Maker-Based Learning

Beyond “Arts & Crafts”

Understanding the real-world perceptions of

K-12 educators towards maker-centered learning

Diffusion & Adoption of Learning Technology Innovations

LT 8200

Case Study Paper

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Introduction

The Learning Environment

For my hypothetical case study, I wanted to focus on the instructors teaching style and how they leverage or do not leverage maker-centered learning practices rather than focusing on just the student outcomes. There have been several studies on the effects of maker-centered learning, which is a student-centered approach, however there are not many that have attempted to understand the teacher mindset when introducing instructors to making. One of those limited studies was conducted by W. Monty Jones. In *Teachers' perceptions of a maker-centered professional development experience: a multiple case study* Jones tasked educators’ perceptions of maker-centered learning after immersing them in an 8-week professional development learning experience at a local commercial makerspace. In the design of this case study the participants were encouraged to take part in maker related activities and projects to foster development of their own maker-mindset. “[Dougherty] suggests makers possess a certain mindset, one that is critical to integrating making in educational contexts. This idea is echoed by Clapp et al. (2017) who note, ‘Cultivating maker empowerment is not just a student outcome; it is important for educators to feel maker-empowered as well’ (p. 163).” (Jones, 2021) That is an important element that I would like to also include in my case study.

At the heart of this research will be the search to identify the adult learner element and what factors are needed to support their learning and adoption of maker-centered learning. There are few studies that focus on specifically adult learners in the maker-centered and student-centered approaches. The few articles I found pointed to

an element that, if missing, makes it increasingly less likely that an instructor would adopt either approach. Jones wrote, “they suggest teachers must be knowledgeable of appropriate subject matter and pedagogical practices, experienced with specific materials and equipment, and be able to implement unfamiliar curriculum and address unanticipated problems.” (Jones, 2021) Charles R. Nuckles in *Student-centered teaching: Making it work* similarly wrote “A high-level of content mastery allows for the possibility that you will be able to accomplish the subject matter objectives and also be student-centered to learners, including individualizing instruction. As Knox (1986) says, ‘a very proficient instructor may be able to respond to unanticipated questions and directions of inquiry and to encourage learners to pursue their varied interests related to the content’ (Knox, 1986, p. 42).” (Nuckles, 2000) In both maker-centered and student-centered approaches instructors are not supposed to be the primary source of knowledge but rather a guide to knowledge. It is in fact encouraged, especially in maker-centered learning, to say “I don’t know.” This is part of the growth mindset that helps students in these approaches to become life-long learners. In my hypothetical case study, I would look at ways to evaluate this type of thinking. My hypothesis would be that this type of thinking stems from the conditioning of standardized testing and its harmful influences on teaching it takes to implement. “They note standardized testing often forces educators into standardized practices and scripted curriculum, leaving little time for innovative teaching practices such as maker-centered learning.” (Jones, 2021)

The Need

As an instructional designer that introduces experiential learning to instructors from multiple disciplines, I have seen a wide range of teacher acceptance for the maker-

centered approach. One of the common problems I have heard is that instructors do not have time to learn a new teaching style on top of all the extra things they are already tasked to do. An observation I have also noticed is that when the instructors do receive training it is short, information packed, and there is nothing to continue reenforcing or to support their learning after. Educators typically get this training through a conference or a one-time online training. Additionally, according to Jones, little research exists on the perceptions that teachers have while participating in authentic making activities, so it is difficult to assess the feelings that a teacher may have towards maker-centered adoption.

The Targeted Audience

The target audience for this educator training will be open to all private and public K-12 instructors and administrative staff that work with students directly. It is important for this case study to evaluate the range of positions of influence. Typically, there are better rates of adoption in private institutions where new and more effective practices are encouraged. One of the goals of this study is to discover what factors may exist that would cause learning practices to either be adopted or not by comparing educators and decision makers from different backgrounds and types of institutions.

Innovation

Description of the Learning Technology

My teaching curriculum is not necessarily revolutionary in its innovation. However, it is a call to commit to the practices that we ourselves, as educators, do with our students. It is my theory that not enough time is given for adult learners to practice new skills and behavior and that is the essential element that is missing in maker-

centered learning adoption. The curriculum that I want to build would scaffold their knowledge in smaller microlessons over a longer duration of the school year. Additionally, the information that will be taught focuses on them as an instructor and their teaching methods. Maker-centered teaching may not always have easily measurable results to that of other teaching methods. Instructors will be taught the methods and ways to adapt grading rubrics to show other indicators of learning.

The design of this curriculum will adapt to the very real needs of educators and their mindset as adult learners. Jones recommends considering elements of the andragogical model. “This model provides six assumptions about adult learners:

- Adults need to know why they need to know something.
- Adults need to be treated as being capable of self-direction.
- Adults' experiences should be considered in designing learning activities.
- Adults are ready to learn things that apply to their current life.
- Adults are life-centered in their orientation to learning.
- Adults are often more internally motivated to learn than externally.”

(Jones, 2021)

Andragogy as a whole has little empirical support comparatively to pedagogical research. This is an additional hurdle in a case study regarding maker-centered learning which has even fewer formal studies to draw from.

Additionally, the maker mindset is an ethos of learning and teaching. Maker-centered learning is not a singular event nor simply inputting “craft-related” projects into curriculum. If the making being included is still being taught with a teacher-centered approach it would not be in alignment with maker-centered practices. “Dougherty (2016)

notes: Project-based learning can be aligned with making, but there’s an important difference. If students are doing a hands-on project at the direction of a teacher, often to support a curricular goal, it is not a maker project. If the things students make have no personal value to them, even if it is physical, it is not a maker project. (p. 176)” (Jones, 2021) The reason for this distinction is because it will greatly affect the outcomes of student learning. The purpose of maker-centered learning is to cultivate a practice of life-long learning where students take initiative in their own education. They are encouraged to teach one another to reenforce their own learning and build their critical thinking. Maker-centered learning also creates an understanding environment where students can freely ask questions without fear of reproach. In response to the need to develop this understanding in educators, Agency *by* Design has created a micro practicum that teaches educators how to develop a student’s agency and sensitivity to design. Agency *by* Design is a multi-year research initiative by Project Zero from Harvard Graduate School of Education “to investigate the promises, practices, and pedagogies of maker-centered learning. Through this work [they] have identified maker empowerment—a sensitivity to the designed dimensions of objects and systems, along with the inclination and capacity to shape one’s world through building, tinkering, re/designing, or hacking— as a key outcome of maker-centered learning experiences.” (Zero, n.d.)

Intended Outcome

It is intended that the outcome of adoption be long-term. Success would be a changed educator mindset and behavior in teaching methods. Partial adoption is welcomed as it is as the purpose of this curriculum to offer continued support as the

educator grows in their own learning. Because this is such a shift in mindset to traditional teaching approaches, lower rates of adoption are expected. In Jones’ findings, “37% of the participants in this study articulated they had experienced a shift in their mindset.” (Jones, 2021) This change in mindset would also include increased empathy towards the educator’s student learners as they observe their own resilience when creating and building their projects. The maker-centered mindset encourages introspection, as it did with most of the Jones’ study participants. “Anna, throughout the experience expressed feelings that she was alone in her struggles to master certain maker technologies, and related this to her own students in saying, ‘Ok, so this is how they feel when they don't know something and everyone else does. So, that was enlightening and a reminder.’” (Jones, 2021)

Potential Barriers

Generally, the findings show that if an educator has negative control believes towards maker-centered learning then an educator will not adopt the teaching practices. “..Noting these types of activities may not align with specific content areas and grade levels, may be difficult for some students due to the lack of structure, and require excessive time.” (Jones, 2021) Additionally, Jones remarked on another article which asserted that there are three critical aspects that control teaching design to K-12 students. This includes the “(a) ability to navigate a complex design process, (b) managing digital and analog design materials, and (c) balancing different modes of teaching.” (Jones, 2021)

Potential Enablers

The addition to include administrators or other decision makers, who may be considered the change agents within the organization, is something that may not typically be included in teaching curriculum. In developing and growing successful makerspaces, either within schools or independent away from formal education, there is always a few maker champions that help to drive the direction of the space. It is essential in building a makerspace environment to have someone who knows more and teaches the others. This can be teachers, administration, or even student groups. The important aspect to the sustainability of the maker environment is that multiple partners are involved and there is no one single expert or point of contact. Doing otherwise creates a central point of failure and prevents the maker environment from thriving organically. Maker environments are dependent on a community spirit.

Strategies for Adoption

Many strategies are being built into the maker-centered learning curriculum for educators that will increase eventual adoption. This includes building a continued support ecosystem within the school and through the course, as well as longer learning sessions with microlearning. In my own experience working with educators, I have found that they biggest hinderance to adopting maker-centered learning into curriculum was the lack of experience in integrating or understanding how to incorporate these kinds of activities. “Stevenson et al. (in press) noted that after a phase of situated professional learning, in which their study participants implemented maker-centered learning activities in their classrooms, participants' enthusiasm increased. They noted that participants were able to overcome pre-implementation concerns with collegial support, and experienced greater confidence in implementing these types of learning

activities.” (Jones, 2021) Giving educators more time to learn how to leverage maker-centered teaching in their respective disciplines and teaching them the ways to adapt their new skills for future use is vital for the success of adoption.

Methods

The method of assessing success will be a combination of collected surveys and one-on-one interviews looking for the indicators of maker-centered mindset. A similar model for pattern codes will be adapted from the Jones study for collecting data.

Table 4 Pattern codes for participants’ mindset changes

First level codes	Pattern code
agency	Self-efficacy (I can make)
“excited”	Interest (I like to make)
“Fail” B: experiencing failure is important	Failure positive
It was challenging Learning curve	Resilience
Personal growth	Growth oriented
Working with colleagues Working with others	Collaborative
“Proud” “excited”	Motivation/positive towards making (I want to make)

Conclusion

Maker-centered learning is still a relatively new approach in teaching and learning. It is the hope of this new curriculum and (hypothetical) case study that more educators come around to adopting its principles. Not only for the success of their students but for the growth of the educators as well. The teaching practices of making have over the years gained attention of many educators, however not many have taken the time to understand or implement it into practice. This new curriculum with its focus on the educators as adult learners will hopefully change that, and, in the future, maker-centered learning will become the standard practice.

Works Cited

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