Designing for Generative Online Learning: A Situative Program of Research

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Abstract

This paper describes an interdisciplinary program of research on generative (i.e., readily transferable) online learning. This work expands upon the work of the late Randi Engle. We present *productive disciplinary engagement* and *expansive framing* as learning tools to understand and explain how students use their unique experiences and positioning to frame curricula and engage with content. Instructional designers and researchers alike should find this approach informative and potentially transformative.

Keywords: online learning, expansive framing, productive disciplinary engagement

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Education scholars have applied the theoretical concept of situativity (Greeno, 1997, 1998; Greeno & Engeström, 2014) to help explain and promote generative learning whereby learners develop meaningful connections between knowledge and experience that transfer to subsequent settings. Interest in fostering generative learning has a long history in education research (e.g., Wittrock, 1974; Fiorella & Mayer, 2016). The situative perspective argues that such learning occurs by engaging in disciplinary practices and discourse (Greeno, Collins, & Resnick, 1996). Many who embrace this perspective argue that generative learning is most likely when learners make connections between past and potential future contexts and consider how disciplinary practices have and could be used.

The Randi Engle proposed *productive disciplinary engagement* (Engle & Conant, 2002; Engle, 2012) and *expansive framing* (Engle, 2006; Engle, Lam, Meyer, & Nix, 2012) as pedagogical frameworks to foster generative learning. Both ideas have been studied extensively, mostly in conventional STEM classrooms. This paper presents an interdisciplinary research program that extends expansive framing and productive disciplinary engagement, into online contexts where many educators find generative learning elusive and where framing of learning is crucial. Instructional designers and researchers should find this approach informative for their research and practice. These two concepts approach knowing and learning from the learner's position (Lobato, 2012) as a starting point for understanding course content, promoting engagement, and supporting generative learning. The paper ends with a discussion of a study at a large Midwest university that applied productive disciplinary engagement and expansive framing to an undergraduate educational psychology course for pre-service teachers.

Framework

Productive disciplinary engagement. Engle and Conant's (2002) initial framework of productive disciplinary engagement is an approach that designers can use to create generative learning environments. The distinctions between *engagement*, *disciplinary engagement*, and *productive disciplinary engagement* were initially used to characterize generative learning. Engagement is understood by analyzing learners' participation, interactions, and responsiveness. Learner engagement can take many forms: contributions made in coordination rather than independently, few learners involved in unrelated "off-task" activities, attentiveness to one another, and emotional arguments (Engle, 2012). In an online environment, engagement can be responding/referencing peer entries, sharing/linking outside resources, and learners leading conversations,

For engagement to be disciplinary, activities should touch upon and work toward embodying the issues and practices of a discipline's discourse. While no one instructor or course constitutes a discipline, the ways of knowing and learning that generally make up a discipline should involve shared social, material and rhetorical practices (Ford & Foreman, 2006). When learners engage in these authentic practices, they are more likely to understand the core disciplinary ideas and concepts embedded in those practices and be able to use them in subsequent situations (Brown, Collins, & Duguid, 1989).

Finally, disciplinary engagement is considered productive when it continually advances the intellectual quality of learners' practices over time. Productivity depends on the discipline, task, topic, and the progression of the learners (Engle & Conant, 2002). Learners' practices should develop from *sharing* ideas to *comparing and evaluating*, and eventually *challenging and synthesizing*. This progressive evolution should transition learners from basic participation

toward advancing their ability to generate new arguments, new questions, and new ways of engaging with content.

The initial naturalistic characterization of productive disciplinary engagement evolved into a set of widely cited design principles (Engle & Conant, 2002) for fostering generative learning:

Problematizing. Support learners as they "problematize" curricular concepts and take on problems from their perspective. Rather than having learners simply observing and passively soaking up information, instructors and instructional designs should enable students to pose questions, submit proposals, challenge ideas, and offer other contributions to learning. Problematizing curricula can help learners articulate their reasoning, identify gaps in thinking, and surface disagreements in understanding (Reiser, 2004).

Authority. Give learners the authority to deeply engage with problems rather than going through the motions. Here the concern is empowering learners take on an active role (i.e., agency) in making consequential decisions for learning, transitioning toward nascent experts (Gresalfi, Martin, Hand, & Greeno, 2009; Lindgren & McDaniel, 2012).

Accountability. Encourage learners to hold themselves and each other accountable for extending and building upon shared knowledge. Learners are

expected to collaborate and respond to each other (Zhang, Scardamalia, Reeve, & Messina, 2009; Scardamalia & Bereiter, 2014).

Resources. Provide adequate resources for learners to productively engage with the problem at hand. The learning environment and instructional decisions must afford ample time, adequate space, access to necessary tools and information, and contact with experts. Instructors also need to be aware of the learners' backgrounds, the instructional goals, and the topic choice in order to arrange for and scaffold appropriate resources.

Expansive framing. Engle's subsequent notion of expansive framing provided further guidance for fostering productive disciplinary engagement and generative learning. Learners are first asked to think and reflect expansively on course content and then asked to make connections between course content (i.e., learning context) and personal and meaningful experiences (i.e., transfer context). Learners are encouraged to consider their own experiences in relation to the subject matter and ideas presented in the course. Expansive framing pushes learners to think and connect ideas while supporting reflective inquiry as knowing and learning is situated in one's experiences and personal context.

Expansive framing contrasts with cognitivist notions of transfer, which argue subject matter and content to be learned must first be sufficiently and independently abstracted, understood, mastered, and ingrained (National Research Council, 2000; Day & Goldstone, 2012). Whereas the cognitivist view emphasizes the use of cognitive structures and mental representations, the situative view focuses on an individual learner's experiences and interactions

and how they are shaped to participate and act (Greeno, 1997, 1998). One's background and context are not separate from learning; this perspective treats both as vital to learning, so that learners insistently use their knowledge and relevant experiences to help construct meaning and understanding.

Engle (2006) and Engle et al. (2012) contended that when learners think and reflect expansively, they extend their understanding to situations beyond the bounded confines of a course (e.g., extending to other people, places, topics, times, authors). In expansive framing, the social situations that involve other people, places, topics, times, and authors are used to frame one's engagement and understanding with course content. When learners are asked to reflect and connect, they are reframing content in ways they find relevant. It is this contextualization that is theorized to support truly generative learning. By emphasizing one's individual interactions, expansive framing uses the learner's position to provide agency in their learning. Expansive framing involves learners using the following framing aspects to connect their experiences with course content:

Time. The activity can be linked to a past or future instances. Learners draw upon prior knowledge during an activity or envision future applications of applying the current course content.

Place. The activity is relevant to other situations (other than time; i.e., other courses, out-of-school, at home, at work) outside of the course. Learners draw on experiences from other situations during the ongoing activity or envision other situations where the knowledge can be applied.

Topic. The activity relates to non-course subject areas and topics. Learners connect the current lesson and other course ideas with external corresponding lessons and course ideas that they are currently studying, have studied, or will study.

Participants (People). The activity is relevant to a broad community that extends beyond the course. Learners consider their interactions with their peers and other people.

Authorship. Learners are authors who are responsible for developing, sharing, and defending their ideas. Learners may also build upon the ideas of others.

Accountability. Learners are members of a community who feel accountable and hold their peers accountable for developing, sharing, and defending their ideas. Learners directly engage others and encourage productive discussions.

Expansive framing helps learners continually think about and make connections between course content and their own experiences. This process of repeatedly extending back and forth between the learning and transfer contexts creates an encompassing context called intercontextuality (Floriani, 1994), which is related to the idea of intertextuality (Bloome & Egan-Robertson, 1993; Kumpalainen & Sefton-Green, 2014). Intercontextuality and

intertextuality describe the relationships between different sociocultural contexts and texts across places and times.

As the intercontextuality becomes more robust with more connections, it links the learning and transfer contexts together, enabling learners to perceive both contexts as relevant to each other. Consequently, expansive framing pushes learners while priming their growing understanding to perceive even more possible connections to yet more transfer contexts (Greeno, Smith, & Moore, 1993).

Study

One recent study (Andrews, Chartrand, & Hickey, accepted) applied productive disciplinary engagement and expansive framing to the design of an online educational psychology course for pre-service teachers. There were 17 student participants enrolled. The study investigated 1) to what extent were students' interactions expansively framed and 2) how was expansive framing related to individual learning outcomes.

Students were asked to regularly comment on assigned readings and reflect on peers' and their own comments. At the end of the course, students completed a written final exam where they analyzed a pedagogical practice (e.g., lecturing) from two theoretical perspectives and designed an assessment and learning activities for an assigned academic standard from their subject (e.g., visual arts). Within the constraints of a typical teacher education course, the activities and exam were a reasonable proxy for a transfer measure that was indicative of generative learning and was likely to transfer to subsequent educational and professional contexts.

Students annotated course readings using a social annotation tool called *Hypothesis*, which allowed participants to directly comment on portions of text. Table 1, below, outlines the coding scheme used in the study. The scheme was adapted from Engle et al. (2012). Example statements are provided to show how learners might begin fostering intercontextualities.

Table 1. Expansive Framing Coding Scheme

Code/Frame	**Example**
Time	"This reminds of me of a course I took last semester …" "My English teacher in high school …" "I think this might be useful for …" "In my future work …"
Place	"In my internship at …" "At high school …"
Topic	"My sociology course is covering something similar …" "This is what museum educators do …"
Participants	"I see the teacher mentors doing this …" "My students always …"
Authorship	"I feel this is an important idea …" "Let's not forget …"
Accountability	"I agree with your statement …" "What are your thoughts about …" "Lisa's comments help me to understand …"

Analysis in a follow-up study is underway on an additional 20 students enrolled in the same course the following year. These students also used Hypothesis to annotate assigned readings and reflect on their own and their peers' comments in weekly posts. This study is focusing on 1) to what extent students hold each other accountable, 2) to what extent students exhibit the role of being an author, and 3) how accountability and authorship aspects factor into learning outcomes such as final course grades.

Findings

Findings from the first study (Andrews et al., accepted) indicated that students did take up expansive framing in their own dialogue. During the 16-week course, students generated 459 comments; more than 95% of those comments referenced at least one aspect of expansive framing and 62% referenced multiple aspects of expansive framing and provided specific examples connected to those aspects of expansive framing. In their annotations, students most often referenced Participants (76% of all annotations; e.g., students, teachers), Authorship (71%), and Topics (61%; e.g., other courses, their own subject area). The authors also found that students who took up expansive framing in their threaded annotations performed better on the written final exam ($r = 0.56$, $p < .05$). These results were promising and warranted a qualitative exploration of how expansive framing led to more generative learning.

The qualitative analyses used discourse analysis (Wooffitt, 2005) to identify patterns in students' annotations and how their use of framing shaped subsequent discourse. They found that three patterns emerged: connecting content-area pedagogical practices to course readings, connecting general pedagogical practices to course content, and student-generated questions. When students' annotations connected course readings to pedagogical practices in their own content area or to general pedagogical practices, student responses also took up this framing which generated rich dialogue. In these annotations, students often positioned themselves as "future teachers" by generalizing the course content to their future pedagogical practices. This positioning and generalizing have shown to help shape future classroom practices (Lee & Shallert, 2016) and enhance transfer more generally (Gick & Holyoak, 1983; Salomon & Perkins, 1989). When students asked questions in their annotations, especially when they

requested ideas from their peers about how to apply a concept from the readings, it often led to robust threaded conversations. Responses to these questions also led students to connect the course readings to content-specific and general pedagogical practices.

Impact & Conclusion

The studies mentioned in this paper are part of a series of ongoing work to transform the design principles from productive disciplinary engagement and expansive framing from its original conception as *pedagogical tools*, used by instructors to encourage learning, into *learning tools*, used by learners to promote their own generative learning. This reconceptualization prioritizes learner agency and enables them to direct their own learning as they work toward establishing their axiological identities.

Instructional designers and researchers will find the use of open web annotation in this paper and the study discussed to be informative for their research and practice. Designers and technologists should consider the role of framing discourse and how learners can be encouraged to make connections with course content across their individual experiences and educational, professional and personal contexts. Kalir and Perez (2019) note that while studying learner annotations may be initially useful when the level of analysis is on the individual and the acquisition of discrete skills (i.e., associationist and cognitivist), turning the focus of inquiry toward social, collaborative, and other participatory interactions (i.e., pragmatist) will be more generative (Green, Collins, & Resnick, 1996).

Consequently, designers and technologists may find that re-engineering their current discussion tools to further support learner interactions and connections of this nature to be worthwhile. Tools like Hypothesis are well-suited to help promote interactivity and networked

discourse and they can be impactful for research. Social annotation data can be used to help researchers identify additional sources of information beyond expansive framing and social, collaborative, and other participatory interactions. Recent work in education (Chen, 2019; Kalir, 2019) have shown the designing for interactivity can help promote generative learning through sensemaking, referencing/remixing, problem-solving, and artifact generation.

Other ongoing work that extends the issues discussed in the context of this paper includes 1) examining the consequences of social annotation use on disciplinary artifacts (i.e., course readings, support documents); 2) the inclusion of social justice aspects (e.g., diversity, historicity, and identity) and how learners might frame their engagements with these considerations; 3) a closer inspection of other expansive framing aspects (such as accountability and authorship) on online learning, 4) a new survey of expansive framing currently being piloted with approximately 6,000 students via the National Survey of Student Engagement, and 5) a deeper investigation of the relationship between expansive framing and the widely used Community of Inquiry framework and survey (Arbaugh et al., 2008)

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