

# Depth of Knowledge of American Elementary Pre-Service Teachers' Social Studies Lessons

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## Abstract

The purpose of this study was to investigate the cognitive complexity of elementary pre-service teachers' (PSTs') social studies lessons plans they developed to teach and assess 7<sup>th</sup>-grade students. The data source included 235 lesson plans and assessments, which were coded using Webb's (1997, 1999) Depth-of-Knowledge Model (DOK). The PSTs' assessments primarily required only recall (36.2%) and basic reasoning (29.8%); however, more than one-third of their assessments required students to apply complex or extended reasoning. How PSTs integrate cognitive complexity in their teaching to align assessments with state standards is vital to their students' performance, as well as to their performance evaluations.

**Keywords:** Depth of Knowledge (DOK), Assessment, Teacher education, Social studies

## 1. Introduction

Stemming from a consortium of U.S. governors warning about global competitiveness and extolling the necessity of a concerted focus on college and career readiness, the Common Core State Standards (CCSS) have been adopted by 45 states for K-12 mathematics and English language arts. Despite the recent release of CCSS-like standards for science and social studies, there are no plans for their inclusion in the CCSS or the accompanying assessments required as part of the Obama administration's Race to the Top (RTT) program. Furthermore, Michigan, the state in which this study was situated, has recently renewed its commitment to using the statewide Michigan Educational Assessment Program (MEAP) to assess students in grades 3-8. For social studies, the MEAP is aligned with the Michigan Grade-Level Content Expectations (GLCEs).

States that seek to receive some of the \$4.35 billion RTT grants must base at least 40% of their teacher evaluations on student achievement. Since teachers' effectiveness will be linked directly to their students' MEAP scores, it is imperative for teachers that their lessons and assessments match the type of cognitive complexity articulated in the GLCEs.

The purpose of this study was to investigate the cognitive complexity of 235 elementary pre-service teachers' (PSTs') social studies lessons plans they developed and taught to 7<sup>th</sup>-grade students. How PSTs integrate cognitive complexity in their teaching to align assessments with state standards is vital to their students' performance, as well as to their performance evaluations.

As part of field-intensive undergraduate teacher education program that uses a cohort model to provide emerging teachers with increasing classroom responsibilities over four semesters, the PSTs in this study were enrolled in a block of four methods courses during the semester prior to student teaching. One of the field experiences of the semester involves a four-day unit during which the PSTs work in groups of two to three to deliver lessons in all subjects to classrooms of 7<sup>th</sup>-grade students. Essentially, the local 7<sup>th</sup>-grade teachers turn over their classes to the PSTs for four days, where each PST is the lead teacher for at least one lesson in all subjects.

Early each semester, the cooperating teachers identify the specific Michigan GLCEs they would like the PSTs to teach in each subject during the field experience. For this study, we focused on the PSTs' social studies lessons. Admittedly, the cooperating teachers assigned the PSTs GLCEs they would rather not teach themselves. The three topics the cooperating teachers assigned the PSTs to teach include: human/environment interaction in Russia, world religions, and global economic interdependence. Each of those topics contains three specific objectives (GLCES). Each PST was required to develop an original lesson plan that she taught solo to the 7<sup>th</sup>-grade students, while her group mates observed and helped students as needed. Additionally, each PST was expected to assess the students' learning of the objective she taught. Using Webb's (1997, 1999) Depth-of-Knowledge Model (DOK) we examined the level of cognitive complexity of the social studies GLCEs the PSTs were assigned to teach, as well as the DOK required of the 7<sup>th</sup>-grade students in PSTs' lessons, particularly in their assessments of student learning.

## 2. Literature Review

Educators and psychologists alike have attempted to develop models for understanding cognitive complexity as it relates to the designing of instruction and assessments (Hess, 2006). Arguably, the tasks that are assigned to students and the assessments given on a daily basis have never been more important than they are today. Notions of predominantly teacher-led instruction, memorization of content, and simple multiple-choice assessments have been rejected by the authors of the Common Core State Standards (CCSS), who placed an emphasis on showing and applying knowledge rather than just being able to remember and recall it (Skinner & Feder, 2014). Previous standards have been criticized as being “a mile-wide, but only an inch deep.” The CCSS, however, aim to be “fewer, higher, and deeper” (Darling-Hammond et al., 2013, p. 2). With a goal of preparing students for college or career readiness, today’s standards emphasize critical thinking, quantitative reasoning, and solving complex problems – higher-order cognitive tasks (Miri, David, & Uri, 2007).

Originally published in 1956 and then later revised in 2001, Bloom’s Taxonomy has been the dominant model for representing levels of cognitive processing. Bloom’s Taxonomy has a total of six cognitive categories that range from lower-order remembering skills to higher-order creating skills (Forehand, 2010). More recently, a second popular model has emerged for representing differences in cognitive demand: Webb’s Depth of Knowledge, or DOK. DOK is the dominant model used at the state level for aligning standardized assessments with mandated state content standards (Baughman, Carlock, McGaugh, & Walkup, 2009). Despite the recent ubiquity of DOK in the literature on the CCSS and associated assessments, no research exists on the preparation of teachers to use DOK as a framework in their lessons and assessments.

### 2.1 Cognitive Processing and Critical Thinking

The need to develop students’ cognitive processing and critical thinking skills is at the foundation of the CCSS. As the nature of work and society change, students will need to be able to analyze, synthesize, and apply what they have learned in order to address problems, create solutions, collaborate effectively, and communicate persuasively (Darling-Hammond et al., 2013). Critical thinking has been defined as a skill of taking responsibility and control of one’s own mind. Critical thinking involves a number of complex cognitive sub-skills such as being able to identify a source of information to analyze its credibility, to reflect on whether that information is consistent with prior knowledge, and to form conclusions. Because students’ future lives will be greatly enhanced by their ability to think critically, schools should make fostering these skills a priority (Miri et al., 2007).

### 2.2 Bloom’s Taxonomy

One of the first cognitive processing classification systems was developed by Benjamin Bloom in 1956 and has since become known as “Bloom’s Taxonomy” or simply, “Bloom’s”. Bloom’s Taxonomy contains six different levels of cognitive processing that are based on complexity. This specific taxonomy is often depicted as a pyramid with the lowest levels of complexity being the bottom, and as you increase with level, so does the complexity of the

cognition required. In the 1990's Bloom's went through a series of revisions and was republished with the same number of levels, but with some of the names of the levels altered (Forehand, 2005). The purpose behind the revision was to take a one-dimensional framework and alter it to be two-dimensional, referencing both the amount of knowledge required for a task and the level of cognitive processing needed (Krathwohl, 2010). Benjamin Bloom consistently expressed that his taxonomy was simply a work in progress, and would support the interaction between the content needed for a task and the thought processes associated with completing the task (Hess, Jones, Carlock, & Walkup, 2009).

The six levels of the revised edition of Bloom's Taxonomy are as follows in order from lowest level to highest level of cognitive processing required: *Remembering*, *Understanding*, *Applying*, *Analyzing*, *Evaluating*, and *Creating*. *Remembering*, the lowest level of cognitive processing according to Bloom's, involves retrieving, recognizing, and recalling types of relevant information. *Understanding* involves determining the meaning from oral, written, and graphic messages through interpretation, classification, summarization, and explanation. *Applying* deals with carrying out or using a procedure in a situation that is given. *Analyzing* is breaking material into parting, determining how the parts relate to each other and the overall structure or purpose. *Evaluating* involves making judgments based on criteria and standards. *Creating*, the highest level of cognitive procession according to Bloom's, involves putting elements together to form a coherent or functional whole (Anderson et al., 2001; Noble, 2004).

The revised edition of Bloom's Taxonomy provides educators with specific verb and product linkage with each of the levels of Cognitive Processing, allowing them to utilize specific key words during instruction and assessment to elicit particular levels of cognitive demand (Forehand, 2005). There is, however, one major issue with the taxonomy. According to (Hess et al., 2009, p. 2), Bloom's taxonomy offers

[I]nsufficient guidance in formulating assessment and instructional delivery strategies. With no natural tie between the taxonomy levels and the depth of understanding required to respond to each question, their assessment strategies begin to fall back on traditional crude rules of thumb and gut feel.

What's more, many verbs, such as compare or explain, appear in multiple levels of the taxonomy.

### 2.3 Webb's Depth of Knowledge

Webb's Depth of Knowledge (DOK) offer a classification system that bridges the gap between the content assessed in a task and the depth to which students are expected to demonstrate understanding of that content (Hess et al., 2009). Although both Bloom's and DOK are related through their natural ties to the complexity of thought, they differ in the scope and application of each model. Bloom's focuses on and categorizes the cognitive skills required when faced with a new task, therefore describing what type of thinking processes are necessary. The DOK model relates more to the depth of content understanding and the scope of a learning task, which can manifest in the skills required for completion of a task from start

to finish (Hess et al., 2009). Different from Bloom's, which focuses the level of cognitive processing, Webb's DOK focuses on depth of content knowledge (Hess, 2006).

Today, DOK is the dominant framework for aligning curriculum, instruction, and assessment; most U.S. states use DOK to align their standardized assessments with curriculum (Hess et al., 2009). With DOK being used by policymakers to match the depth and complexity of state standards with their corresponding assessments, teachers need to become competent at using DOK to design their classroom instruction and assessments. Alignment analysis in the field of education is more important than ever before. As standards-based assessment becomes further integrated into the process of determining school and teacher effectiveness, educators must learn to align their curriculum and instruction with the appropriate DOK level (Baughman et al., 2009).

While both Bloom's Taxonomy and Webb's DOK serve very important and complementary functions in standards development and assessment alignment, considerably less research exists on Webb's DOK. A great need exists for more research on the role of DOK in daily lesson planning and assessment, particularly at the pre-service teacher stage.

### **3. Methods**

The PSTs, from an approximately 9,000-student public university in the upper Midwestern region of the U.S., were predominately Caucasian, female (88%), and in their early- to mid-20s. The site school for the field experience is located in a local rural school district that serves approximately 2,500 K-12 students, 91% of whom are Caucasian, 4% African American, 2% Native American, and 1% Asian. Students represent a wide range of socio-economic levels, including 33% who qualify for free or reduced lunch. All of the cooperating teachers in whose classroom the PSTs taught were White and evenly split male/female.

Using phenomenological principles (Creswell, 1998), we examined the lesson plans of 235 PSTs from eight semesters. Particularly, we examined how the PSTs assessed student learning. Using classical content analysis (Leech & Onwuegbuzie, 2008), we coded each lesson plan twice. First, we used Webb's (1997; 1999) DOK levels to categorize each of the assessments into one of the four levels: Recall and Reproduction, Skills and Concepts, Strategic Thinking, and Extended Thinking. Using Webb's DOK levels as predetermined codes, we saturated the lesson plan data until each lesson plan was placed in one of the four DOK levels. Next, we repeated this process for the lessons plans within each of the four primary categories, using Hess's (2005) DOK Level Descriptors for Social Studies as predetermined subcodes. Throughout this process we coded collectively discussing and reconciling any discrepancies together until all lesson plan assessments were captured by both Webb's DOK categories and Hess's subcategories (Campbell, Quincy, Osserman, & Pedersen, 2013).

### **4. Findings**

Of the nine Michigan GLCEs the PSTs were assigned to teach, four (44.4%) had a cognitive complexity of DOK level 1, four (44.4%) were at DOK level 2, and one was at DOK level 3

(11.1%). None of GLCEs demanded extended reasoning. Rather, eight (88.9%) of the nine GLCEs merely expected students to recall information or use basic reasoning.

The PSTs' corresponding assessments were also dominated by tasks involving recall (36.2%) and basic reasoning (29.8%); however, more than one-third of their assessments required students to apply complex or extended reasoning (see Table 1). In other words, the PSTs tended to demand more depth of cognition than the state content standards required.

Table 1. PSTs' Assessment DoK Levels

Level:	Number of Assessments	% of Total
1. Recall and Reproduction of Information	85	36.2%
2. Basic Reasoning Skills and Concepts	70	29.8%
3. Strategic Thinking/Complex Reasoning	80	34%
4. Extended Thinking/Reasoning	0	0%

Of the 85 assessments categorized at Level 1, 58 required students to recall a fact, term, concept, event, or document. For example, one PST had students answer the following two prompts on an exit ticket: "Name one important invention from China. What is one new thing you learned about China today?" Another PST teaching the same GLCE asked students to do the following: "In your journals, describe at least one major achievement from Chinese civilizations in the area of art, architecture, or technology."

The next-most common type of assessments at Level 1 involved tasks requiring students to describe or explain who, what, when, or where. For example, during a unit on the world's six largest religions, one PST had students explain the key beliefs and principles of Hinduism and why they were important to followers of that faith. In a lesson on the circular flow model of economics, one PST assessed students on their ability to create their own diagram or map of the movement of a product of their choice and indicating where it is manufactured and sold, and demonstrating the flow of materials, labor, and capital.

Seventy (29.8%) of the assessments consisted of Level 2 tasks, which require students to apply basic reasoning skills. Of those 70 assessments at Level 2, 17 involved tasks requiring students to describe cause-effect relationships of events. For example, one PST asked students to answer for homework: "How do you think Judaism has impacted society today? How has religion in general, impacted your life?" Another PST required students to respond to the questions: "How did new inventions influence the people of China during ancient times? How do the Chinese inventions impact our lives today? Which Chinese invention has been most important to the development of civilization throughout the world?"

Also common among the 70 Level 2 assessments were tasks requiring students to compare and contrast, such as questions like: "What similarities did you find in sharing about each religion? What were some of the differences you learned about the different god/leaders?"



Other common assessments at Level 2 required students to describe the impact or significance of events (“Explain the importance of trade between the United States and China”) and summarize major problems and events (How are resources in high demand affected by economic interdependence? What does that mean for us?).

At Level 3 of Webb’s DOK, the PSTs’ assessments diverted from the prescribed GLCEs, though arguably for the better. While only one (11.1%) of the assigned GLCEs required depth of knowledge beyond Level 2, 34% of the PSTs’ assessments required strategic thinking or complex reasoning. The most common type of assessment at DOK Level 2 were those in which the PSTs asked students to apply and concept to other contexts. For example, one PST had students complete the following assessment:

Imagine that you are a representative from a country in the Eastern Hemisphere. Write a letter to another country in the Eastern Hemisphere asking them to trade a specific good with you. Persuade them to trade goods with you by explaining why it would be beneficial to them. Goods must be actual goods of a region.

Another PST asked students to use what they had learned about productive resources to list the human, capital, and natural resources that were used to produce their favorite toy.

Assessments at Level 3 also commonly included tasks requiring students to make and support inferences. For example, one assignment asked: “How would Japan’s economy be different if they weren’t able to trade with other countries to get the supplies they need to make Nintendo Wiis?” Another PST assigned students to write a in a paragraph “3 ways your life would be impacted if you did not consume goods imported from China. Also, consider how the GDP of China and the United States would be impacted if we did not import goods from China.”

Other assessments involving strategic thinking or complex reasoning required students to explain or connect ideas using evidence from additional texts. For example, a PST had her students use graphs about the GDP of various nations to explain how standard of living is related to exports and imports. Additional assessments at Level 3 included tasks requiring students to analyze similarities and differences in current problems. One PST had students describe the similarities and differences between Hinduism and Buddhism, as well as analyze current conflicts those religions face in modern society, particularly with governmental supports and limits. These DOK Level 3 tasks could not be completed successfully without students extending their thinking beyond the material presented in class. Whereas with Level 2 tasks the students had to describe how and why, Level 3 tasks required students to justify how and why using evidence and reason (Hess, 2006).

## **5. Discussion**

Not only does DOK promote cognitive complexity and critical thinking, it improves students’ engagement in the educational environment. Students want supportive teachers who care about their development (Certo et al. 2008; Intrator, 2004). “Students consistently say that the most engaging teachers encourage classroom discussion and debate, tie instruction to students’ own lives, and allow students to experience a degree of autonomy” (Baughman et al., 2009, pg. 4). According to Certo, Cauley, Moxley, and Chafin (2008), activities that

align with DOK-1 hold little interest for students. Students find themselves easily disengaged when asked to perform task like memorization and recall. Students reported feeling bored with this type of instruction and they felt as though their teachers cared little about student learning. Conversely, students are most engaged when creating or thinking about something new. They are most tuned-in when they feel ownership over their own ideas, when they feel safe sharing their own ideas, and when they are taken seriously (Intrator, 2004). In order to increase student engagement and establish ownership, learning tasks must extend beyond recall and basic reasoning.

It is clear that education is always changing to meet the needs of the student population. The need for instruction, curriculum, and assessment that promote the development of higher-order thinking is essential to the success of our future citizens. Webb's DOK provides an avenue for educators to align their instruction with both the needs of the students and the mandated standardized assessments used to analyze school performance. Learning tasks and assessment activities that push students to build their depth of understanding increases the likelihood that students will be able to apply their learning to real-world contexts.

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