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An Ontology for Conceptual Analysis of Signature Pedagogies

Abstract

Signature pedagogy is a multifaceted concept that has been found useful by education researchers for analyzing and characterizing pedagogical methods for particular professions. A signature pedagogy must impart not just the formal disciplinary knowledge but also the cognitive, behavioral and attitudinal norms of the profession. The pedagogy is characterized by four dimensions of surface structure, deep structure, implicit structure and shadow structure. The abstract and multifaceted nature of the concept affords researchers latitude in construing and applying the concept in analyzing and describing pedagogies, making it difficult to compare pedagogies across professions and across academic papers. Based on a conceptual analysis of twenty-four journal papers describing signature pedagogies of various professions, the paper proposes and outlines a Research in Signature Pedagogy (ReSiPe) ontology.

1.0 Introduction

Signature pedagogies of the professions is a concept introduced by Shulman (2005a; 2005b) to refer to types of teaching for educating students into particular professions, by imparting not just formal disciplinary knowledge but also ways of thinking (habits of the mind), ways of performing (habits of the hand), and ethical values (habits of the heart) that are normative in the profession. A signature pedagogy is characterized by four dimensions of surface structure, deep structure, implicit structure and shadow structure. The concept has captured the imagination of education researchers as it points to subtle cognitive, behavioral and attitudinal attributes that are expected in a competent member of the profession, and thus should be imparted using appropriate teaching methods.

Signature pedagogy is an abstract and multifaceted concept. Shulman did not define the concept very precisely, and researchers have applied the concept differently according to their analytical purpose and the characteristics of the profession they are analyzing. However, the abstractness and ambiguity of the concept make it difficult to compare signature pedagogies across professions and across academic papers. It is also difficult to apply the concept in designing professional education programs.

We carried out a conceptual analysis of the concept as used in twenty-four journal papers analyzing signature pedagogies of twenty professions/disciplines. The purpose of the conceptual analysis was to clarify what a signature pedagogy is, its subcategories and parent categories, its component parts, and its attributes and aspects. Based on the conceptual analysis, we are developing an ontology that researchers can use to analyze, evaluate and compare signature pedagogies described in academic papers. Shulman (2005a, 58) noted that “the comparative study of signature pedagogies across professions can offer alternative approaches for improving professional education ...”

2.0 Method

An initial coding scheme was constructed based on a close reading of a set of Shulman’s (2005a; 2005b; 2005c; 2006; 2008) seminal papers and four journal articles describing four signature pedagogies. The coding scheme was then used to analyze ten
more papers. A Microsoft Excel spreadsheet was used to analyze each article. The analysis was carried in several iterations: 1) Reading through each article to extract passages that correspond to categories in the coding scheme; 2) Identifying significant concepts in the passages tagged with the coding categories; 3) Analyzing issues relating to each group of categories. Based on the results of the conceptual analysis, an initial Research in Signature Pedagogy (ReSiPe) ontology was constructed and used as an analytical framework to analyze ten more papers to evaluate its utility and completeness. An outline of the ontology is given in Table 1.

3.0 Conceptual analysis of descriptions of signature pedagogies

3.1 Concept of signature pedagogy

Shulman conceived of signature pedagogy as being inextricably identified with a particular profession. However, our analysis of the sample papers indicate that it is difficult to pinpoint the essential characteristic of a pedagogy that is tied to the profession (with the obvious exception of disciplinary content knowledge). Descriptions of signature pedagogies involve abstractions that can conceivably be applied to other disciplines and professions. Authors have relaxed the definition of the concept to apply to subject disciplines (e.g., political science, history and humanities). We propose a broader concept, distinctive pedagogy, to abstract the characteristics of a family of related signature pedagogies across professions. Some authors have narrowed the scope of the concept to particular schools or locales, rather than to the whole profession. To represent innovations in pedagogy, we adopt the idea of emerging or aspiring signature pedagogy (Chick et al. 2012; Horn 2013) to refer to new pedagogical methods developed by particular schools. It will also be useful to identify pedagogies of individual gifted teachers. A profession will also exhibit different characteristics in different countries, indicating that a signature pedagogy should have a location attribute. We propose therefore a class hierarchy with Distinctive pedagogy as the top-level class (see Table 1).

Shulman argued that a signature pedagogy should be pervasive in the sense of being adopted in most professional schools, be routine throughout an education program, have a high level of engagement among students and instructor, resulting in a degree of uncertainty within each instructional session. In the ontology, these are represented as attributes of signature pedagogy.

3.2 Pedagogical structure: surface, deep, implicit and shadow structure

Descriptions of signature pedagogies in the sample papers typically include substantial details of the surface structure, including the component teaching methods (e.g., fieldwork, tutorial and rounds) and characteristics relating to use of space and time, sequence of activities involved, participant roles (e.g., facilitator, coach, expert), and artifacts and technologies employed. The sample papers also discuss the strengths and weaknesses of the surface characteristics, as well as relate some characteristics to professional competencies that they help to impart. Some papers discuss the possible underlying explanation/mechanism of how surface features help students to acquire particular competencies. The papers highlight the distinctive characteristics of a pedagogy that account for its effectiveness and that distinguish it from other pedagogies.

Characteristics of the deep structure (underlying assumptions about how to impart professional competencies) and implicit structure (beliefs about professional attitudes
and values) are abstract and theoretical concepts. Deep structure is often specified as principles relating to pedagogy execution, student and learning, and teacher and teaching. They are often related to habits of the mind. In contrast, implicit structure is often related to habits of the heart. The shadow structure reflects the characteristics that are lacking in the pedagogy. However, what is missing may be positive (a strength) or negative (a weakness).

### 3.3 Types of professional competencies

According to Shulman (2005a), a signature pedagogy seeks to impart four types of professional competencies: 1) habits of the mind (i.e. ways of knowing and thinking); 2) habits of the hand (i.e. ways of performing and doing things); 3) habits of the heart (i.e. ethics and attitudes); and 4) pedagogical content knowledge.

In the sample papers, habits of the mind tend to be specified as generic (transferable) skills (e.g., critical thinking), research skills, and development skills. The sample papers are generally not successful in characterizing how transferable skills take different forms in different professions. The sample papers are also weak in specifying habits of the hand. It is difficult to disentangle habit of the hand from habit of the mind, as educational programs focus on the professional thinking and judgement that inform practice.

Habit of the heart is often taken to refer to ethics and values, but have been expanded to include attitude, disposition, and identity/being. Attitude appears to represent the professional’s stand or relation towards objects of significance for the profession, leading to a particular behavioral disposition. Identity and being suggest professional self-awareness and self-image, including a sense of the professional’s place and role in society and in the world.

A signature pedagogy must of course impart the formal disciplinary knowledge, but this must be tempered with an understanding of learning and teaching, as well as practical experience of applying the knowledge to form pedagogical content knowledge.

### 4.0 Utility of the ontology

The initial ReSiPe ontology was encoded in Turtle format using the TopBraid Composer ontology editor, and used to analyze an additional ten journal papers. Preliminary results indicate that the coding can readily reveal which aspects of a signature pedagogy are lacking in descriptive details. However, to adequately compare signature pedagogies, the class hierarchies for various concepts need to be fleshed out further. We believe it is feasible to compile comprehensive class hierarchies for surface structure features, i.e. Teaching method, Activity, Participant role, and Artifact and Technology used. More difficult will be to identify the different habits of the mind, habits of the heart, and teaching/learning principles (of the deep structure). More work is also needed to model the underlying explanations of how surface features help to impart a competency.

A graphical visualization web application based on the ontology is being developed to support educational researchers to systematically analyze and visualize a signature pedagogy, and compare its characteristics with those of the twenty-four signature pedagogies that we have analyzed and coded as ontology instances. The tool is also expected to help teachers to understand and compare pedagogical methods.
Table 1. Research in Signature Pedagogy (ReSiPe) ontology: An outline

*Note: relations are indicated in italics.*

**Distinctive pedagogy**
- Signature pedagogy
  - Signature pedagogy of a profession (*educatesFor* Profession)
  - Signature pedagogy of a discipline (*educatesFor* Discipline)
  - Signature pedagogy of a school (*associatedWith* Educational institution)
  - Signature pedagogy of a teacher (*associatedWith* Teacher)
- *location*: Geographic location or Educational institution
- *structure*: Pedagogical structure
- *imparts competency*: Professional competency
- *engagement characteristic:*
- *uncertainty characteristic:*
- *pervasiveness characteristic:*
- *routineness characteristic:*
- *distinctive characteristic*: Pedagogical structure or Competency

**Pedagogical structure**
- Surface structure
  - *teaching method*: Teaching method
  - *space characteristic:*
  - *temporal characteristic:*
  - *activity*: Activity
  - *participant role*: Participant role
  - *content:*
  - *artifact*: Artifact
  - *technology*: Technology
  - *imparts competency*: Professional competency
- Deep structure (with relation *imparts competency*: Professional competency)
- Implicit structure (*imparts competency*: Habit of heart)
- Shadow structure (*lacking competency*: Professional competency; *lacking structure*: Pedagogical structure)
  - Positive shadow
  - Negative shadow

**Professional competency**
- *Habit of the mind*
  - Transferable skill
  - Research skill
  - Development skill
- *Habit of the hand*
- *Habit of the heart*
  - Ethics/values
  - Attitude
  - Identity/being
  - Disposition
- *Content knowledge*
  - Academic and research knowledge
  - Pedagogical content knowledge
  - Professional knowledge
  - Classroom knowledge
References
https://www.aacu.org/publications-research/periodicals/pedagogies-uncertainty