Practitioner as Researcher, Researcher as Practitioner: Opportunities and challenges to implementing an innovative instructional design

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Abstract: A challenge for practitioners seeking to understand student thinking and learning as developing phenomena within innovative instructional designs is being able to step back from what they think they know and expect or assume will happen. Similarly, a challenge for ethnographers seeking to uncover previously invisible knowledge and patterns of practice is to understand what members of a social group need to know, understand, predict and produce undertake culturally relevant actions and participate in socially appropriate ways (Heath, 1982; Heath & Street, 2008; Green, Skukauskiate, & Baker, 2012). These roles and challenges converge in this study examining challenges in transforming an undergraduate General Chemistry course from an algorithmic to guided inquiry instructional design from the perspective of one practitioner who also served in multiple roles: curricular designer, professional developer for a team of teachers, instructor in her own class with a background in researching innovative learning environments in higher education settings.

Overview

In April 2015, the Head of the Department of Chemistry and Life Science at the United States Military Academy (USMA), approved adopting a Process-Oriented Guided Inquiry Learning (POGIL)-based instructional design with modifications for the General Chemistry course proposed by Kalainoff [author], and "guided inquiry" was implemented course-wide in the Fall of the same year. In undertaking this task, Kalainoff assumed multiple roles guided by a *practitioner as researcher[ethnographer]* and *researcher[ethnographer] as practitioner* approach to understanding how to make visible to instructors (n=20), program directors, and institutional administrators the affordances and outcomes of the new instructional design that served as a base for this transformation at a systems level. In order to meet the significant challenge of making visible the often invisible processes and practices of, in this case, guided inquiry, she drew on multiple dimensions of her academic background: as a senior practitioner in this course and as an interactional ethnographer (Kalainoff, 2013). Through this process, she sought to create a resource to support the development of practitioner roles and relationships by developing a purposeful iterative, recursive and abductive reflexive process. To this end, she constructed an internal-external interactional ethnography research team (Green & Bridges, in press; Green, Chian, Stewart, and Couch, 2017) to support her and her colleagues in *stepping back from the known* and exploring differences in what the internal and external ethnographers understood about the processes being constructed. In this way, she sought to meet the challenge to ethnographers that Heath (1982) framed in terms of the types of theoretical inferences the ethnographer seeks to construct and, through this reflexive process, build the same type of reflexive practices for practitioners.

Transforming the Instructional Design through a Reflexive Process: An Institutional Intervention

Transforming the instructional design was not a decision initiated by the institution or recommended as a professional development or curricular intervention. Rather, Kalainoff, as a senior instructor in this course and lead designer of the curriculum process, decided to develop and propose a process of guided inquiry to meet the developing transformation and leadership goals within the military academy (Kalainoff & Clark, 2017). This process involved identifying inquiry processes and practices that her experience as well as academic background identified as critical. This led to a search of developing programs in inquiry-based learning at a national level to identify promising resources. She identified the POGIL model (Farrell, Moog, & Spencer, 1999) which is based on principles that promote scientific thinking, as a potential beginning point for the transformation of the curriculum from an algorithmic model to an inquiry based model. Rather than accepting this as a structure for implementation, Kalainoff engaged a design team in considering the potential of the design to meet long term educational needs of the institution in developing scientific reasoning and intellectual self-reliance in students (future US Army officers). This process allowed the design team to begin to identify what was entailed in engaging all 1200 students (i.e., Cadets in a military academy and undergraduate university) and instructors in a guided inquiry model for this General Chemistry course. Based on these goals, Kalainoff and her team

understood that this course was not only concerned with disciplinary knowledge in chemistry, but that it also served a particular purpose within the institution, a purpose that made visible the need to transform chemistry instruction from an algorithmic approach to a guided-inquiry approach in which *thinking scientifically* (folk/insider term) forms a basis for decision-making. At this institution, their decisions initiated a process of reformulating course outcomes goals to include developing ways of thinking (e.g. an epistemological base) (United States Military Academy, 2017) in order to create a potential for building decision-making capacity for engaging in the complex and previously unknown environments of future military warfare. This action also addressed national calls for inquiry-based (National Research Council(NRC), 2011; 2012) and collaborative instructional models (NRC, 2011) in undergraduate science and engineering courses.

Given her background in ethnographic research, Kalainoff, elected to develop a reflexive process for her design team to explore how and in what ways the guided inquiry process was being undertaken with students. As lead designer of the curriculum process as well as chemistry practitioner, she formed an internal/external interactional ethnography research team of internal ethnographers (Kalainoff & Fallot) as well as external ethnographers (Green & Skukauskaite) with whom she had previously worked. The goals for this internal - external Interactional Ethnographic research team are reflected in the following perspective on ethnography as a logic-of-inquiry proposed by *ethnographers in education*, Shirley Brice Heath and Brian Street, individually (Heath, 1982; Street, 1993) and collectively (Heath & Street, 2008):

- Suspending known categories to construct understandings of local and situated categories and referential meanings of actions being developed by participants;
- Acknowledging differences between what they as ethnographers know and what the actor(s) in the context know;
- Constructing new ways of knowing that are grounded in local and situated ways of knowing, being and doing the processes and practices of everyday life within a social group or configuration of actors;
- Developing ways of representing what is known by local practitioners and what the ethnographers learn from the analysis at different levels of analytic scale.

These principles of conduct constitute a *chain of orienting principles* and *implicated actions* that ethnographers *in* education (and other social settings) draw on as they seek to gain emic (insider) understandings of what constitutes *members' (insider) knowledge.* These *principles of conduct* frame an Interactional Ethnographic approach to the study of social, cultural and linguistic phenomena that shape, and are shaped by (Fairclough, 1992) what participants in particular learning environments *count as learning and knowledge* (cf. Heap, 1991; Kelly, 2016).

The inclusion of the insider-outsider (internal-external) Interactional Ethnographers (c.f., Green, et al., 2017; Green & Bridges, in press), therefore, provided a basis for exploring the ways in which multiple practitioners designed, engaged in, and undertook the processes that led to transforming the course from a traditional, algorithmic approach to the guided inquiry-based instructional design that constituted the lived curriculum of this General Chemistry course. To create the research team, she invited a more junior organic chemistry instructor, Lucas Fallot, to take on the role of analyst of video records from an IE perspective, given his interest in learning what General Chemistry students would bring to his advanced level course. She also invited Judith Green and Audra Skukauskaite, with whom she has engaged in Interactional Ethnographic research (e.g., Kalainoff, 2013) as well as at professional meetings (e.g., American Educational Research Association, 2015, 2017). Thus, like Bridges (Bridges, Botelho, Green, & Chau, 2012; Green & Bridges, in press), she laid a foundation for reflexivity that enabled her to step back from the known or expected process of implementation to examine the following questions:

- What actions and decisions were undertaken by the design leader (a practitioner-researcher/researcher-practitioner) to develop the planned inquiry-oriented instructional process that instructors were asked to undertake?
- How and in what ways did instructors (self and others) engage in a process of guiding students in developing conceptual knowledge of chemistry concepts, processes and practices as well as collaborative decision-making and thinking processes?

Study Context(s)

In this program, reflexivity refers to both the interactional ethnographic research process that guided the study of the transformation from an algorithmic to a guided inquiry instructional approach, and to the inclusion of an internal-external research team to support the designer and instructors in exploring the developing program.

The institutional context of the study: situating General Chemistry and its practitioners

In this study, the institutional setting is the introductory General Chemistry course in first year of a 47-month developmental experience (folk/insider term) which constitutes the developmental program at the United States Military Academy (USMA) at West Point, NY, USA. One semester of General Chemistry is required as part of a 17-course core sequence and foundation of the academic program. Although classified as a liberal-arts undergraduate institution, USMA's history is entrenched in science and engineering as the first engineering school in the United States. Therefore, regardless of intended major, all student/cadets take the same General Chemistry course intended for science and engineering majors. In this course, 1200 freshmen are assigned to classes of 18, and instructors (n=20) may lead up to four classes each semester. Instructors are both PhD civilians and active duty military professors (MA/PhD in the disciplinary fields of chemistry, life science, chemical engineering and other related disciplines. Given that most military faculty rotate through the Academy on a 3-year tour of duty, the department sees 20-25% faculty turnover every year, requiring a summer faculty development workshop for incoming faculty. Because students take the same major graded events, major administrative tasks are planned and conducted at the course level with a designated course director who also teaches two classes in the course. Major administrative features in-common to all classes in the course include: lesson outlines with learning objectives and homework for each lesson, materiel resources (textbooks), and laboratory experiments and resources. Course directors maintain and contribute to a common course digital resource called *notes for instructors* (or NFIs) (folk/insider term) that orients instructors to key concepts in the lesson, potential challenging concepts for the students, recommended key questions in the guided inquiry text and available material for in-class demonstrations.

The theoretical context of the study: situating Interactional Ethnography

In order to trace developing innovative programs over time, events, activity and configurations of practitioners, we take up Interactional Ethnography as a logic-of-inquiry, not a method. Central to this orienting theory is that we live socially-patterned lives by engaging in structuring (Mehan, 1978) activity (or processes). As these processes occur over time in certain ways, for particular purposes, and with intended outcomes, they take on particular meanings and develop into social practices that constitute part of a conceptual system of meanings. Therefore, developing an understanding of the meanings of disciplinary process and practices made visible in changes to patterns of activity over time constitutes "learning". This argument builds on directions in anthropology in which *culture* is understood to be a verb, not a fixed or existing phenomenon (Street, 1993; Heath & Street, 2008), and *culture* as defined as a conceptual system (Agar, 1994; 2006). Interactional ethnography as a logic-of-inquiry empirically makes visible these socially structured patterns of life (co-constructed cultural norms) through tracing interactions (the observables) in order to determine roles and relationships, norms and expectations, and rights and obligations (Green, Skukauskiate, & Baker, 2012) for doing what counts as any social activity (Heap, 1980; 1991)—in this case, guided inquiry. In particular, IE preferences discursive interactions--how practitioners enact their understandings of the social situation through what is signaled, proposed, recognized, and acknowledged as socially significant (Bloome, Carter, Christian, Otto, & Shuart-Faris, 2010) in order to understand the developing referential and social systems and how this knowledge is jointly constructed and shapes and is shaped by (Fairclough, 1992) particular interactions across time and events as well as configurations of practitioners. These disciplinary-based processes and practices frame what counts as epistemic knowledge (Kelly, 2016) in which, in this study, learning chemistry (and science more generally) as a way of thinking is a goal.

The instructional context of the study: situating Guided Inquiry

The Process-Oriented Guided-Inquiry Learning (POGIL) learning originated in General Chemistry the early 1990's as a chemistry professor's response to what he believed was an ineffective traditional lecture-based instructional model. This instructional design is based in Karplus model of learning which was informed though Piaget (Karplus & Thier, 1967; Piaget, 1964). Karplus drew on Piaget's work that learners build their own mental constructs (or reasoning patterns) for knowing science through experience with the physical world (Fuller, 2003).

In short, the process cycle phases are: exploration, concept invention, and application (Karplus, 1977). As designed, the POGIL process begins with a guided exploration of, in this case of a general chemistry course, a scientific (chemical) representation (e.g. diagram, table of scientific data) through orienting students to particular aspects of the model through direct questioning (called Critical Thinking Questions or CTQs) in the inquiry text (Moog & Farrell, 2015). These questions make visible the patterns in the data such that the students may hypothesize the qualitative relationships (concepts). Then the student addresses questions that

require applying the concept and terms to complete the process cycle. This process itself models a scientific methodology- an ideal feature of a learning environment for a science course. The process is intended to occur in interactive learning teams of 3-4 students with an instructor-facilitator present (Farrell, Moog, & Spencer, 1999) which models the collaborative aspect of science and engineering research and professional teams. Although originating in chemistry, the POGIL instructional design has been used to design activities in other disciplines (e.g., calculus, biology, computer science, environmental science).

Challenges and Opportunities of Implementing a New Instructional Design

In order to meet the challenges and opportunities of implementing a new instructional design, both practitioner as researcher and researcher as practitioner roles and relationships require stepping back from the known to make visible what is required for outsiders to understand what is happening from the insider perspective. This paper provides a basis for understanding a new form of collaboration between practitioner-researchers and external ethnographers as they seek a common understanding of what is entailed in transforming, not merely developing a sedimented (i.e. traditional) institutional model of teaching chemistry to one that meets both institution goals and national calls. Through tracing the multiple roles and relationships that Kalainoff undertook as designer to professional developer to classroom instructor, we seek to develop new understandings of who counts as practitioner for a new curriculum and how the movement across roles brings new challenges and relationships to those guiding the transformation. Additionally, given the goal of this section of ICLS, by making visible the interactional ethnographic frame, we demonstrate how the theoretical logic of inquiry informs both the research and the reflective practices of different practitioners in a developing guided inquiry curriculum. As will be demonstrated, this frames what constitutes the basis of a reflexive process at the intersection of theory, practice, and researchers, not supported by external.

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