurial culture [6].

The rise of entrepreneurship in Morocco is somewhat driven by necessity: unemployment rates remain high, especially in recent college graduates—in 2018, it was reported that around one third of graduating students in higher education were unable to find a job [7–9]. To help lower this unemployment rate, there has been an increase in the integration of entrepreneurship [10], innovation, and design thinking training in Moroccan Universities. New programs such as the Morocco: Entrepreneurship program conducted by the Council on International Education Exchange [11], the entrepreneurship program offered by the partnership of Virginia Commonwealth University, the International Institute of Higher Education in Morocco, and the Ford Fund [12], and the U.S. Tunisia Morocco Partnership on Entrepreneurship and Innovation in Engineering Education program offered by Pennsylvania State University [13] all aim to support entrepreneurship and innovation. The content and curriculum of these programs are based largely on results from design theory and methodology (DTM) studies conducted in the U.S. on U.S. student samples. The driving question then becomes are the findings from this prior work transferrable across cultures? Further, can we successfully identify if or what variations in training are needed in these new environments?

One of the focuses of DTM research has been on factors that impact the generation [14–20], selection [20–24], and development [21,25] of innovative concepts in engineering education and industry. This is vital because *coming up* with and *developing* innovative ideas is critical to successful entrepreneurial enterprises [26]. However, prior works have shown that generating new ideas can be difficult for engineering students due to human biases like fixation and attachment to

ideas [16], and the unique, open-ended, wicked-problems style of ideation that results in no definite solutions [16,17]. Specifically, studies have shown that engineering students in the United States were influenced by factors such as ownership bias during the idea selection process [22], which can impact the objectivity [22,23,27] and ultimately the quality of the ideation process [28,29]. These findings have informed the development of engineering design education curriculum and design methods that can improve outcomes [15,22,23]. However, these studies have largely focused on U.S. students, and it is not known if these same patterns persist across culture.

The term culture can be used broadly to encompass societal factors such as religion, language, and education [30,31], which shapes the environment around which an individual will immerse themselves in and absorb knowledge from [30]. Its effect on the behavior of individuals is significant, as studies have found that the values of a culture can impact the preference of individuals [32]. For example, a study has found that the rigidity of social structures present in a country can result in its inhabitants to exhibit a preference for similar structures in other areas, such as employment [30]. This impact on the psychological thought process of individuals is why this topic is of special interest to the field of engineering design and decision making. In a world where multi-disciplinary and multi-cultural teams become increasingly common [33,34], the need to design teaching methods and design strategies for everyone has also increased. Therefore, previous research that focuses on domestic populations and their behavior in engineering design is no longer sufficient as a knowledge pool. Therefore, the current pilot study was developed to identify similarities and differences in concept generation and screening practices between a U.S. and Moroccan student population through the workshop designed previously by Toh and Miller [35]. The goal of this work was to conduct a preliminary investigation to explore potential differences across culture during concept generation tasks. The results from this study will lay the foundation for future work to compare design cultures across populations.

RELATED WORKS

The generation and development of innovative ideas serve as one of the most important facets of the success of a project [26] [36,37]. However, the exhibition of this ability varies greatly from person to person [16,17] due to inherent biases, individual experiences, and societal norms. To understand the multitude of factors that can affect concept generation and selection in the context of varying cultures, relevant literature regarding the importance of culture and its impact in the decision-making process is reviewed. In addition, literature exploring salient factors such as ownership bias, gender, and idea goodness and their relationship to decision making processes is also reviewed.

The Role of Culture on Design Processes

The effect of culture on design processes is an emerging area of interest due to the increased globalization of markets around the world [1,2,38], manifesting as boosts in immigration [33] and international student population [34]. For example, previous research has found a correlation between culture and creativity [39–42], especially in multi-cultural teams [41,42], making it of particular interest to the design field. Culture is an intangible concept the definition of which is different for everyone [30]. Studies done on this area often attempt to describe it by breaking

it down into smaller sub-parts [30,31] such as religion, language, family, politics, education, and economic structure [30,31,43]. For this study, we will be focusing on the culture at two levels—the environmental level and the educational level.

At the environmental level, culture refers to the societal structures, norms, values, and beliefs that shape the unconscious thought-processes and behaviors of the population [44,45]. For example, cultures that value more individualism may have inhabitants that work more independently and hold the wellness of self above others [32]. This could, in turn, lead to the making of self-enhancing decisions, ultimately resulting in the display of ownership bias [46,47]. On the other hand, cultures that value collectivism may have inhabitants that are more willing to contribute in a group to reach a common goal [32]. These fundamental issues can then impact more specific factors in decision making, such as thought processes, communication, and personal preferences [32]. For example, studies evaluating the difference between Asian and American cultures have found the members of each culture have fundamentally different analytical thinking methods [48–51]. In addition, another study identified that the speed at which people absorb information, the amount of information taken into consideration, and the type of information used are significantly different between East Asians and North Americans [48]. These differences can significantly impact a designers' performance as the amount and type of information considered during early stage design are important factors in idea generation and selection [52,53].

Culture can also be present at the educational level. Educational systems can vary significantly between countries and regions [54]. For example, comparisons between the American educational system and the French system have found that the French system is much more organized and uniform comparatively [54]. The funds and resources allocated and class structure can also vary significantly from school to school in the American education system [54]. In addition, the informal learning processes that individuals are exposed to as a member of a society can also have a significant impact on the behavior and thought process of people [45]. For example, studies have found that in the Western culture, males were more likely to be independent and focus more on self while females were more likely to be interdependent and exhibit a higher preference for collaborations [45,55–57].

Comparing specifically Morocco and the United States, differences can be found in the gender distribution of both student and professional engineering populations [58–60]. For example, in the United States, the amount of women in engineering education is significantly less than the amount of men [58,59]. The retention of women in STEM fields is historically challenging due to the “leaky pipeline” [59,61]. However, in Morocco, women make up about half of the STEM (science, technology, engineering, and math) student population in universities, both at the graduate and undergraduate level, and the number is continuously increasing [60]. However, there is a significant decrease in the number of women that enter and remain in STEM fields after graduation, dropping to rates that are even lower than those in the United States [59]. While yet to be investigated, the unique composition of the student population in Morocco and its drastic difference from the population in the United States may have some bearing into the effect of gender and educational norms on design processes.

Concept Generation: The Impact of Idea Fluency, and Idea Goodness.

Concept generation is a crucial part of the creative design process and the success of a project, as it is the stage where innovative and creative ideas are produced [26,36,62–65]. This significant role is what makes it an integral part of engineering education, which seeks to train students with various design processes for better design performance [66–69][69]. This study is interested in two aspects of concept generation: idea fluency [63,69,70] and idea goodness [22,71–76]. Previous research has identified the term fluency as the ability to generate a large quantity of creative and original ideas [77], which is of particular importance to creative literature [78,79]. Idea fluency is highly related to creativity, as creativity had been identified as a key factor in the production of new ideas [80]. This is supported by previous research that has found a correlation between the creativity rate of the idea generators and idea fluency [81], and that an increase in idea fluency can result in increased creative originality [82]. Some research has even equated idea fluency with an increase in creativity and originality, stating that the generation of a large number of ideas can be the reason behind high creativity and originality in some circumstances [65,83]. Idea fluency has also been found to fluctuate with different circumstances in the concept generation process [84]. Its effectiveness as a measure of creativity and productivity has been tested on people with different backgrounds, as research has found bicultural individuals' increased creative originality could be accounted for by the high idea fluency [83]. This trend was also present in multi-cultural teams, and could be attributed to the different perspectives and increased pool of knowledge provided by the different group members [83]. These unique characteristics of idea fluency makes it a useful strategy to when avoiding fixation [63] and promoting creativity and originality [65,83] during idea generation, and why it is an important part of the engineering education.

Another important aspect of concept generation is idea goodness, which can be used as a way of assessing the quality of a concept produced during the generation process [22] and can encompass factors such as technical rigor, creativity, novelty, variety, feasibility, and viability [71–75]. It is important to note that, in this study, idea goodness is a subjective measure based entirely on the judgment of the participants. Idea goodness is crucial to the design process because it evaluates a concept, although subjective, in aspects not limited to creativity [71–75]. Its usefulness as an assessment criterion can serve as a useful reminder to designers that an idea needs to have high quality overall in order to guarantee the success of the project [85]. Research has found a correlation between ideas of high goodness and an increase in amount of discussion between group members, resulting in an overall increase in creativity and quality of the team [86]. These unique characteristics of idea fluency and idea goodness are what makes them of interest to this research investigating the specific impact of idea fluency and goodness on the concept generation process, and if this impact can be observed at two locations in two different countries.

Concept Screening: The Impact of Biases, Gender, and Idea Goodness.

One of the important factors that can influence concept screening is cognitive biases. It does so by affecting the

decision-making process of individuals, shaping and altering their perception, interpretation, and judgement on the task of interest, and can possibly result in individuals arriving at an incorrect or less than optimal conclusion [87]. Overall, there have been about 2000 different cognitive biases discovered, each manifesting in different ways in different people [88]. For this study, the focus will be on ownership bias. Ownership bias stems from the essential idea of ownership, possession, or association with physical objects or intangible things like concepts ideas [46,89–92]. Psychologically, this manifestation has been linked to the need and desire to be and remain in control [93], as well as the preference for self-enhancing actions [46]. Research has found that individuals often perceive objects they have a sense of ownership over as more favorable, and have a positive feeling over them when compared with objects they do not own [46,94]. The effects can also have an impact on the evaluation of the information presented to the designers [95]. This preference for “owned” ideas may present itself as an unwillingness to reject “owned” ideas [96] and ultimately result in a loss of objectivity in design decision making [22,23,27], which is why ownership bias is particularly relevant in engineering design. Especially for the concept selection process common in engineering, where any changes in the decisions made can significantly impact the outcome of the entire project [28,29]. Studies looking specifically at the effect of ownership bias on decision making have found that ownership bias presented more in male engineering students when compared with female engineering students [28]. In addition, studies have found professional engineers to display higher ownership bias toward ideas that are rated as low in goodness [27].

As identified by a previous study [28], gender can have a significant impact on human thought and behavior. Its relationship with ownership bias can be a result of the impact of gender on human preference [97,98], as studies have been done that found a difference in preference does exist between males and females [97,98]. It is theorized that this difference may be due to a difference in factors such as self-esteem across gender [97,99]. Studies have also found that gender can significantly impact the quality of individual performance during a task by influencing the mindset of the participants—females tended to have a lower expectancy for success, which resulted in poor performance [100]. This can be attributed to the fact that women often refrain from taking credit for their work, thus in a way, negatively view their abilities, while men tend to express more outwardly the impact of their abilities on the final success [101]. Another factor that may have resulted in this phenomenon is the difference in self-confidence, as studies have found that women display lower self-confidence than men in many disciplines [102], which may negatively impact the engagement, and ultimately the performance, of females. This difference has also been found to impact group work, where groups gender composition had been found to impact the rate of social loafing occurring, leading to a possible decrease in collaboration and underperformance [103].

Another factor that can impact ownership bias and decision making during the concept screening process is idea goodness. Idea goodness, as identified previously, is used to evaluate the quality of the concept generated with respect to the values of the team members [22,76]. However, it is important to note that idea goodness relies heavily on the subjective judgement of the participant and therefore is only a perceived measure, not a

standardized measure. It still serves as an essential evaluation criterion because it provides a measure of evaluating a concept that goes beyond creativity [28]. It can also help to determine more clearly concepts that fit the goals previously defined in the project[85]. For example, studies have found a positive correlation between the quality of the idea and the number of links the idea establishes with other ideas and design decisions [104], which is an integral part of the concept selection and product development process. Good ideas also fuel discussion and communication between group members, resulting in an evolution of ideas that can result in higher quality concepts being generated [86]. Research has been done to look at the relationship between idea goodness and ownership bias in the concept selection process for engineering students in the United States, which indicates that ownership bias may play a significant role in decision making on the “goodness” of the idea [22]. In a similar study looking at idea goodness and ownership bias in design professionals in the U.S., it was found that ownership bias tends to be more prominent for ideas that were relatively low in goodness [76].

RESEARCH OBJECTIVES

The main goal of this study was to identify the similarities and differences in concept generation and screening practices between U.S. and Moroccan student populations. The research highlighted above showed the importance of ownership, gender, and idea goodness in the study of ownership bias and concept selection. However, because the research conducted on the impact of these factors have focused on populations inside the United States, this study was established to widen the perspective and examine if their impact can persist in the populations gathered for this study, one from Morocco and the other from the United States. The current work will address the following research questions:

RQ1: What differences exist, if any, in idea generation outputs between U.S. and Moroccan students? Are there gender effects? Our hypothesis was that there would be a difference in idea fluency and goodness between males and females, and between the U.S. and Moroccan population. This was supported by previous research that had found concept generation to be correlated idea fluency, and that culture can have an impact on concept generation and idea fluency [83]. In addition, previous research have found gender to be significant in impacting the creativity and problem solving skills of individuals [105,106].

RQ2: What differences exist, if any, in concept screening practices in terms of percent ideas selected between U.S. and Moroccan students? Are there gender effects? We hypothesized that there would be a difference in the percent of ideas selected for further consideration across gender and culture, which was supported by previous research that found culture to have a significant impact on individual preferences [32], and gender to have a significant impact on concept screening practices of engineering students in the U.S. [22].

RQ3: Can culture, ownership, gender of the participants, idea goodness of the ideas be used to predict the likelihood of an idea being selected? Our hypothesis was that the four factors and their interaction effect would have a significant impact on

the result of the concept screening process. This is due to the prior research that found factors like ownership, gender, and idea goodness could have a significant impact on the concept screening process of engineering population in the U.S. [22,27,28,76]. In addition, this was also supported by previous research that found culture to have a significant impact on the decision making processes of individuals [32,48]. More specifically, the four factors of interest in this research questions are: 1) culture of the participant: whether they were part of the U.S. population nor the Moroccan population; 2) ownership of the idea: whether the idea was produced by the participant or not; 3) gender of the participant (male or female); and 4) idea goodness: the idea goodness of that idea.

METHODOLOGY

There were two datasets utilized for comparison in the current study. The first was data gathered from an innovation workshop conducted by Toh and Miller " in the United States with 36 engineering students (25 males, 11 females) recruited from engineering courses at a large Northeastern University. The same workshop format, timeframe, design task, and administrator was then used in a subsequent engineering design and innovation workshop held in Marrakech, Morocco with 50 students from various academic backgrounds (24 males, 26 females) recruited from a private Moroccan university. The main difference between the two workshops was the geographical location of its administration, as well as the backgrounds of the participants. The remainder of this section highlights the details of the workshop held in Morocco and any logistical differences that were present between the Moroccan and U.S. study samples.

Participants. Participants were recruited for the study from an Engineering Design and Innovation workshop held in Marrakesh, Morocco in the Spring of 2019. Participants for the workshop were recruited from a private university in Marrakesh based on student interest in engineering design and their English proficiency, as the workshop was held in English. While a total of 50 student participants and consented to the workshop, only 40 students (21 females, 19 males) completed both concept generation and selection were presented here. As such, the sample size used for the current investigation is 40 students; see comparison to U.S. sample in Table 1. Participants in the workshop were also assigned to 3- and 4- member design teams based on prior expertise and knowledge of engineering design, as was done in the prior studies [35].

Procedure. As previously reported, the procedure of the current study followed that of the study conducted by Toh and

TABLE 1 COMPARISON BETWEEN US AND MOROCCAN PARTICIPANTS

US Population	Morocco Population
36 Students	40 Students
25 male students	18 male students
11 female students	21 female students
First-year and third-year undergraduate students	Undergraduate and graduate (master's and PhD) students
Engineering background	Backgrounds in multiple areas (math, biology, chemistry, etc.)

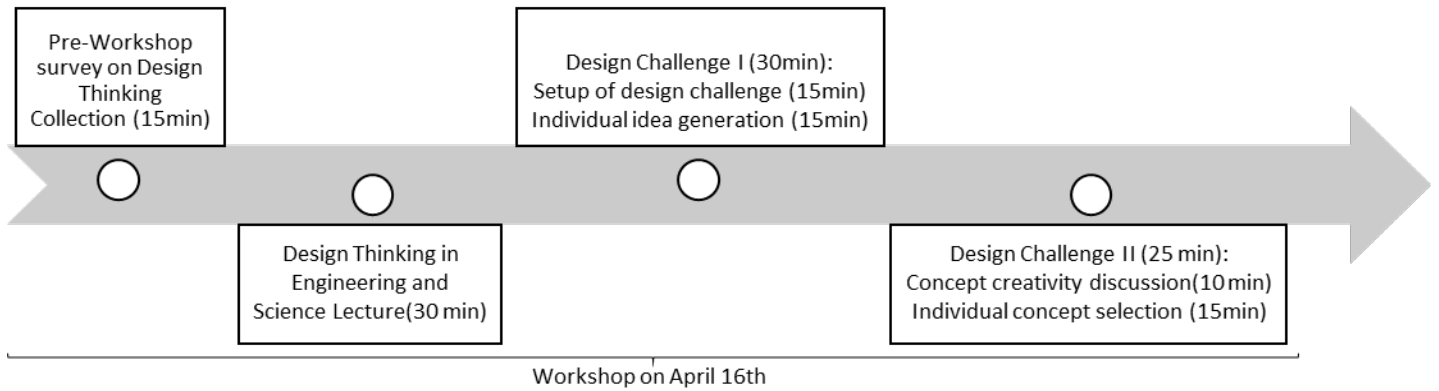


FIGURE 1 TIMELINE OF WORKSHOP

Miller [35] with a U.S. student sample. Specifically, at the start of the study, the purpose and procedures were explained to the participants and consent was attained, in accordance with Institutional Review Board procedures. Next, participants were asked to complete a series of questionnaires that asked for their demographic information, the Preference for Creativity Scale (PCS) [20,107], and the short form of the five-factor model (FFM) personality test [108]. After completion of these questionnaires, the participants were given a 30-minute lecture regarding the concept of design thinking and the importance of idea development. They were then separated into groups of 3-4, the composition of which was determined by the research team beforehand. After this, the participants were given a prompt to “develop concepts for a new, innovative product that can froth milk in a short amount of time with minimal instruction.” The full design prompt can be viewed at (http://www.engr.psu.edu/britelab/resources/Milk%20Frother_heat.pdf). This task was chosen based participants familiarity with the design task and the capability and expertise needed to come up with design concepts. Once the prompt was given and any questions were answered, participants were given 15 minutes to generate as many concepts as possible for a novel milk frother. No discussion was allowed during this individual brainstorming session. Participants were then instructed to stop generating ideas at the 15-minute mark. Participants were instructed to sketch only one idea per sheet of paper and write notes on each sketch such that an outsider would be able to understand the concepts upon isolated inspection.

Following the idea generation session, participants were asked to individually review and assess all concepts that their design team had generated in the previous session by using a concept assessment sheet, see Figure 2. Specifically, the participants were provided with a stack of ideas (anonymous) from one of their team members and they were asked to assess all of the concepts generated by their team members by categorizing each concept as follows:

Consider: Concepts in this category are the concepts that will most likely satisfy the design goals. You want to prototype and test these ideas immediately. It may be the entire design that you want to develop, or only 1 or 2 specific elements of the design that you think are valuable for prototyping or testing.

Do Not Consider: Concepts in this category have little to no likelihood of satisfying the design goals and you find minimal value in these ideas. These designs will not be prototyped or tested in the later stages of design because there are no elements in these concepts that you would consider implementing in future designs.

After the participants completed one round of evaluation for the designs received, they then shuffled the ideas (to randomize them and reduce ordering bias) and passed them clockwise to the next team member. This assessment continued until all ideas were rated by each member on the team, including the ideas produced by the rater. It was stressed that participants were not allowed to communicate during the activity and should remain silent until the end. This was stressed in order to minimize any biases that may result from team communication.

Although outside of the context of the current investigation, the workshop continued by leading the Moroccan students through prototyping activities and the workshop concluded with elevator pitches and a discussion of the role of risk taking in the design process

Metrics. In order to answer our research questions, several metrics were used. This section serves to highlight these metrics and their computation.

Idea Fluency: For this study, the idea fluency was defined as the number of ideas generated by each participant. This serves to measure the idea generation capabilities of the participants. This data was collected as part of the workshop where participants were asked to label the owner of the ideas. The number of ideas produced by each participant was labeled, and the sum of the numbers were recorded. This produced a total of 100 unique ideas by Moroccan student population and a total of 266 unique ideas by U.S. student population that will be used as part of the data analysis process.

Idea Goodness (G): This metric used in this study was a modified version of the one first used in a study by Toh et. al

Who's Idea is it?	Idea #	Brief Description of Idea	Is this idea worth considering for further design?	
			Consider	Do Not Consider
Erika	1	Plastic sheet with grid	✓	
Erika	2	Snap off UTI test strips		✓
27	1	Milk frother with voice C.	✓	□
27	2	Creating foam with air jet	□	✓
29	1	Ultrasonic device	✓	□
29	2	high shaking frequency	✓	□
29	3	Extinguisher like frother	□	✓

FIGURE 2 CONCEPT ASSESSMENT SHEET EXAMPLE COMPLETED BY PARTICIPANT 27

[22] to rate and evaluate the quality or effectiveness of a concept generated by looking at the number of members in the team that chose that concept for further development on the concept assessment sheets. In this case, idea goodness is measured by the level of consensus between group members. Idea goodness is an important criteria in evaluating factors such as creativity, feasibility, technical rigor of a concept [71–75]. To reduce potential biases that may exist in the decision-making process, goodness is calculated for each concept by *excluding* the decision of the individual who generated the concept. The equation used in the calculation is as follows:

$$Goodness_i = \sum_{n=1}^N \left[\frac{\sum_{m=1}^M (X_{m,n})}{M} \right] \quad (1)$$

Where $X_{m,n}=1$ if the m th member of the team selected the n th idea generated by another member in their team for further consideration, and $X_{m,n}=0$ otherwise. M is the total number of members in the design team excluding the participant that generated that idea. Using this equation, a goodness score above 0.5 indicates that the majority of the team members have selected the idea for further consideration during concept selection. A description of the goodness scores calculated using the data gathered for this study can be found in Table 1. This metric was used to calculate the goodness of each concept generated in this study evaluated by each participant in their team, resulting in a sample size of 310 data entries for the Moroccan student population and 927 data entries for the U.S. student population that will be used for further analysis.

Proportion of Idea Selected by Individual (P_i): This metric, constructed based on two metrics used by Toh and Miller [28] in a study, looks at the total amount of ideas selected by an individual out of the total ideas produced by the group. This is to measure the participant's habit in idea selection. This metric uses the ratio of the number of ideas selected by each participant out of the total number of ideas generated by the group. The equation used can be seen in Equation 1:

$$P_i = \frac{S_i}{T_P} \quad (2)$$

where S_i is the total number of ideas selected by a participant, and T_P is the total number of ideas produced by the group.

Ownership Bias: Ownership bias could be defined as exhibiting more favor towards objects or ideas perceived as own [46,89–92]. As previous studies have found, ownership bias tended to be influenced by factors like gender [22] and idea goodness [22,27,76] In this study, this metric was measured as whether or not the idea was owned by the participant. The responses were either 1 or 0, with 1 meaning the idea was owned by the participant and 0 meaning the idea was not owned by the participant. The specific effect of ownership bias would be investigated during the data analysis section where the ownership of the ideas were analyzed for its relationship with the selection of an idea. The interaction between ownership bias and factors such as gender and idea goodness would also be analyzed in the data analysis section as interaction effects.

DATA ANALYSIS AND RESULTS

During the study, the 40 Moroccan students generated a total of 100 unique ideas while the 36 U.S. students generated a total of 266 ideas. The average percentage of selection was 72.2% for

Moroccan students and 80.2% for U.S. students. The remainder of this section highlights our findings with reference to our research questions. SPSS v.26 was used to analyze the data collected. Data is presented as Mean $\pm$ Standard Error unless otherwise noted.

RQ1: What differences exist, if any, in idea generation practices between U.S. and Moroccan students? Are there gender effects?

The first research question was developed to investigate if the idea fluency and goodness of the generated ideas differed between the U.S. and Moroccan student populations or between male and female students. Our hypothesis was that there would be a difference in idea fluency and goodness between males and females, and between the U.S. and Moroccan population. This was supported by previous research that had found concept generation to be correlated idea fluency, and that culture can have an impact on concept generation and idea fluency [83]; and that gender was significant in impacting the creative problem solving skills of individuals [105,106]. Before conducting our data analysis, normality and homogeneity of variances of the data was tested using the Shapiro-Wilks test for normality and the Levene's test for homogeneity of variance. The results revealed that the data was not normal ($p < 0.05$), nor did meet the requirement of homogeneity of variance ($p < 0.05$). As a result, analysis of the interaction effect between gender and the culture of the participant could not be analyzed for its effect, and a non-parametric Mann-Whitney U tests were used for analysis of data for this research question. A total of six non-parametric Mann-Whitney U tests were conducted to address this research question.

The first part of this question explored the possible differences in the fluency (number) of ideas between U.S. and Moroccan students. To answer this, a Mann-Whitney U test was computed with the independent variables being culture and the dependent variable being idea fluency. Before conducting this the Mann-Whitney U test, assumptions were checked. This analysis showed that the distribution between the idea fluency for U.S. and Moroccan students were similar, as assessed by visual inspection. While outlier analysis revealed three outliers, the analysis was run with and without the outliers to identify their impact on the results. Because the results remained the same, the outliers were kept as part of the dataset for the final analysis. Once assumptions were verified, the analysis proceeded. The results of the Mann-Whitney U Test showed a statistically significant effect of culture on idea fluency, $U = 1399.5$, $z = 7.120$, $p < 0.0005$. Specifically, U.S. students ($Mdn = 7$) had a significantly higher median idea fluency than Moroccan students ($Mdn = 2$), see Table 2 for mean and standard error. This result supported our hypothesis that the culture of the participants (U.S. or Morocco) had a significant impact on the idea fluency of the participants. More specifically, it was found that U.S. students in general produced more ideas than Moroccan students.

A second Mann-Whitney U analysis was done to assess the relationship between idea fluency and gender. The independent variable used was gender and the dependent variable was idea fluency. Before conducting the Mann-Whitney U test, assumptions were checked. Analysis through visual inspection showed that the distribution between the idea fluency for the two genders were similar. In addition, outlier analysis revealed three

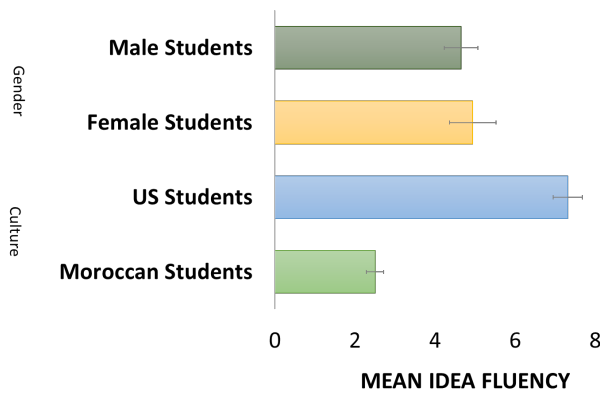


FIGURE 3: IDEA FLUENCY WAS STATISTICALLY SIGNIFICANTLY DIFFERENT ACROSS CULTURE, BUT NOT ACROSS GENDER

outliers. The analysis was ran with and without the outliers to account for their impact. It was found that the inclusion and the exclusion of outliers did not significantly impact the outcome of the analysis, and therefore they were kept as part of the dataset. Once the assumptions were verified, the analysis proceeded. The results of the Mann-Whitney U test showed no statistically significant differences between males (Mdn = 4) and females (Mdn = 4) for idea fluency scores, $U = 688$, $z = -0.227$, $p < 0.820$, see Table 2 for mean and standard error. This refuted our hypothesis that gender had a significant impact on the idea fluency of the participants. Specifically, this meant that the number of ideas generated by males and females were not statistically significantly different from each other.

To test if gender could impact idea fluency and if that impact was influenced by culture (U.S. or Morocco), a Mann-Whitney U test was computed with the data split by culture (Moroccan or U.S.). The independent variable was gender and the dependent variable was idea fluency. Before conducting the analysis, assumptions were checked. Visual inspection showed that the distribution between U.S. females and U.S. males was not similar, and the distribution between Moroccan females and

Moroccan males were not similar. In addition, three outliers were found as part of the outlier analysis. To account for their influences, the test was ran with and without the outliers. The results were not significantly different from each other, and therefore the outliers were included as part of the final analysis. Once the assumptions were verified, the analysis proceeded. The results of the Mann-Whitney U test showed that the difference between Moroccan males (Mdn = 2) and females (Mdn = 3) was not statistically significant, $U = 137.000$, $z = -1.754$, $p > 0.05$. Specifically, this meant that the number of ideas generated by Moroccan males and females was not significantly different from each other. However, the results of the Mann-Whitney U test showed a statistically significant difference between U.S. females (Mdn = 8.50) and U.S. males (Mdn = 7) for idea fluency, $U = 78.500$, $z = -2.219$, $p < 0.026$. The mean and standard error of mean for both U.S. and Moroccan students could be found in Table 2. This meant that U.S. females generated more ideas than U.S. males. This confirmed our hypothesis that idea fluency would be impacted by gender, and that impact would be different across culture.

Next, analysis was conducted on the impact of culture (U.S. or Moroccan) and gender on the “goodness” of the ideas created using two Mann-Whitney U Tests: one with the independent variable as culture (U.S. or Moroccan) and the other with gender. The first Mann-Whitney U test was done with the independent variable as the culture of the participants and the dependent variable as the idea goodness scores. Before conducting the analysis, assumptions were checked. No outliers were found, and visual inspection of the box plots revealed that the distribution between culture and idea goodness were similar. As such, the analysis proceeded. The results of the Mann-Whitney U test showed that the idea goodness scores between Moroccan (Mdn = 0.5) and U.S. (Mdn = 0.67) students were not statistically significantly different, $U = 139068$, $z = -0.207$, $p < 0.836$, see Table 2 for mean and standard error. In addition, Mann-Whitney U Test results also showed that the idea goodness score between female (Mdn = 0.667) and male (Mdn = 0.657) were not statistically significantly different, $U =$

TABLE 2: MEAN AND STANDARD ERROR OF IDEA FLUENCY, GOODNESS, AND % IDEA SELECTION WITH RESPECT TO CULTURE AND GENDER

Idea Fluency			
	Mean ± Standard Error of Mean		Mean ± Standard Error of Mean
Moroccan Participants	2.50 ± 0.218	Moroccan Females	2.90 ± 0.358
US Participants	7.31 ± 0.363	Moroccan Males	2.05 ± 0.195
Female Participants	4.94 ± 0.577	US Females	8.50 ± 0.669
Male Participants	4.65 ± 0.423	US Males	6.71 ± 0.383
Idea Goodness			
	Mean ± Standard Error of Mean		
Moroccan Participants	0.666 ± 0.020	Moroccan Females	0.687 ± 0.027
US Participants	0.666 ± 0.011	Moroccan Males	0.637 ± 0.031
Female Participants	0.678 ± 0.014	US Females	0.673 ± 0.017
Male Participants	0.657 ± 0.013	US Males	0.662 ± 0.015
% Idea Selection			
	Mean ± Standard Error of Mean		
Moroccan Participants	0.723 ± 0.048	Moroccan Females	0.774 ± 0.068
US Participants	0.803 ± 0.080	Moroccan Males	0.666 ± 0.068
Female Participants	0.788 ± 0.072	US Females	0.639 ± 0.049
Male Participants	0.725 ± 0.048	US Males	0.885 ± 0.115

175753, $z = -0.886$, $p < 0.376$, see Table 2 for mean and standard error. This refuted our hypothesis that there would be a significant difference in idea goodness scores of ideas generated between U.S. and Moroccan students as well as between male and female students. Specifically, this result showed that the idea goodness scores did not differ significantly between ideas generated by U.S. and Moroccan students. In addition, the idea goodness scores did not differ significantly between ideas generated by males and females.

To investigate if the impact of gender on idea goodness was different across culture (U.S. or Moroccan), a Mann-Whitney U test was computed with the data split by culture (Morocco or U.S.). The independent variable was gender and the dependent variable was idea goodness of the ideas. Before conducting the analysis, assumptions were checked. Visual inspection showed that the distribution between U.S. females and U.S. males was similar, and the distribution between Moroccan females and Moroccan males was similar. In addition, no outliers were found as part of the analysis. The results showed that the difference between Moroccan males (Mdn = 0.5) and Moroccan females (Mdn = 1) was not statistically significant, $U = 10824.00$, $z = -1.316$, $p > 0.05$. The results also showed that the difference between U.S. males (Mdn = 0.667) and U.S. females (Mdn = 0.667) was not statistically significant, $U = 96290.00$, $z = -0.124$, $p > 0.05$. The mean and standard error of mean for both the Moroccan and U.S. students could be found in Table 2. This refuted our hypothesis, as the results showed that idea goodness was not significantly impacted by gender, and it was not different between the two cultures (U.S. and Morocco).

Since the sample size was all above 30, by Central Limit Theorem, Independent Sample T-Tests were carried out with bootstrapping to validate the findings. All following analysis were ran with 1000 bootstrapping samples. With the independent variable as culture (U.S. or Morocco) and the dependent variable as idea fluency, Independent Sample T-Test found the mean idea fluency for Moroccan students was -4.81 , 95% CI $[-5.65, -3.96]$ higher than U.S. students. There was a statistically significant difference in mean idea fluency between U.S. and Moroccan students, $t(58.035) = -11.362$, $p < 0.005$, bootstrapped $p < 0.001$. This result was congruent with our findings, which also showed a statistically significant relationship between culture and idea fluency. On the other hand, when the independent variable was gender and the dependent variable was idea fluency, the Independent Sample T-Test did not find a statistically significant difference in mean idea fluency between male and female students, $t(53.823) = -0.506$, $p < 0.615$, bootstrapped $p < 0.62$. This finding was also congruent with our results. When comparing the effect of gender in each population on idea fluency, the Independent Sample T-Test found that the difference in mean idea fluency between Moroccan male and female students was not statistically significant, $t(30.598) = -2.092$, $p < 0.05$. On the other hand, the difference in mean idea fluency between U.S. male and female students was statistically significant, $t(18.453) = -2.325$, $p < 0.03$, bootstrapped $p < 0.03$. Both of these findings were congruent with our analysis results.

Independent sample T-Test was also conducted for independent variable of culture (U.S. or Morocco) and the dependent variable of idea goodness. The result showed that the mean idea goodness was not statistically significantly different between U.S. and Moroccan students, $t(508.75) = -0.019$, $p <$

0.99 , bootstrapped $p < 0.99$. When the independent variable was gender and the dependent variable was idea goodness, the independent sample T-Test found the mean difference between male and females to not be statistically significant, $t(1167.157) = -1.086$, $p < 0.28$, bootstrapped $p < 0.29$. This finding was also congruent with our analysis results. For idea goodness, the Independent Sample T-Test found that mean idea goodness scores were not statistically significantly different between Moroccan male and female student, $t(283.23) = -1.242$, $p < 0.22$, bootstrapped $p < 0.22$, nor was it statistically significantly different between U.S. male and female students, $t(802.70) = -0.519$, $p < 0.60$, bootstrapped $p < 0.57$. These findings were congruent with our analysis findings.

RQ2: What differences exist, if any, in concept screening practices in terms of percent ideas selected between U.S. and Moroccan students? Are there gender effects?

While the first research question focused on the impact of culture and gender in ideation practices, the second research question turns the focus to concept screening. Our hypothesis was that there would be a difference in the percent of ideas screened for further consideration across gender and culture, which was supported by previous research that found culture to have a significant impact on individual preferences [32], and gender to have a significant impact on concept screening practices of engineering students in the U.S. [22].

Before conducting our data analysis, normality and homogeneity of variances of the data was tested using the Shapiro-Wilks test for normality and the Levene's test for homogeneity of variance. The results revealed that the data violated normality ($p < 0.05$), nor did meet the requirement of homogeneity of variance ($p < 0.05$). As a result, analysis of the interaction effect between gender and the culture of the participant could not be analyzed for its effect, and a non-parametric Mann-Whitney U tests were used for analysis of data for this research question. A total of three non-parametric Mann-Whitney U tests were conducted to address this research question.

This first Mann-Whitney U test was computed with the independent variable being culture and the dependent variable being percent of ideas passing the screening process. Before the start of the analysis, assumptions were checked. Six outliers were found through visual assessment of the box plots. In order to account for the effect of outliers, the test was computed with and without the outliers. The results were found to be not significantly different from each other. Therefore, the final analysis was computed with the outliers included. The distribution between percent idea screened and culture was similar by visual inspection. The results of the analysis showed that there was no statistically difference on the percent of ideas screened between Moroccan students (Mdn = 0.667) and U.S. students (Mdn = 0.659), $U = 730$, $z = .104$, $p < 0.917$. The mean and standard error of mean could be found in Table 2. The results of this analysis refuted our hypothesis that there would be a difference in percent of ideas screened between U.S. and Morocco students.

A second Mann-Whitney U was computed with the independent variable being gender and the dependent variable being the percent of idea passing the screening process. Assumptions were checked before running the analysis and six outliers were found. The test was computed with and without the

outliers to assess their impact. The results of the analysis were not significantly different from each other, and therefore the outliers were kept as part of the dataset for further analysis. Visual inspection of the distribution between gender and percent idea screened found that they were similar. The results of the analysis failed to reveal a statistically significant difference between the percent of ideas screened by male students ($Mdn = 0.667$) and female students ($Mdn = 0.720$), $U = 682$, $z = -0.288$, $p < 0.773$. The mean and standard error of mean could be found in Table 2. The results of this analysis refuted our hypothesis that the percent of ideas screened would be different between males and females.

To investigate for the impact of gender on percent idea selection and to see if this impact was consistent across culture (U.S. or Morocco), a Mann-Whitney U test was computed with the data split by culture. The independent variable used in this test was gender, and the dependent variable was percent of idea passing the screening process. Assumptions were checked before running the analysis and six outliers were found. The test was computed with and without the outliers to investigate the impact of these outliers. The results were not significantly different from each other, and the outliers were kept as part of the data for analysis. Visual inspection of the distribution between gender and percent idea screened found that they were different for both the U.S. and Moroccan population. The results of the analysis did not reveal a statistically significant relationship between male ($Mdn = 0.659$) and females ($Mdn = 0.678$) in percent idea screened for U.S., $U = 128.00$, $z = -0.537$, $p > 0.05$. The results of the analysis also found the relationship between male ($Mdn = 0.666$) and female ($Mdn = 0.800$) Moroccan students to be not statistically significant, $U = 161.00$, $z = -1.047$, $p > 0.05$. The mean and standard error of mean could be found in Table 2. This result refuted our hypothesis that there would be a significant difference between males and females across culture.

For percent selection, when the independent variable was culture (U.S. or Morocco), independent sample T-Test found the mean difference between U.S. students and Moroccan students to be not statistically significantly different, $t(58.239) = -0.854$, $p < 0.396$. This finding was congruent with our analysis results using the Mann-Whitney U Test. When the independent variable was gender, independent sample T-Test also did not find the mean difference between male and female students to be statistically significantly different, $t(69.262) = 0.730$, $p < 0.47$. To see if the impact of gender on percent idea selection is different across culture, the data was split into Moroccan and U.S. and analyzed. The independent T-Test found the mean difference between Moroccan male and female students to be not statistically significant, $t(37.862) = -1.123$, $p < 0.27$. In addition the test did not find the mean difference between U.S. male and female students to be statistically significant, $t(29.965) = 1.970$, $p < 0.058$. All of these findings were congruent with our analysis results.

RQ3: Can culture, ownership, gender of the participants, idea goodness of the ideas be used to predict the likelihood of an idea being selected

The final research question was developed to determine if a relationship exists between factors of culture, ownership, gender, goodness, their interaction effects and the factor of concept screening (whether an idea was selected for further

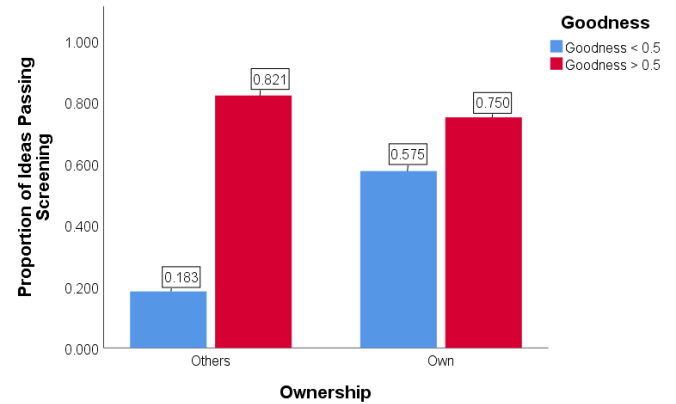


FIGURE 4: HIGHER PERCENT OF IDEA PASSING SCREENING WAS OBSERVED IN "OWNED" IDEAS WITH HIGH GOODNESS ($p < 0.0005$): PARTICIPANTS SHOW PREFERENCE FOR "OWNED" IDEAS THAT ARE HIGH IN GOODNESS

consideration or not). Our hypothesis was the culture, ownership, gender, and idea goodness would have a significant impact on the selection of an idea for further consideration. This is due to the prior research that found factors like ownership, gender, and idea goodness could have a significant impact on the concept screening process of engineering population in the U.S. [22,27,28,76]. In addition, this was also supported by previous research that found culture to have a significant impact on the decision making processes of individuals [32,48].

To do so, a binomial logistic regression was done with independent variables: culture, ownership, gender, and idea goodness and dependent variable: selection of an idea. This was to see if any second, third, or fourth interaction effect was significant in impacting the likelihood of an idea being selected for further consideration. Before the analysis was computed, assumptions were checked. The analysis output showed that the logistic regression model was statistically significant, $\chi^2(15) = 523.861$, $p < 0.0005$. The model explained 50.4% (Nagelkerke R^2) of the variances in idea screening. It correctly predicted 79.1% of cases. Sensitivity was 93.8%, specificity was 46.4%. Positive predictive value was 79.6% and negative predictive value was 76.9%. Of the predictor variables, only ownership (Wald Criterion = 44.419, $p < 0.0005$) and idea goodness (Wald Criterion = 9.365, $p < 0.002$) were found to be significant. The analysis shows that only the interaction effect between ownership and idea goodness (Wald Criterion = 45.923, $p < 0.0005$) was significant. Details on the results of the analysis, including could be found in Table 3 in the Appendix. The results from this analysis indicates that only an increase in idea goodness would lead to increase in probability of an idea passing concept screening. And if an idea would have a lower probability of passing concept screening when evaluated by participants other than its owner. The interaction effect between idea goodness and ownership showed that selection of an idea would be higher if that idea had high goodness score and if it is owned by the evaluating participant.

DISCUSSION

The study was designed to investigate the difference in student performance during concept generation and concept selection between U.S. and Moroccan students. The results of the

study were able to provide some preliminary insights into the effect of culture and gender on student performance, as well as the effect of other factors of decision making. Specifically, the analysis of the data collected found that:

- The impact of gender on idea fluency was different for the U.S. population and the Moroccan population.
- The logistic regression model of culture, ownership bias, gender, idea goodness, as well as their interaction effects was found to be statistically significant in prediction of idea selection
- Ownership and idea goodness, as well as the interaction effect between these two factors contributed significantly to the prediction of the model.

The role of culture and gender on idea fluency

One of the main findings of this study was that idea fluency, specifically for the design task of frothing milk, was found to be different between the U.S. and Moroccan population. More specifically, it was found that for the given prompt and the given task, U.S. students produced more ideas than Moroccan students. This was congruent with previous research that culture could have an impact on concept generation and idea fluency [83]. We have several hypotheses as to what could have resulted in this difference in performance between the U.S. students and Moroccan students. One hypothesis is that the coffee culture is different between U.S. and Morocco, and Moroccan students are not as used to the concept of frothing milk as U.S. students. Their lack of familiarity with this action as well as the existing tools and methods associated with it may have resulted in less stimulation on their creativity. On the other hand, U.S. students may have more knowledge about the concept of frothing milk, and therefore have a wider knowledge pool from which they can use to generate ideas. Another hypothesis is that this difference could be influenced by the academic backgrounds of the participants. The U.S. population who participated in this study all had engineering related backgrounds; on the other hand, the Moroccan population included individuals from different academic backgrounds, such as biology and chemistry. This could have resulted in them being less familiar with the task of concept generation as a way to solve a technical problem, thus hindering their ability to generate novel and non-repetitive ideas. An additional hypothesis for this difference was that this workshop was developed by researchers from the same university as the U.S. participants. This could have resulted in the workshop being more familiar and understandable to U.S. students, who speak the same language and have relatively the same customs as the developers. As a result, the information presented in the workshop may have been easier to understand for U.S. students, resulting in the difference in performance between the two groups.

In addition, this study also found gender to have a significant impact on idea fluency in the U.S., but not in Morocco for designing for task of frothing milk. More specifically, the analysis showed that idea fluency was higher for U.S. females than U.S. males. One of the hypothesis for why this gender difference occurred in the U.S. and not in Morocco was because the U.S. students were all from an engineering background, while the Moroccan students were from different academic backgrounds. This meant that almost all Moroccan participants possessed relatively the same level of familiarity

(or unfamiliarity) with the design prompt as well as the process of concept generation. This unfamiliarity could significantly impact their level of engagement in the activity as well as the design prompt, as a study have found that people tend to be more cognitively and behaviorally engaged with tasks that they are more familiar and confident with [109]. Therefore, since Moroccan participants were unfamiliar and may lack in confidence with the given prompt, their level of engagement, and ultimate the number of ideas produced, was roughly on the same level across all participants, regardless of gender. On the other hand, for the U.S. population specifically, we hypothesize that the observed significant difference could be due to the fact that the administrator of the workshop was a female. The presence of a female leader have been found to lead to a more cohesive team [110], which in this case would be the group of participants as a whole. We hypothesize this would then help to inhibit the potential biases and negative perceptions of self that may, in other circumstances, suppress female performance.

The role of culture, ownership, gender, idea goodness, and their interaction effects on concept screening

Another main finding of this study was that the passing of an idea through the concept screening process, specifically for the design prompt of frothing milk, was significantly impacted by the ownership of the idea. More specifically, it was found that an idea had a higher chance of passing screening if it was evaluated by its owners. This was consistent with prior research that found individuals to display a higher preference for their own ideas [46,94], and also by a study that found engineering students in the U.S. to exhibit ownership bias toward their own ideas [28]. The fact that participants from both U.S. and Morocco displayed this tendency shows that the effect of ownership bias extends beyond cultural background and can occur in both U.S. and Moroccan populations. This indicates that ownership bias and its effect in design, especially in design decision making, need to be stressed in both U.S. and Morocco to help minimize their effects. In addition, our analysis revealed that ideas with higher goodness scores were more likely to pass concept screening regardless of whether the participant was from the U.S. or Morocco. This is congruent with prior research that designers were more likely to select ideas they believe will be more successful [111].

In addition, a significant correlation was found between ownership and idea goodness. More specifically, it was found that ideas would have a higher possibility of passing the concept screening process if it had high goodness score and was owned by the evaluating participant. This was supported by previous research that there was a correlation between ownership bias and idea goodness [22,76]. This finding was in agreement with prior findings that individuals would perceive physical or intangible objects in their possession as more favorable [46,94], resulting in their unwillingness to “reject” these objects or concepts [96].

LIMITATIONS AND FUTURE WORK

This study was developed to investigate first the impact of culture and gender on the idea generation process, and second the impact of culture, ownership bias, gender, and idea goodness on the idea screening process. More specifically, the study looked at differences across gender and culture in student performance and behavior when generating ideas. This was done to see if there is a difference between idea fluency and idea

goodness of ideas generated between males and females, and between U.S. and Moroccan students. The results showed that gender did impact idea fluency, as U.S. students were found to have higher idea fluency. In addition, culture was found to have an impact on idea fluency in that there was only a male-female difference in U.S., and not in Morocco. However, gender and culture did not have an impact on idea goodness. In addition, the study looked at the impact of culture and gender on the percent of ideas passing the concept screening process. However, no significant impact was observed. The study also looks at if culture, ownership bias, gender, and idea goodness can impact the outcome of the idea screening process. More specifically, it looks at the selection of an idea and whether it can be predicted by the culture, ownership, gender of the participant, or the goodness of that idea. The results showed that ownership and goodness impacted the outcome of idea screening. More specifically, it was found that individuals were more likely to pass their own ideas, ideas that were high in goodness, or their own ideas that were high in goodness.

Although the analysis done in this study was able to produce some significant findings, the limited sample size and low effect size should be kept in mind for future analysis. As a result, the findings in this study are preliminary and are only applicable to the population tested here. Further analysis should be done with more participants from a wider variety of backgrounds in order to test the extent of the influences of the factors proposed here. For example, the background composition of the population in this study was also different, as the U.S. population was comprised of engineering students and the Moroccan population was comprised of students from different educational backgrounds. It is impossible to say if the differences and lack of differences observed in this study was impacted by this background difference. Therefore, future studies should look at the differences between populations of similar educational backgrounds. Future work should also collect qualitative data via participant interviews. This would allow researchers to triangulate quantitative findings and reconstruct participants' narratives of their design experiences. Such rich qualitative data could be used to not only confirm preliminary statistical findings but add further insights to the work. It is important to also note that the workshop as well as the prompt used was developed by researchers who were from the same university as the U.S. participants. In addition, no previous efforts have been made to ensure that the workshop translates completely to the Moroccan population. Future studies should be aware of this limitation, and keep in mind that this could have been a possible cause for the difference in performance between the U.S. students and Moroccan students observed in this study. Whether this workshop translates entirely to the Moroccan population is also a topic that is interesting to explore in future studies. And while the same task of frothing milk was given in the workshop for both U.S. students and Moroccan students, the exact familiarity of Moroccans with the concept of as well as the tools associated with frothing milk was not explored. Therefore, future research on this topic should delve deeper into this topic to see if Moroccan and U.S. students have the same perception of the task of frothing milk, and if this could have resulted in the difference in performance observed in this study. In conclusion, the analysis done in this study was unable to pinpoint the exact origin of the cause of the difference, since the difference

between the two workshops extends beyond simple geographical location. Therefore, we recommend that future studies should delve deeper into the backgrounds of the participants and how that may impact participant responses and performance in this workshop.

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TABLE 3 SUMMARY STATISTICS OF THE LOGISTIC REGRESSION MODEL ON THE RELATIONSHIP BETWEEN CULTURE, GENDER, OWNERSHIP, IDEA GOODNESS, AND IDEA SCREENING SHOWING A SIGNIFICANT RELATIONSHIP BETWEEN OWNERSHIP, IDEA GOODNESS, THE INTERACTION EFFECT BETWEEN OWNERSHIP AND IDEA GOODNESS, AND THE PROBABILITY OF AN IDEA PASSING CONCEPT SCREENING

Variables in the Equation									
		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
								Lower	Upper
Step 1 ^a	Culture(1)	.858	.987	.756	1	.385	2.358	.341	16.308
	Gender(1)	-.465	.586	.630	1	.427	.628	.199	1.981
	Ownership(1)	-3.661	.546	44.916	1	.000	.026	.009	.075
	IdeaGoodness	1.424	.465	9.365	1	.002	4.154	1.669	10.340
	Culture(1) by Gender(1)	1.508	1.345	1.258	1	.262	4.519	.324	63.075
	Culture(1) by Ownership(1)	-3.637	2.360	2.374	1	.123	.026	.000	2.689
	Culture(1) by IdeaGoodness	-.600	1.438	.174	1	.676	.549	.033	9.186
	Gender(1) by Ownership(1)	.434	.916	.224	1	.636	1.544	.256	9.301
	Gender(1) by IdeaGoodness	-.074	.841	.008	1	.929	.928	.179	4.822
	IdeaGoodness by Ownership(1)	6.048	.893	45.923	1	.000	423.475	73.636	2435.374
	Culture(1) by Gender(1) by Ownership(1)	-1.152	.884	1.697	1	.193	.316	.056	1.788
	Gender(1) by IdeaGoodness by Ownership(1)	-.372	1.433	.068	1	.795	.689	.042	11.418
	Culture(1) by IdeaGoodness by Ownership(1)	6.948	4.495	2.389	1	.122	1041.508	.155	6984822.492
	Culture(1) by Gender(1) by IdeaGoodness	-1.056	1.858	.323	1	.570	.348	.009	13.280
	Constant	.010	.333	.001	1	.977	1.010		
a. Variable(s) entered on step 1: Culture, Gender, Ownership, IdeaGoodness, Culture * Gender , Culture * Ownership , Culture * IdeaGoodness , Gender * Ownership , Gender * IdeaGoodness , IdeaGoodness * Ownership , Culture * Gender * Ownership , Gender * IdeaGoodness * Ownership , Culture * IdeaGoodness * Ownership , Culture * Gender * IdeaGoodness .									