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CORRELATION ANALYSIS OF LEARNING MOTIVATION AND LEARNING POTENTIAL IN ONLINE EDUCATION

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Abstract
Online education transcends temporal and spatial constraints, delivering unfettered and equitable educational resources to humanity. Traditional online educators prioritize the efficiency of knowledge dissemination, while students place emphasis on the frequency of knowledge absorption, with learning motivation acting as the conduit that bridges the two realms. Currently, there exists a dearth of global research on online education's impact on learning motivation. This study delves into this subject by examining 45 sophomores specializing in product design. Employing a questionnaire, comparative analysis, and in-depth case interviews, it concludes that learning motivation and self-efficacy possess the capacity to ignite latent learning potential. This research offers a novel perspective and methodology for steering the course of online education and fostering its seamless transition toward excellence.
Keywords: Online education, learning motivation, learning potential, self-efficacy, product design

1. INTRODUCTION

At the outset of 2020, the advent of the COVID-19 virus compelled society to slow its pace, resulting in a gradual shift from offline work to online operations. This transformation, especially evident in the realm of education, bore significant implications. On one hand, online courses demonstrated their efficiency and rapidity, elevating the effectiveness of one-way information dissemination. On the other hand, they lacked the interpersonal communication inherent in face-to-face interactions, thereby diminishing communication efficiency.
Consequently, the motivation of learners transitioned from passive education to an active educational approach. Thus, the focus of this study lies in nurturing the proactiveness of learning.

2. LITERATURE REVIEW

Education and design education

Since scholars George Siemens and Stephen Downes introduced the concept of MOOCs in 2008, online education has garnered substantial popularity and significance (Fini & Learning, 2009). McNamara and Patrick contend that online education has revolutionized traditional learning, employment, and work processes while reducing costs (McNamara & Education, 2015). Furthermore, online education has markedly enhanced the velocity and effectiveness of

knowledge dissemination (Wang, Paquette, & Baker, 2014). However, some argue that the influence of MOOCs has been exaggerated, and online education permits educators to disseminate their ideas with minimal scrutiny, resulting in a lack of regulation (Haggard et al., 2013). Teacher uncertainty, they argue, diminishes the quality of education (Donnelly, Rizvi, & Barber, 2013).

Neither perspective adequately considers the needs of learners, as online and offline education is invariably guided by learners' motivation. This forms the central theme of this paper: to empower educators with new methods and tools for online education that can invigorate learners' motivation. Of course, the most significant impact of online education on educators lies in the absence of timely access to teaching feedback and dynamic interaction and guidance.

Hence, teaching necessitates novel methods and tools to cultivate students' motivation and enhance learning efficiency. After all, a teacher's primary role is to sustain students' interest and motivation (Hew, Brush, & Development, 2007).

2.1 Motivation and learning motivation

The most profound transformation brought about by online education for students is their shift from passive knowledge absorption to active knowledge evaluation. Motivation can be categorized into endogenous inspiration and exogenous motivation (DECI & Ryan, 1985). Endogenous stimulation pertains to an individual's innate inclination to engage in social activities for personal growth, exemplified by curiosity and a thirst for knowledge. Extrinsic motivation, on the other hand, relates to an individual's inclination to participate in social activities to attain external rewards such as material gain, social recognition, competition in the marketplace, and more.

Given that this research pertains to the guidance methods in design education, we reference the Fogg Behavior Model's design theory. According to the FBM Model's definition: Behavior = motivation * Ability * trigger point, motivation encompasses three dimensions: pleasure and pain, hope and fear, and social acceptance and social rejection (Fogg, 2009). Our focus will be on learning motivation, exploring its correlation with learning efficiency and learning potential. Concurrently, we must consider teaching objectives and the learning environment (Lucero, Zuloaga, Mota, & Muñoz, 2006).

3. RESEARCH METHODOLOGY

3.1 Study participants

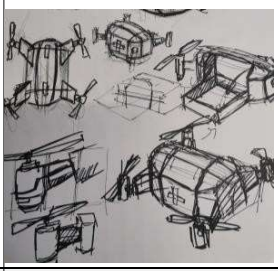
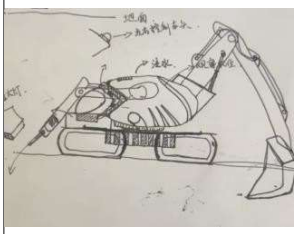
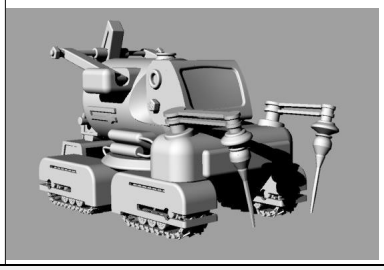
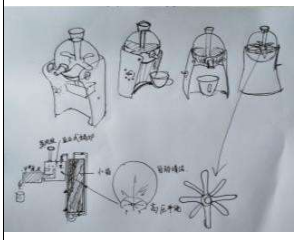
The participants in this experiment comprise 45 sophomores enrolled in the Product Design program at Fuzhou University. Among them, 32% are male students, while 68% are female students. These students have recently completed their foundational coursework and are preparing to embark on their first specialized course, "Product Design 1." This course encompasses early exposure to essential elements such as sketching, color theory, design methodologies, the fundamentals of mechanical design, and other introductory aspects, all integral to the comprehensive application of product creative design. This transition from introductory courses to specialized approaches aligns with the experiment's objectives, which

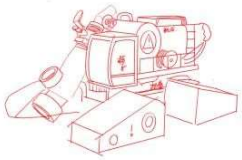
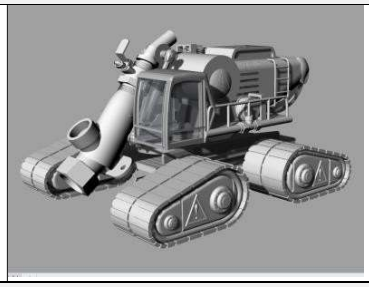
aim to examine the relationship between learning motivation, general self-efficacy, learning interest, and the achievements of novice designers starting from a foundation of zero experience.

3.2 Research tools

As a result of the influence of COVID-19, the "Product Design I" course has shifted to an online format, spanning a total of sixty hours over four weeks. During this timeframe, students are required to progress through three distinct stages: topic selection, sketching, and rendering. A total of 45 students were invited to participate in two experiments, and their performance was evaluated and scored (as depicted in Table 1). The average score was chosen as the indicator of their academic performance. Concurrently, a five-point Likert scale was employed for each assessment.

Table 1. Students first and second homework scores (Likert scale, Six representative pieces of work were randomly selected based on the distribution of students' previous grades)

Abstract expression	Concrete expression	
Textual description	Rough drawing	Computer rendering
Flight Rescue Kit: provides self-rescue equipment for high-altitude fires.		
3.8	3.53	
Forest fire water cutting trench machine: uses water to isolate thespread of forest fires.		
3.83	3.79	
An electrical appliance for recycling used tea leaves.		

3.48	2.74	
A baby stroller can climb stairs: solve the safety problem of baby stroller going up and downstairs.		
3.35	2.87	
SMART WRISTBANDS for children: Smart Devices to prevent children from getting lost in public places,		
3.35	2.823.	
Debris flows search and rescue aircraft: Adisaster relief vehicle adapted to the debris environment.		
3.6	3.89	

3.3 Research procedures and methods

As per the findings from the Steering Committee for Teaching Informatization and Teaching Method Innovation in colleges and universities, 17.97% expressed delight, 26.58% conveyed satisfaction, 51.37% expressed dissatisfaction, and 4% indicated they were not satisfied. It is noteworthy that the majority of students exhibit confidence in their online education experience. The objective of this study is to extend the general satisfaction assessment to the realm of online product design education.In line with the design process, the following questionnaires were administered: the Learning Motivation Scale, the scores for the first and second homework assignments, the variance between the two homework scores, and the General Self-Efficacy Scale.（1）The T-test was employed to analyze the correlation between the learning motivation score and the performance in the first assignment, thereby elucidating the relationship between learning motivation and capability. Subsequently, the connection between learning motivation and potential was delineated.（2）The study delved into the correlation between the learning motivation score and the General Self-Efficacy score, using a t-test for analysis.

4. RESEARCH RESULTS

4.1 Descriptive statistics

To assess the potential for improvement in online education, we conducted a survey on class preferences and course satisfaction with 45 students both before and after the course. The following conclusions have been drawn:

（1）Students exhibit a stronger inclination towards offline classes, indicating that there is substantial room for enhancing online education. Prior to the course commencement, only 10% of students favored the online education model, with 50% opting for offline education, and 32% remaining neutral. Following a month of online courses, 12% of students continued to choose online education, 70% preferred offline education, and 18% maintained their neutral stance. This suggests that the proportion of students opting for online learning remained relatively unchanged. Interestingly, some students who were initially hesitant about online learning ultimately decided to switch to the offline learning model (See Figure 1).

（2）As the course progressed, student satisfaction gradually improved, indicating that the online education model is steadily gaining recognition. Since this course represents their first foray into specialized topics, it differs from previous foundational techniques, making it particularly valuable for research. Prior to the course, students' satisfaction with online learning based on their past experiences was as follows: 61% of students expressed high satisfaction, 18% were satisfied, 13% felt average, and 8% were dissatisfied. After the course commenced, student satisfaction shifted notably: 80% of students reported high satisfaction, 15% expressed satisfaction, and 5% found it to be average. This indicates that after one month of study, student satisfaction significantly increased, and dissatisfaction diminished. However, this shift in satisfaction levels did not alter their preference for offline classes.

Figure 1. The way to do classes before and after the course starts is based on a satisfaction survey

In this study, a reliability analysis was conducted on a set of 15 questions from the "General Perceived Self-efficacy Scale" (Scholz, Doña, Sud, & Schwarzer, 2002). The analysis results indicated a satisfactory level of internal consistency with a Cronbach's alpha coefficient

of 0.843, which is deemed acceptable. Additionally, in terms of validity, the Kaiser-Meyer-Olkin (KMO) measure yielded a value of 0.8, surpassing the recommended threshold of 0.5, signifying that the data is highly suitable for exploratory analysis.

Regarding Amabile, Hill, Hennessey, and Tighe's learning motivation scale, a total of 30 questions underwent a reliability analysis. The findings indicated a Cronbach's alpha internal consistency coefficient of 0.714, indicating good credibility. Similarly, the KMO measure, with a value of 0.507, surpassed the threshold of 0.5, affirming its suitability for exploratory analysis.

4.2 Main research results and statistical writing

Among the numerous questionnaire items, we selected six key variables for investigation: learning motivation, the score of the first homework (text proposal), the score of the second homework (computer renderings proposal), the difference between the first and second grades, self-confidence (general self-efficacy), and the effectiveness of persuasion strategies (reward and punishment).

（1）Based on the analysis of the T-test for dependent samples (as shown in Table 2), a statistically significant difference was observed between students' scores on the first homework and the second homework, $t(44) = 12$, $p = 0 < 0.05$. The mean score for the first homework ($M = 3.49$, $SD = 0.3$) was significantly higher than that of the second homework ($M = 2.71$, $SD = 0.38$).The above data shows two points: as the depth of the course and the difficulty increase, the student's later grades will be reduced; Secondly, during the design proposal review process, students exhibit a higher level of receptivity towards abstract textual representations compared to concrete visual representations in the form of effect diagrams.

(2) The analysis of the dependent sample T-test found that there was a significant difference between the learning motivation and thetwo scores, $t(44) = 23.58$, $p<0.01$. The learning motivation($M=2.33$, $SD=0.26$) is significantly greater than the difference between the two grades ($M=0.8$, $SD=0.42$). The data presented above demonstrates that motivation for learning does influence the performance in online learning.

(3) The analysis of the dependent sample T-test found that there was no significant relationship between learning motivation and self-confidence level (general self-efficacy) $t(41) = -1.73$, $p=0.89>0.05$.Learning motivation ($M = 2.35$, $SD = 0.25$) difference between thetwo grades of ($M = 2.5$, $SD = 0.42$) there was no significant difference between the different. The above data indicate that the degree of self-confidence is not directly related to the learning effect.

(4) According to the analysis of the dependent sample T-test, it is found that the degree of self-confidence (general self-efficacy) is significantly different from the difference between the two scores, $t(41) = -17.81$, $p<0.05$. The degree of self-confidence ($M=2.5$, $SD=0.42$) was significantly more significant than the difference between the two scores ($M=0.82$, $SD=0.42$). The data above indicates that there is no direct correlation between students' self-confidence in learning and their ultimate learning outcomes.

(5) The analysis of the dependent sample T-test found that the persuasion strategy (reward and punishment) was significantly different from the difference between the two scores, $t(44) = 8.495$, $p<0.05$. The persuasion strategy ($M=1.47$, $SD=0.5$) is significantly larger than the

difference between the two scores (M=0.8, SD=0.42). The above data suggests that altering the teaching method during the course does not directly impact students' grades.

Table 2. The analysis encompassed the following aspects: the discrepancy between the scores of the first and second homework assignments, the relationship between learning motivation and both scores, the correlation between learning motivation and self-confidence, the level of self-confidence, the variance between the two scores, and a t-test for the persuasion strategy (N = 45).

Dimension	Mean (standard deviation)		Degreesof freedom	t value	p
	First homeworkresults	Second homework results			
Achievement	3.5 (0.3)	2.71(0.38)	44	12	0
	Learning motivation	First grade minus second grade	Degrees of freedom	t value	p
	2.33 (0.26)	0.8 (0.41)	44	23.58	0
	Learning motivation	Confidence level	Degrees of freedom	t value	p
	2.35 (0.25)	2.5 (0.42)	41	-1.74	0.89
	Confidence level	First grade minus second grade	Degreesof freedom	t value	p
	2.5 (0.42)	0.82 (0.42)	41	-17.8	0
	Persuasion strategy (reward and punishment)	First grade minus second grade	Degrees of freedom	t value	p
1.47 (0.5)		0.8 (0.42)	44	8.495	0

4.3 Other research findings

(1) The shift in students' attitudes towards online learning. In comparison to online education, students exhibit a preference for the offline education model. In the initial pre-course questionnaire, 57.9% expressed a desire for offline learning, 10.5% preferred online education, and 31.6% felt no discernible difference between the two modalities. Following the conclusion of the course, the post-course questionnaire revealed that 70.5% of students now aspire to learn through offline education, 11.4% still opt for online education, and 18.2% perceive no significant distinction.

In essence, the staged online education did not substantially enhance satisfaction with online education but instead led to a reduction in the number of students in the intermediate category, decreasing from 31.6% to 18.2%. Those students who altered their preferences chose to pursue offline education.

(2) The variation in students' performance during the course. During the divergent phase of

inspiring students for creative design. At the stage of students grading each other, we found that abstract textual expression can bring more creative space than concrete computer rendering. Therefore, this resulted in the students' second grade being generally lower than the first grade.

(3) In comparison to learning confidence, motivation has a more significant impact on academic performance. This means that in the online learning process, it is more crucial to acquaint students with the context, procedures, and expected outcomes of their studies than to enhance their interest and confidence.

5. CONCLUSION AND DISCUSSION

5.1 Conclusion

Online education undeniably represents a future trajectory in the realm of learning. It offers the potential to provide abundant, equitable, and efficient learning resources to people across the globe. Nonetheless, this shift has brought about a transformation in learning motivation, transitioning from passive knowledge absorption to active knowledge evaluation. This article investigates the impact of learning motivation on learning outcomes and delves into a more fitting online education model, specifically within the context of design education.

This study, conducted through questionnaires and the Delphi method, has yielded the following conclusions:(1) Learning motivation represents the potential for students' academic improvement and directly influences the extent of grade changes.(2) Students' general self-efficacy is not significantly related to their learning motivation, but it does have a significant correlation with the potential for academic progress.(3) Factors influencing students' acceptance of online teaching go beyond the teacher's teaching methods and also encompass the classroom learning atmosphere and timely feedback in interactive discussions.In summary, enhancing learning motivation and self-efficacy can significantly improve learning efficiency, thereby unlocking students' full potential.

5.2 Discussion

In addition to examining learning motivation, we also conducted an analysis of students' preferences regarding online education. Despite the improvement in students' satisfaction with online courses by the end of the class, the majority of students continue to favor offline education. While online education proves to be more efficient in terms of knowledge dissemination, it lags in terms of knowledge acquisition.

It is evident that what influences students' learning experiences is not only the knowledge imparted by the teachers but also the atmosphere created in the offline classroom. Such a learning experience can instill in students a heightened sense of competition, group pride, interactive communication, and prompt feedback, all of which inadvertently contribute to their motivation and learning outcomes.

Certainly, this distinction is also tied to the variances between disciplines, particularly in design-related fields that prioritize practical skills and in-person instruction. As an illustration, in peer evaluations, narrative text proposals tend to receive higher scores compared to graphic suggestions. This highlights the influence of user context and usage context on learning motivation.

It is precisely due to this cognitive friction that our research carries significant

relevance. Future investigations should place emphasis on the standardization of online teaching across various facets: from the selection and dissemination of knowledge to interaction, input, comprehension, and absorption. Undoubtedly, learning motivation serves as the pivotal conveyor in this educational journey.

5.3 Research limitations and recommendations

（1）It is crucial to diversify the professional backgrounds of the research subjects. This study focused on second-year students majoring in product design, specifically tracking their progress in the first professional course. Therefore, it does have certain limitations. To yield more precise and universally applicable conclusions, it is imperative to expand the scope of the survey to include students from various academic backgrounds, appropriately extend the duration of online courses, increase the sample size, and consequently, the findings drawn will hold broader applicability.

（2）Protecting individuals' privacy and enhancing the questionnaire's reliability and validity are of utmost importance. Given that the study involved three separate questionnaires administered at different points in time, it is essential to provide students with their individual results to garner more comprehensive feedback. This approach might encourage more candid responses from students, including their extreme or dissatisfied sentiments, ensuring the collection of the most accurate data during the questionnaire and interview phases.

(3) Online and offline classrooms each have their own strengths and weaknesses. In the future, traditional offline classrooms will continue to be the mainstay of education. We should integrate the advantages of both teaching methods. During theoretical knowledge instruction, we should actively utilize the internet to enhance learning efficiency. In discussion and hands-on learning segments, we should actively employ offline teaching to promote interaction.

(4) Many factors influence students' online learning outcomes, including students' learning interests and confidence, teacher's teaching methods and experience, an undistracted teaching environment, students' prior online learning experiences, and differences in course content. Therefore, future research should aim for more precise limitations and definitions when studying these aspects.

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