Visual Embedded Assessment: Fostering the Development of Critical Dispositions in Maker Education

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August 15, 2023

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This paper focuses on the results of a 4-month long design-based field study exploring ways to capture, synthesize, communicate, support, and develop educational practices for Applied Design Skills and Technology (ADST). Together a Grade 5/6 classroom teacher and a group of researchers co-designed, co-enacted, and co-reflected on educational practices through an iterative process of designing, developing, implementing, and analyzing assessment tools to help develop generalizable theories of learning, assessment, and design principles for ADST. The results of the study show that involving students in the assessment process helps foster the development of critical dispositions necessary for success in the twenty-first century.

Keywords and Phrases: Constructionism, School-Based Making, Embedded Assessment, Interdisciplinary Approach

1. DESCRIPTION

1.1. DESCRIPTION OF SETTING

This design-based research took place in my Grade 5/6 classroom at École Aubrey Elementary located in Burnaby, British Columbia, Canada. École Aubrey Elementary is a dual track (French Immersion and English) public school with about 385 students. The school is rich with ethnic and cultural diversity, different languages, backgrounds, experiences, and needs. In my class, there are twenty-four students and one full-time Educational Assistant (EA). My class consists of a diverse group of learners with different proficiency levels and learning needs. In the class, 25% of students have special needs (autism spectrum disorder, hearing loss, dyslexia, attention deficit hyperactivity disorder, and mental illness) requiring additional support, and Individual Education Plans (IEP) to enable them to access and participate in educational programs, and 42% of the students are English Language Learners (ELL) with varying degrees of English acquisition requiring additional language supports, small group instruction, and special considerations. Generally speaking, the students come from supportive homes and are engaged learners who feel a sense of belonging and connection to their school and community.

My rationale for this field study was to gain a better understanding of my assessment practices and determine if my assessment methodology supported learning in meaningful ways, helping students become more self-directed learners as they engage with the Applied Design Skills and Technology (ADST) curriculum. My goal was to uncover which skills and capacities are relevant to assess in ADST and develop embedded assessment practices that would elicit further skill development and improve the learning outcomes for those I teach. I also wanted to learn effective ways to put students at the center of their learning and the assessment process. In order to explore strategies to meet these goals, I collected a variety of data (student assessment surveys, photos, transcribed audio recordings of interviews with students, video recordings, observational notes, self-assessments, samples of student work, artifacts, educator assessments, and educator/researcher reflections). In collaboration with the researchers, I completed a descriptive statistical analysis on the survey results and conducted a close reading of all the data to identify emerging patterns to see how I could use the findings to enhance my teaching, assessment practices, and the learning taking place in my classroom. This study forced me to analyze if my pedagogical approach and embedded assessment practices were increasing student assessment literacy and leading to increased student voice, agency, participation, and more meaningful learning and growth. This not only helped me

improve my practice but also helped the research team and I develop generalizable theories of learning, assessment, and design principles for ADST.

1.2. DESCRIPTION OF THE EDUCATIONAL EXPERIENCE

My initial approach to assessment of ADST involved a variety of formative and summative assessments (Black & Wiliam, 1998). My formative assessments included a combination of observation, observational notes, mini conferences with students, class discussions, surveys, exit slips, written reflections, checklists, rubrics, digital portfolios, and self and peer evaluations. As I began to evaluate the collected evidence of learning, I noticed the assessments were relying heavily on observational notes and student written reflections, which I realized was not inclusive for all learners, and did not take into account the language barriers and challenges many of my students have with writing. Additionally, the assessments did not yield reliable results, were time-consuming, interrupted the flow of learning, took away valuable time from making, and were preventing me from providing consistent and frequent feedback in the moment to guide learning. My summative assessments also tended to evaluate artifacts, final projects, and presentations, relying heavily on rubrics.

The more I reflected on the data the more evident it became that I needed to develop new forms of assessment to evaluate the learning that was occurring during these school-based making sessions. I needed to find a new way to embed formative assessments within ADST. This new method of assessment needed to be flexible, accessible, inclusive, authentic, and consistent for all learners. It also needed to help students develop agency, provide richer evidence of their learning, and not disrupt the learning process (Black & Wiliam, 1998).

A backward design framework for my curricular planning allowed me to think purposefully about what assessment evidence the students and I needed to collect to validate whether or not they were achieving the targeted learning outcomes (Wiggins & McTighe, 2008). To encourage students to become agents of their own learning, I opted to explicitly teach and employ visual journaling to help students collect evidence of their own learning, using the embedded assessment framework (Kim, et al., 2020). Instead of daily written reflections, students began collecting photos and video evidence of their learning with the help of the teachers taking and printing their photos. Students then used stickers to identify dispositions and skills they were using throughout the making process. The students used the visual timelines they constructed to reflect on their learning process after the activity, exchanging peer feedback while also documenting and reflecting on the process in their digital portfolios. As they gained more independence with visual journaling, they learned to transfer these skills to other contexts and were more independent with creating their own labels to identify skills and dispositions. Visually documenting their learning allowed them to think about and understand their learning making the learning experience more constructionist (Clayson, 2018).

Figure 1: (Top left) Photo prop to signal to teachers they are ready to take photos. (Bottom left) Capacity and skill stickers. (Right) Student's visual assessment board.

2. CONCLUSION

2.1. RESULTS

The data collected from student assessment surveys and interviews revealed that students preferred the visual journaling method of collecting evidence of their learning (43.48%), or a combination of visual journaling with written reflections (39.13%), more than mere written reflections (17.39%). This form of self-assessment, also appeared to be more flexible and accessible to everyone. For example, my international students who struggle to communicate orally and in writing were able to successfully visually document and name the capacities and skills they were using in ADST. In addition, visual journaling made it easier for students to analyze the evidence and outline their strengths and areas for improvement in a visual and written format at the end of the task. This seemed to encouraged them to be more intentional in selecting evidence of their learning and the making process, reflecting on the skills they were using on a deeper level. It also allowed me to conduct more frequent check-ins and have more meaningful conversations with them about their learning. Moreover, this approach was less time consuming because students had been explicitly taught how to self-assess and had knowledge of the tools they needed to complete their own self-assessments. It allowed me to place students at the center of the assessment process helping them develop a shared understanding of the goals and strategies for collecting, interpreting, and communicating their learning. Based on the analysis of the data this approach appears to be inclusive, authentic, and consistent for all learners. As a result, the assessment helped many learners develop agency, supported their growth, and prevented the need for constant support and attention from me. This taught me that it is not only important to consider the type of assessment we give students, but the timing and frequency at which the assessment occurs if it is to yield meaningful results. These visual capacities and skills-based assessments helped me address the challenges I initially had with collecting evidence of learning, overseeing, the making process, and providing consistent and frequent feedback to direct their learning. They also allowed students to find, interpret, evaluate, use, and create visual narratives to communicate their learning beyond mere written self-reflections. Furthermore, I was able to triangulate the data from embedded assessments (student visual self-assessments, student's written reflections, and teacher observations) over time to form a strong evidentiary argument about each student's growth for my summative assessment. All of these changes in my assessment practices allowed me to develop an interdisciplinary assessment approach, which set my students up for success and led to positive learning outcomes. It also inspired my colleagues to test out and adopt similar approaches.

2.2. BROADER VALUE

This field study showed that making supports students' development of dispositions (autonomy, problem-solving, sense making, failure-positive mindset) beyond content and skills. As learners engaged in creative expression and exploration throughout the making process, they were learning to co-construct their understanding of the world through objects and artifacts. As described in Papert's constructionist learning theory, the tangible artifacts became "objects-to-think-with," supporting and transforming one's thinking. Through tinkering learners were able to make connections and develop analytical processes to construct their own knowledge and were not just passive recipients of information. Through making, they were able to extend their own learning, while also developing critical skills, abilities, and learning dispositions that are required for success in the twenty-first century (Holbert, et al.,2020).

The study highlighted that students need to be given criteria, open-ended prompts, and various pathways for expressing their ideas and showcasing their learning because making projects rarely have a single path to completion. It also indicated that if we do not involve students in the assessment process, it can actually hinder and limit the quality of evidence obtained. Much of the learning that takes place in the ADST curriculum involves

skills (ex: agency, problem-solving, risk-taking, reflective thinking, collaboration) that cannot be measured using conventional assessment approaches. By using an embedded assessment framework, I was able to monitor and support learning within the lesson without interrupting the flow of learning. I discovered it is possible to involve students in the assessment process and they are capable of critically reflecting and assessing their own work.

In addition, the study revealed that visual journaling not only helped students develop agency over their learning but also helped them see how many of the dispositions and skills they were applying were actually transferrable skills that are important in many subject areas. This was consistent with Strickland (2023) who points out that visual journaling can be used as a powerful tool to help students develop their metacognitive skills, giving them a way to make meaning and express themselves in other ways, other than text alone. He suggests that visual journaling is a reflective process and can be applied across all academic content and different contexts and that when students engage in visual journaling, they also develop important visual literacy skills, which are necessary in the current landscape of the twenty-first century, where the world we live in is saturated with images and visual media. Our study underscored that visual journaling is an invaluable tool for formative assessment that makes students' thinking and growth visible, leading to higher level learning (Richard & Church, 2020).

Lastly and most importantly, this study illustrated that it is possible for educators to collect meaningful evidence that highlights students learning and achievement over time during making by embedding formative assessment throughout the learning process, triangulating various types of formative assessment from different stakeholder views (students and teachers). Embedded visual assessment on capacities and construct-driven skills did not interrupt the flow of learning, allowing students to easily collect visual evidence of their learning to communicate what skills they are applying at different points throughout the open-ended learner-driven making process. This form of embedded assessment is also an interdisciplinary approach that can be used to help students develop critical transferrable dispositions and metacognitive skills they need to become autonomous learners.

3. BIO

Crystal Smith is a Grade 5/6 classroom teacher who teaches at École Aubrey Elementary in Burnaby, British Columbia, Canada. She has over 17 years of experience working with students from preschool through Grade 7 in the public and private sectors. She holds a Bachelor of Applied Arts (Child and Youth Study) Degree, from Mount Saint Vincent University in Halifax Nova Scotia, Canada; a Graduate Diploma of Education (Primary Education), from Edith Cowan University in Joondalup, Western Australia, Australia; and she is currently completing a Graduate Degree (Exploring Making: Art, Design and Technology in Education) at Simon Fraser University in Burnaby, British Columbia, Canada.

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