Texture, Buttons, Sound and Code: Modal Preference and the Formation of Expert Identities

Short Paper

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ABSTRACT

This paper examines a making project in a 9th grade English language arts (ELA) class through the lenses of multimodality and identity. Students retold popular picture books in a tactile form for an audience of children with visual impairments. They embedded audio in 3D printed pages using copper tape and Makey Makey boards that interacted with Scratch programs to play student-composed sound. Some students gravitated to certain modes and tools while designing their tactile books. As they developed expertise, they were recognized as resources within their groups and class. This study considers how giving students the opportunity to compose in multiple modes with a variety of tools during a collaborative design experience may offer opportunities for the development of expert identities.[1]

CCS CONCEPTS

• **Applied computing → Education**

• **Social and professional topics → Assistive technology**

KEYWORDS

Maker; Multimodality; Identity

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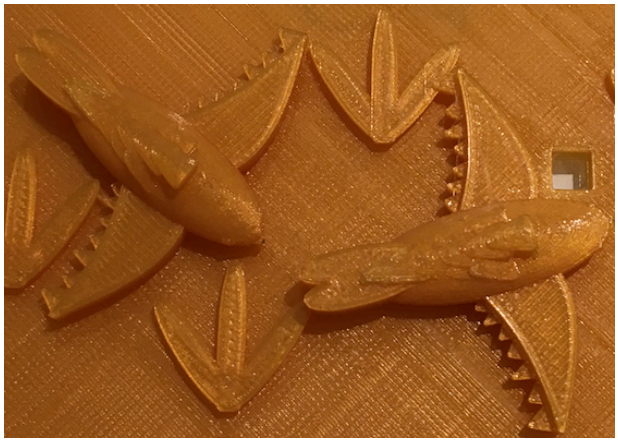

Figure 1: 9th grade student's tactile retelling of D. Flemming's picture book, "In the Small, Small Pond."

1 PURPOSE

Projects that involve multimodal composition tend to support a broader notion of literacy, and thereby potentially "invite" a broader range of students to develop expert identities in design, production, and team management [3].

Previous studies of multimodal composition have focused primarily on the production of texts that combine image and printed text. This study covers an expanded selection of semiotic resources, including tools ubiquitous in the Maker movement (e.g. TinkerCad, 3D printers, Makey Makeys, and Scratch), and tactile and sound modes.

These modes and tools offer affordances that make them appropriate for transmediating picture books into a form that better meets the needs of children with visual impairments [12].

A key question for this study is: How can the act of composing in a variety of modes with a variety of tools contribute to the development of students' expert identities in a collaborative tactile picture book composition project in a 9th grade English Language Arts class? In keeping with the theme of this conference, "creating a sustainable ecosystem for making in education," we suggest that a key element of sustainability is the adoption of making tools and practices by non-STEM educators. The considerable resources necessary for building and maintaining a maker space may be more easily justified to school administrators when an argument can be made for the value of the space to disciplines beyond STEM. This study contributes to this in two ways: demonstrating a potential "fit" by integrating making and multimodal composition in ELA; and offering theoretical insights by examining the process from a multimodal perspective.

2 THEORETICAL FRAMEWORK

For the purpose of this study we look at making in the classroom not as an engineering task or a design challenge, but as an act of composition or meaning making that may lead to the emergence of new identities. We draw primarily on two theoretical perspectives: A multimodal theory of literacy, and a sociocultural theory of identity.

2.1 Multimodal Theory of Literacy

A social semiotic theory of multimodality seeks to investigate meaning in a way that doesn't privilege verbal language over other meaning-making resources [8]. Language-centric notions of literacy are reinforced in schools even as other social institutions are actively recognizing the potential of other forms of communication [13]. The result is that literacy in school often does not resemble literacy in other contexts [9]. A multimodal theory of literacy allows us to examine making as a literacy event [1] that, one could argue, belongs in an ELA classroom alongside other forms of composition. Kress [8] notes that for both individual and cultural reasons, people seem to prefer to rely on different modes for certain types of communication. Smith's [10] mixed methods study of multimodal composition provides a clear view of how modal preference can influence the way students engage in an open-ended project. Other researchers have examined how mode and tools interact to mediate students' composing processes and products [3,10].

2.2 Sociocultural theory of identity.

School culture, curriculum and pedagogy all can contribute to the development of students' identities as learners [5,14]. A broad view a literacy, and giving students access to a wide selection of tools and modes of expression, can make available a larger set of positive identities for students [6]. Hull has shown how students take on expert identities through the act of multimodal storytelling [6]. We contend that giving students the freedom to engage in multimodal composition in a manner consistent with their modal preference may contribute to the development of positive academic identities, including mutually recognized expertise.

3 METHODS

3.1 Overview and design.

This study made use of the combined resources of two research projects: a study of project-based learning (PBL) in 9th grade ELA [2] and a study of tactile picture book making for visually impaired children by middle and high school students, primarily in library maker spaces [15]. We employed a formative design approach [4], iteratively designing sessions based on ongoing analysis and feedback.

3.2 Participants.

This study took place in a high school located in the Western USA. The school serves approximately 84% White and 14% LatinX students, with 16% eligible for free or reduced lunch. This 9th grade ELA class included 29 students who self-selected into 6 design teams. The analysis used data from 22 permissioned students, including three students who are the focus of this analysis.

3.3 Instructional experience.

3.3.1 Empathy building. To build awareness of individuals with visual impairments as agentive and accomplished, students watched videos, including an interview with the first blind person to climb Mt. Everest and a young child fluently reading Braille. They also had a class visit with a computer programmer who was visually impaired.

3.3.2 Tactile immersion. We used a series of immersive tactile experiences to help students better understand the needs of their end users. This included creating raised line drawings and clay sculptures while blindfolded, and trying to identify each other's creations by touch.

Figure 2: Copper tape button embedded in a crafted goat from a "Busy Spider" tactile page.

3.3.3 A circuit in a book. Students used copper tape, a Makey Makey board and a Scratch program to embed a sound button in a page from "Where the Wild Things Are," by Maurice Sendak. This exposed them to the technical challenge of adding sound, and the different types of sound that may be used to enhance a text.

3.3.4 Salient features and texture. We read "The Very Busy Spider," by Eric Carle as part of an ongoing discussion of "salient features" which must be emphasized in order for tactile art to be comprehensible. Students crafted tactile pages and embedded sound buttons (Fig. 2), this time working through the challenge of designing buttons that did not interfere with the shape and texture of their tactile art.

3.3.5 Tinkercad. After a tutorial, students designed objects by arranging, manipulating and joining polyhedrons. Most experimented with making animals.

3.3.6 Planning and designing the 3D pages. Each group reviewed their books and selected key pages to retell in 3D format. A detailed analysis of this is in process by Dalton and colleagues.

3.3.7 Copper tape buttons. Students designed sound buttons by applying copper tape to their 3D printed pages.

3.3.8 Sound design. Groups used a combination of recorded speech and downloaded sound effects to enhance their tactile pages. Sounds were loaded into a Scratch program template that would interact with a Makey Makey.

3.4 Data sources and analytic approach.

Student data sources included the team picture books, Tinkercad 3D design files, Scratch programs, storyboards, and presentations, and individual written reflections. Other data sources included field notes, session materials, photos, and classroom video.

Three students who emerged as experts in their design groups are the focus of this analysis. Carter, Carlotta and April (pseudonyms), took on expert identities, recognized by themselves and peers. These identities were connected to their facility with 3D design, designing sound buttons, and creating a Scratch program, respectively. For these three students, we reviewed multiple data sources, focusing on evidence of the development of expert identity.

4 FINDINGS

Our data suggest that the three focal students gravitated to certain modes and tools in designing their tactile books. The project design allowed for expertise to emerge along lines of interest and skills, rather than through assigned roles. Operating through their mode/tools of choice, the three focal students pursued and achieved design solutions which they shared with peers, helping to increase the general quality of work across the class. They subsequently became identified, by themselves and by peers, as experts with those modes and tools.

4.1 Three students stood out as "mode-tool experts"

4.1.1 Carter. Carter, who had no prior experience with 3D printing, worked with a group retelling "In the Small Small Pond," by Denise Flemming. The original text uses colorful, impressionistic illustrations to represent setting. Carter recreated this setting in a tactile form by "submerging" parts of turtles, ducks and frogs so that the surface of the page itself was recognizable as the surface of the pond (Fig 3.).

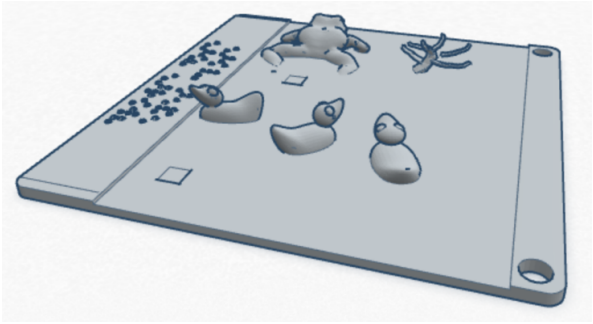

Figure 3: Carter's page showing frog, stick and ducks partially submerged in the surface of the "pond."

Carter's solution for representing setting demonstrates an awareness of both the requirements of his audience and the affordances of the tactile mode [12]. His groupmates mimicked this design when appropriate. Likewise, Carter and his group attended to the texture of objects (Fig. 1). Carter and his classmates identified him as a leader and an expert 3D designer, and frequently sought him out for assistance.

4.1.2 Carlotta. One of the primary technical challenges of this project was the design of the copper tape buttons. The copper tape did not reliably conduct electricity when folded around corners. Several students took great interest in this technical challenge, most notably Carlotta.

Figure 4: One of Carlotta's sound button tests.

She tried a series of tape configurations including using multiple layers and broader patches (Fig. 4). Several designs

worked better than the original, but were not, according to her, satisfactory. Finally, Carlotta tried placing the tape on the front of the tactile page instead of the back. This resulted in buttons that were close to 100% reliable. When she shared her design, Carlotta quickly became a consultant for all copper tape related issues in the class. Survey and interview data also indicated that she was seen as an expert and a leader by herself and her peers.

4.1.3 April. April took a week-long Scratch programming workshop when she was in middle school. She enjoyed it enough that, even though she had no subsequent exposure to programming, she is considering it as a career.

Adding sounds and modifying the Scratch program template proved to be one of the main sources of confusion in the project. For April's group, however, April and her Scratch program became the hub of all work flow. Students recorded speech in quiet corners of the library, found sound effects to accompany the speech, then brought their work to April for testing. She showed them how she converted file formats and uploaded sound clips to Scratch. She showed them how to properly connect the wires and cables. "OK, push the button," she would say quietly, then watch and listen to see if all the pieces were working together. If there was a problem, she would politely instruct her classmate on how to solve the problem. Similar to Carter and Carlotta, April's affinity for a certain mode (sound) and tool (Scratch) led to her taking on an expert role, as a well as a general leadership role within her group and class.

5 IMPLICATIONS

When printed text is the only mode of expression that we value in an ELA classroom we are not reflecting the sort of communication that is valuable in our everyday and professional lives [9,13]. The tools and modes commonly found in maker spaces represent semiotic resources that have an ever-growing place in a comprehensive definition of text [1,8]. From this perspective, puzzling with the best way to simulate the surface of a pond may be viewed as analogous to a poet puzzling over a perfect word, or a novelist trying out dozens of opening lines. But not all students are inclined to joyously play with words. Some are more likely to obsess over the best way to arrange a series of triangles to simulate the texture of a feather (Fig. 1). This too is an act of meaning making--a literacy event. Such acts may not be conventionally literary, but they are undoubtedly in service of a story.

Giving students the opportunity to engage in this sort of composition in English class, with the freedom to focus on the modes and tools they find most compelling, has the potential to make available a broader set of positive academic identities [6,7,11,13]. Students who have previously been cast as "reluctant writers" may, instead, become identified as expert composers and key contributors to group projects, fundamentally changing their relationship with English class. This should help contribute to the argument for why schools should invest in maker spaces as well as training teachers in all disciplines to take advantages of what maker spaces afford them and their students.

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