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**Think and Do: A Phenomenological Investigation into Student Motivation Towards
Making and Doing**

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Abstract

In the field of technology and engineering education (T&E) there is a shared, anecdotal narrative related to student motivation. The narrative, summed up, alludes to the idea that some students become more motivated towards academic achievement when the focus of the course is on making and doing rather than didactically delivered content knowledge. While making and doing remains a hallmark of T&E, in the last two decades a focus on technological literacy for all has emerged. Unfortunately, the goal of technological literacy for all has yet to be met. The purpose of the study is to develop an understanding of the phenomenon of being motivated towards making and doing in the context of a T&E classroom and what aspects of a making and doing centered course engender such motivation.

Introduction

The International Technology and Engineering Educators Association (ITEEA) defines making as referring “to the act of creating something” and doing is defined as “hands-on processes associated with designing, building, operating, and evaluating technological products and systems” (ITEEA, 2020, p. 76). In addition to defining making and doing in the Standards for Technological and Engineering Literacy (STEL) they also identify it as a foundational component of technology and engineering education (T&E) and as a differentiator from other content areas. There is also an anecdotal narrative within T&E that, when summed up, alludes to the idea that making and doing has a positive impact on student motivation towards academic achievement. Because of the prominence of making and doing and the shared, anecdotal narrative amongst T&E professionals the focus of the current study is on collecting descriptions of lived experiences of undergraduate students who are motivated towards making and doing and exploring what aspects of T&E courses engender motivation towards making and doing.

While making and doing holds a prominent place in T&E, the concept of developing technological literacy for all is the stated goal of the profession (ITEEA, 2020). Despite this focus being in place since the mid-1980’s (Lauda, 1986), there is a discernable lack of technological literacy among American citizens (Dyrenfurth et al., 1981; Bybee, 2000; Krupczak et al., 2012; Change the Equation, 2016). Given this, the problem of the current study is the overall lack of technological literacy in the United States. To begin to address the lack of technological literacy for all, the purpose of the study is to develop an understanding of the lived experiences of undergraduate students who are motivated towards making and doing such that curricular augmentations could be made to boost the motivational impacts of T&E courses. This would lead to further engagement with T&E classes and concepts, ultimately leading to enhanced technological literacy.

Research Questions

The central question of the study is: What are the lived experiences of undergraduate students who are motivated towards making and doing? Based on this central question there are two research questions and four sub-questions that drive the study. They are:

Research Question 1: How do undergraduate students in the College of Education at a Research 1 (R1) university experience motivation towards making and doing in a making and doing-centered classroom?

Sub-Question 1: How do students with a background in making and doing experience motivation towards making and doing in a making and doing-centered classroom?

Sub-Question 2: How do students without a background in making and doing experience motivation towards making and doing in a making and doing-centered classroom?

Research Question 2: Which aspects of a making and doing-centered course engenders motivation in undergraduate students in the College of Education at a Research 1 (R1) university?

Sub-Question 3: Which aspects of the course engenders motivation in students with a background in making and doing?

Sub-Question 4: Which aspects of the course engenders motivation in students without a background in making and doing?

Literature Review

To become familiar with the body of knowledge of technology and engineering education (T&E) and motivation theory, as well as to identify gaps in the literature in which a research study may become useful, the researcher conducted a literature review. While conducting the review, the researcher conceptualized the work as in the form of a Venn diagram, taking general information about two main topics, technology and engineering education and human motivation, and reviewing materials from the general to the specific. After this, the researcher investigated the intersection of the two topics to gain an understanding of the motivation related research that had been done in the T&E literature base. To develop a greater understanding of the history and current trends in T&E the researcher reviewed the literature surrounding manual training, industrial arts, technology education and the transitional periods between each era.

With regard to human motivation, the researcher investigated the general motivation theories of Freud, Jung, Horney, Skinner, and Maslow. Taking an education lens, motivation theories that were specific to education were then investigated. These theories were intrinsic/extrinsic motivation, Self-Determination theory, ARCS model, Social Cognitive theory, and Situated Expectancy Value theory. The investigation into motivation theory provided context and understanding to the researcher that allowed for a deeper understanding of motivation as he conceptualized the study.

The final phase of the literature review centered around the convergence of motivation related research and T&E. During this review, several studies were found. The first and most

broadly related to T&E was by Autio and colleagues (Autio et al., 2011). Autio and collaborators qualitatively investigated motivation and technology education in Finnish schools. Using a case study method, several perspectives were produced. The most notable theme from the study was that the artifact to be made in a lesson and the freedom of choice in the creation of that artifact were most significant in terms of motivation. Other motivational factors were noted, such as the teacher, personal talent, interest, need, personal hobbies, the school curriculum, and parents. Another motivation related T&E study was conducted by Clark, Ernst & Scales (2009). Surveying undergraduates in an introductory engineering graphics course, the researchers found that grades, relevance of content, and understanding subject matter were the main factors that impacted a student's motivation for academic achievement. Additionally, there were several categories of studies that examined motivation and were connected to T&E. These topics were: gender-based motivation (Virtanen et al., 2015; Chatoney & Andreucci, 2009), teacher motivation (Fan & Chen, 2021; Wright & Custer, 1998), and K-12 education (Campbell & Jane, 2012; Mentzer & Becker, 2009). After a thorough review of the existing literature, the researcher identified a gap in knowledge base that the current study seeks to address. That being a lack of knowledge surrounding motivation towards making and doing in the context of T&E courses.

Qualitative Inquiry Method

For the current study, the researcher chose to implement a hermeneutic phenomenological design to investigate the research questions. According to van Manen (2016) "...phenomenology is a discipline that endeavors to describe how the world is constituted and experienced through conscious acts...Phenomenology is about what is given to us in immediate experience without being obstructed by pre-conceptions and theoretical notions" (p. 184). Patton (2015) defines phenomenology as "... exploring how human beings make sense of experience and transform experience into consciousness, both individually and as a shared meaning" (p. 190).

In the phenomenological tradition of qualitative research there are two prevailing types of phenomenological designs, the Husserlian or descriptive and the Hermeneutic or interpretive. They are both concerned with studying the lived experience of participants, however the Husserlian researcher focuses on creating a description of the phenomenon that is entirely free from interpretation and bias while the Hermeneutic researcher does not feel that is possible. Instead, the Hermeneutic researcher acknowledges that a complete suspension of prior knowledge is not possible but actively works to restrain its influence by using an analytic technique known as the hermeneutic circle (Peoples, 2021) and by conducting mental exercises known as bridling (Vagle, 2018).

The researcher chose to conduct a Hermeneutic phenomenology for several key reasons. When analyzing how one might investigate motivation, the researcher realized that the concept was not easily measured. This led to the researcher choosing to employ a qualitative measure, as they are well suited to investigate complicated topics (Creswell and Poth, 2018). Adding to this, the researcher is looking to develop an understanding of the shared experience of individuals who are motivated towards making and doing. According to Schwandt (1999) developing understanding is at the heart of qualitative inquiry. Delving into a specific qualitative tradition, the researcher aligns ontologically (social constructivist) and epistemologically (co-constructed, multiple realities) with phenomenological inquiry. At the micro level, the researcher does not

feel that a descriptive approach is feasible for him, as a total suspension of prior knowledge does not align with his views of the research. This then places him in the interpretive tradition.

Researcher Reflexivity

Vagle (2018) notes that a key aspect of any qualitative research design is a researcher reflexivity statement. Creswell and Poth (2018) discuss the importance of a researcher reflexivity statement in that it makes clear biases, prior experiences, and values that the researcher may bring to the study. In an effort to make plain his own experiences, biases, and values, the researcher identified four key facets of his own reflexivity and how they can impact the current study.

The researcher is himself a lifelong maker and doer. He was given toy power tools as a child and roleplayed hands-on activities and processes and as he has aged making and doing has played a central role in his life both professionally and personally. The researcher takes great pride in his making and doing skills and the opportunities they have afforded him personally and professionally. Prior to designing the current study, the researcher conducted pilot tests of the similar studies in the context of doctoral coursework. These allowed him to iterate on his emerging ideas and draw preliminary conclusions about the viability and potential themes that may emerge. Finally, the researcher is very motivated to make and do. This appears in his life personally, as a creative outlet, and professionally in what he prefers to engage with as an educator and researcher.

By identifying these experiences and perspectives, the researcher is more aware of how they could impact the current study. This impact could manifest in how he asks questions, organizes information into themes, and how he creates the final definition of the phenomenon of being motivated towards making and doing. He may also overinflate the importance of aspects of the phenomenon that aligns with his experiences and motives. He may also underestimate facets of motivation that do not align with his own experience and perspectives. These are but a few of the potential ways that prior experience, biases, and values may impact the current study.

Methodology

For the current study, the researcher chose a materials processing technology (MPT) course in a college of education at a research one university in the Southeastern United States as the site from which to sample participants. The MPT course was chosen because it featured the most making and doing centered curriculum in the program area. The course also features built-in open lab times where students can come and engage with making and doing outside of specified course time while under the supervision of a trained and experienced professional. Students in the course traditionally come from a variety of making and doing backgrounds, with some having a great deal of experience and some having none. A unique aspect to this course is the extensive use of both physical and digital making and doing tools and processes. This is advantageous, as students are motivated differently by different tools and processes.

Sampling

When it came to sampling the researcher chose a purposeful sampling strategy. Patton (2015) describes purposeful sampling as "...selecting information-rich cases whose study will illuminate the questions under study" (p. 401). By selecting information rich cases the researcher can learn more deeply about the phenomenon and yield insights and understandings rather than generalizations, according to Creswell and Poth (2018). The researcher expects to have between three and ten participants in his study. This aligns with the range outlined by Creswell and Poth (2018). The sample is drawn from the two sections of the undergraduate MPT course. The students must be enrolled in the course, have the lived experience of being motivated to make and do, be eighteen years of age or older, and not be enrolled in any course the researcher is the instructor of at the time of their participation in the study.

Data Collection Procedures

With the site and population identified, the data collection process begins by gaining approval through the local institutional review board (IRB) and being granted access to the population by the appropriate gatekeepers of the population. With access given, the researcher is then given access to the class rosters of the MPT course sections with names and university email addresses of potential participants. Using an IRB approved template email, the researcher invites all eligible, potential participants to take part in the study. This is accomplished first by thoroughly reading and agreeing to the IRB approved informed consent form.

Next, potential participants are asked to complete a lived experience description (LED) prompt, based on Vagle (2018). As the researcher is not the instructor of record for the MPT course and cannot evaluate a participant's motivation to make and do prior to interviewing them, the researcher employed the LED prompt. This prompt asks potential participants to describe a time that they engaged with making and doing. By evaluating the LED prompt through the lens of Situated Expectancy Value theory (SEVT), the researcher was able to analyze the prompt for evidence of student persistence, student choice of engagement over other valued alternative activities, and a desire for performance in the LEDs. These were chosen as they are considered motivated achievement behaviors in EVT (Eccles et al., 1983). If any of the three achievement behaviors were found in the LED response the potential participant is considered motivated to make and do and will be invited for full participation in the study.

As a means of collecting phenomenological data, semi-structured interviews were employed. The researcher, following the structure put forth by Seidman (2006), conducted two, forty-five-minute interviews. The first interview focused on contextualizing the participant with regards to making and doing and apprehending the phenomenon wherein questions are asked to gain access to the pre-reflective experiences of the participants. Between interviews the first interview is transcribed and analyzed for follow up questions. These questions form the first half of the second interview followed by meaning making questions that allow the participant to reflect and interpret their experiences.

Data Analysis

During the data analysis phase, the researcher must commit to a whole-part-whole perspective (Vagle, 2018; Patton, 2015; van Manen, 2016). To fulfill this, the researcher looks to Vagle (2018) for guidelines for analysis. The process begins with a holistic reading of the text without any analysis followed by a line by line reading where the researcher journals their

thoughts as they analyze. At this point the researcher will begin to code the data and remove the codes to a new document for each interview. A line by line reading of the new document takes place with further journaling. During the journaling processes the researcher returns to a larger perspective about the whole of the data and then returns to the individual interview to consider how what is seen interacts with what has been seen. This process is a part of applying the whole, part, whole methodology to the analysis.

After all data have been analyzed a document is created with individual reports of themes found in individual interviews and is sent out to the participant for member checking. These themes are either confirmed by the participants or further discussion takes place about the theme between the participant and the researcher. If after further discussion the theme is confirmed the member checking is complete. If the participant and researcher cannot come to a consensus about the theme, the disagreement is noted and will be addressed in the final report of the study. Once member checking is complete the researcher will read through interviews and themes once again searching for broad categories. Prior to generating the final description of the phenomenon, the researcher will conduct a peer review exercise to assure that the categories created align with participant intent. Finally, these final categories will be used to create textural and structural descriptions of the phenomenon (Creswell and Poth, 2018).

Validity & Credibility

Creswell and Poth (2018) outline several methods to increase the validity of qualitative research. In the context of the current study, six such methods are employed. They are discovering negative case analysis or disconfirming evidence, engaging in reflexivity, member checking, prolonged engagement and persistent observation in the field, generating thick descriptions, and engaging in peer review. As a means of establishing credibility the researcher will seek out “alternative themes, divergent patterns, and rival explanations” (Patton, 2015, p. 945) while journaling and creating themes and categories.

Ethical Considerations

Peoples (2021) discusses the considerations that should be made regarding who receives the benefits, the costs, and any reciprocity that should be given for the participants time and effort. In the current study the researcher, the T&E profession, and future students who are positively impacted by the information discovered in the study are the benefactors of the research. The cost of the research falls largely on the participants and is seen most readily in the time commitment they make to engage with the study. There is no direct reciprocity given to the participants except for the six hours a week the researcher volunteers to run the open lab sessions that students use to work on projects for the MPT course.

A unique aspect of the current study is the dual role that the researcher plays at the sampling site. The researcher is not only the primary investigator of the study, but he is also an authority figure at the site. This authority role creates a power dynamic that must be addressed by the researcher to maintain participant trust and to not influence the data that the participants give. To address this the researcher consistently and clearly affirms to the participant before,

during, and after participation in the study that their involvement in the study will have no academic impact on participant in the MPT course. The researcher also affirms to the participant that he will not discuss the ongoing research with their MPT course instructor so as not to introduce bias into their management and assessment of the course.

Limitations

The primary limitation of the current study is related to the sample. Participants choose to participate in the study and because of the power dynamic the researcher has with participants there is no reciprocity offered. This, and the requisite criteria of being motivated to make and do, impacts the number of potential participants that the study can attract. This impacts the ability of the researcher to control the sample in such a way to be more representative of the population or to emphasize a diversity of perspectives. This limits the diversity of perspectives that make up the data set and ultimately narrows the findings of the study. Additionally, the population represents one course at one university in the United States. There is a wide variety of perspectives on T&E, making and doing, and a litany of content areas within the discipline. This too limits the range of perspectives captured in the study.

Future Directions

The researcher views the current study as the first steps in a research agenda that will cover a wide variety of areas in the area of motivation towards making and doing. One direction the researcher will explore is motivation to make and do in other T&E content areas. The MPT course was chosen as it is the most direct example of making and doing, however many other content areas in the discipline use making and doing and can provide additional insights into student motivation towards making and doing. The researcher would also like to expand into different models of T&E and how they impact student motivation to make and do. To address the weakness of the current study, the researcher would like to determine ways to gather a more representative and diverse sample of participants. Finally, the researcher is currently designing an exploratory sequential mixed methods study. The current study would serve as the initial qualitative phase of the study and would be followed by a quantitative phase that would aim to investigate the generalizability of the findings of the qualitative phase.

Conclusion

Starting in the mid 1980's the T&E profession has had the aim of technological literacy for all (Lauda, 1986). The profession has not yet achieved its goal and there is a continued lack of technological literacy in the United States (Dyrenfurth et al., 1981; Bybee, 2000; Krupczak et al., 2012; Change the Equation, 2016). After a thorough review of the literature, the researcher found that there is an area for growth regarding what is known about student motivation towards making and doing. Given the issue of technological literacy, the knowledge gap, the central role that making and doing plays in T&E (ITEEA, 2020), and the impact motivation can academic achievement, the researcher designed a qualitative study address the lack of technological literacy through student motivation to make and do. The current study employs a hermeneutic phenomenological design that collects data through semi-structured interviews to create a description of what it is like to be motivated towards making and doing. The themes from this

study can be used to augment in-classroom practice and curriculums to boost their motivational nature and in the process aiding in academic achievement and the development of technological literacy.

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