EDTC 809 Project 2: Qualitative Research and Assessment

Exploring Library-based Makerspaces as Nonformal Education in a Formal Venue

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Background of the Study: The Problem

Library-based Makerspaces are one of the fastest growing educational trends (Bell, 2015). A renewed commitment to Science, Technology, Engineering and Math (STEM) education, national focus on skills for the 21st Century workplace, and a broadening interest in Maker Education have converged into a push to bring Makerspaces into the school building. In an era of easy access to digital resources, school libraries are reinventing themselves and have emerged as the ideal venue for Makerspaces by virtue of available space and personnel (Burke, 2014).

A 2013 survey by the Maker Education Initiative identified 20 school-based Maker Spaces. Although more up-to-date statistics are not currently available, this researcher is aware of at least three school-based Makerspaces that have been inaugurated in this locale since 2014. It is reasonable to project that the number of Makerspaces has risen into triple digits.

As happens with many educational innovations, school-based Makerspace implementation has outpaced planning and evaluation. There is a dearth of research assessing best practice and highlighting models that work. The Center for Innovative Research in Cyber Learning (CIRCL) is currently engaged in National Science Foundation funded research studying and designing Makerspaces ([Halverson & Sheraton, 2015](http://www.nsf.gov/awardsearch/showAward?AWD_ID=1216994)). This study, however is not specific to school-based Makerspaces, neither has this researcher found any record of one underway.

Need and Value

In the absence of research, best practice may never be disseminated and poor practice may continue without the benefit of comparable instances for assessment. Peters-Burton, Lynch, Behrend, and Means (2014) suggest that new initiatives, like Makerspaces, should be examined for student outcomes, systemic impact, and even unintended consequences. Studies that “descriptive information” from a number of different schools that have implemented Makerspaces can be of benefit to institutions considering the addition of a Makerspace (p. 69).

Every new curriculum or educational program can benefit from study, but in the case of school-based Makerspaces, the need is even more critical. There is an immediate tension between the philosophy of Maker Education, as expressed in Makerspaces, and the formal educational goals of most public school settings. Makerspaces are intended to be venues for nonformal education that is student-driven, constructionist (Papert, 1991), and innovative.

Logically, a school-based Makerspace should function as an educational disruptor in a formal setting, but the results can only be determined through study and observation. This paper proposes a qualitative study of library-based Makerspaces that would be exploratory, ideally laying the groundwork for future study.

Research Questions:

1. To what degree does the school-library situated Makerspaces exhibit fidelity to the philosophy of Maker Education?

2. To what degree is the activity in the school-library Makerspace structured and assessed by the same standards as classroom activity?

3. To what degree does student activity in the Makerspace influence classroom learning or activity in the classroom influence what happens in the Makerspace? What is the actual interplay between learning in the Makerspace and the classroom?

Outline of Relevant Literature

**Definition of Educational Makerspace.** Martinez and Stager (2013) describe the theoretical foundations of Makerspaces in progressive education and the influence of Seymour Papert’s (1991) philosophy of constructionism. In part one of a how-to create an Educational Makerspace series for librarians, Kurti, Kurti, and Fleming, (2014) define Makerspaces as inquiry-driven, student-centered, and collaboration-fueled. In their view, Maker Education is a reaction to one-size-fits-all education that focuses on the individuality of the learner.

**Formal vs. Nonformal Learning.** Eshach (2007) provides the working definitions for formal and nonformal learning that will be applied in this study. He sees “motivation, interest, social context, and assessment” as differentiating factors, in addition to structure (p.174). Resnick’s (1987) study was referenced in a number of articles examined here. In this study cognition and tool manipulation are added as a means of differentiating between types of learning environments.

**Student Experience Within the Makerspace.** Bowler (2014) identifies design thinking as pivotal the Makerspace, where innovation is born from “open-ended, nonlinear, and often messy” exploration (p. 59). Gross and Do (2009) suggest that the design process begins with student identifying a specific problem, and then playfully experimenting with solutions until a feasible design emerges. Loertscher, Preddy, and Derry (2013) introduce the *uTEC Maker Model*, describing the student maker experience as a progression from using tools to make standard products (using), to modifying products (Tinkering), to developing a new product through trial and error (Experimenting), and finally, successfully producing a unique product (Creating) (p.49).

**Teacher/Librarian Within the Makerspace.** According to Moorefield-Lang (2015) Makerspaces are a survival mechanism for libraries in an increasingly digitized world. A survey of twelve librarians showed that few had received any formal training in preparation for this new responsibility. Lewis and Loertscher (2014) identify the ways in which the adoption of Common Core State Standards offers opportunities for the school librarian to work closely with classroom teachers. One of the recommended initiatives is a library Makerspace to foster “creativity, innovation, play, building, and experimentation” (p. 50).

**Makerspace Assessment.** Loertscher (2014) offers a list of “developing dispositions” that might be observed in the student as a result of participation in the Makerspace (p. 36). He does not offer them as a formal tool for assessment, but as a guide for reflection and discussion between student and teacher. Peters-Burton, Lynch, Behrend, and Means (2014) identify ten key components that must be present for inclusive STEM programs, such as Makerspaces. They recommend that in both design and implementation, the school needs to be mindful of physical and learning needs of all students. Study and documentation of successful programs, they conclude, will help to propagate effective models. Barker, B., Nugent, G., & Grandgenett, N. (2014) address the question of “fidelity of implementation” or “the degree to which educators implement a program as intended” (p. 40). Although, the studies described here overlap somewhat with potential Makerspace content (Geo-spacial Technology and Robotics), the structures for learning are much more formal. Martinez and Stager (2013) recommend a master-based rubric as the best tool for assessment. Yokana (2015) provides an example of a Maker Education rubric.

Methodology

As a qualitative study, the goal of this research is to develop an understanding of how library-based Makerspaces function as nonformal educational programs within the formal educational framework of the public school (Sargeant, 2012). Merriam, (1998) describes ethnographic studies as those used to collect data about “the social order, setting, or situation being investigated” (p. 14). The method used in this research will be ethnographic, as it primarily seeks to gather information about the culture and function of library-based Makerspaces within three public middle schools.

Reiter (2013) observes that exploratory research is more demanding of the researcher in terms of preparation and time-investment, but it is generally more cost-effective and can be accomplished by one person. In the view of this researcher, the flexibility and convenience of implementing the study without a team are advantageous. Creswell (2009) describes an inductive process for qualitative that is well suited to this project. The researcher moves from information gathering, to analysis, and then finally arrives at point where theories and hypotheses can be generated. Given the current dearth of research about Maker Education, and specifically about Makerspaces in schools, it is logical that the most beneficial first steps would be to to use ethnographic data to create theories that can be tested in further research.

Population Sample

The sample selection for this study will be non-probability, purposive sampling. Merriam (1998) indicates that purposive sampling is used in qualitative research when a particularly “*information-rich*” phenomenon is to be studied. The three schools to be studied can be seen as a typical sample as all three represent public middle schools located within a limited geographic area.

Each school sample contains several subsets of participants in this research, including the principal, librarians, teachers, and students. The school population will be approached as a stratified sample with separate instruments used for collecting data from each.

Collection Instruments

Bowen (2005) recommends that the credibility of a qualitative study increases when multiple instruments are used and data can be “triangulated” (p.215). This study will be conducted using non-participant observation of the activity within the Makerspaces, interviews for the librarians, and surveys for the classroom teachers, students

In a cautionary note Reiter (2013) suggests that the ethnographic researcher needs to be cognizant of his own “situatedness”, which he enumerates as “preconceived ideas, notions, categories, explanatory models, and theories” (p.9). Hence the greatest potential hazard in ethnographic research is the researcher himself. The researcher must address the study as a blank slate and must maintain impartiality.

Using school-based Makerspaces requires the completion of an IRB from both the governing school district and the university. Further, permission must be requested from the principal to study the Makerspace, conduct interviews, and deploy surveys. Student participation also depends upon the receipt of parent permission. The researcher will need to enlist the assistance of the principal or his delegate to facilitate communication with the faculty, students, and parents. Marshall and Rossman (2011) identify a number of potential weaknesses in ethnographic interview, including the need for consistent and honest cooperation from the participants. As well, the interviewer needs to construct effective questions and to be able to understand the answers he receives.

Observation

Observation codes to be used in data collection will be derived from the uTEC Model presented by Loertscher, Preddy, and Derry (2013). Each of the following would be indicative of the presence of Maker Education:

* “Using”: using tools to recreate a standard product
* “Tinkering”: modifying or customizing a standard product
* “Experimenting”: developing something new through trial and error
* “Creating”: producing a working model of something new (p. 49).

Interviews

The questions to be used in the librarian interviews will be based on those used by Moorefield-Lang (2005) in her study of Makerspaces in public libraries. Selected examples would be:

1. How long have you had a Makerspace in this library?
2. What type of planning or preparation took place before the Makerspace opened? Who was involved in the planning?
3. What are the responsibilities that you and/or your staff currently have with regard to the Makerspace and its activities?
4. What considerations determine the types of materials and activities that are available in the Makerspace?
5. What would you describe as indicators of the success of this program?

Student and Teacher Surveys

The goals of the student survey will be to gather information on the level of and motivations for their participation in the Makerspace and their feelings about its relevance to school. The goals of the teacher surveys will be to gather information on the teachers’ level of knowledge about the Makerspace, the degree of their involvement in its development and implementation, and their perceptions about its impact on student motivation and performance.

Timetable

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Element** | **Month 1** | **Month 2** | **Month 3** | **Month 4** |
| Preparation and vetting of surveys & interview instruments | x |  |  |  |
| Written communication & meeting follow-up with principals | x |  |  |  |
| Written communication & telephone follow-up with librarians to schedule observations and interview | x |  |  |  |
| One week at each school to conduct observations, interviews, and administer surveys |  | x |  |  |
| Data organization & analysis |  | x | x |  |
| Research additional literature |  |  | x | x |
| Write-up results for publication |  |  |  | x |

Note: The acceptance of IRBs in the school district and the university will predate the preceding timeline.

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