

Positioning Ideas: Creating and Relating Physics Identities Through Video Analysis

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Abstract. Prior research has documented that analyzing video of children learning science aids pre-service teachers in developing physics knowledge and deepens their understanding of the learning process. Research on video analysis in teacher education suggests that the primary value of such tasks comes not from watching the video, but from the subsequent discussions. We questioned whether similar advantages would be evident when participants watched and analyzed video clips via online threaded discussions. We found that participants used the video clips as a mediating tool to position their own current ideas about physics topics with respect to their prior understandings as well as to ideas articulated by the students in the video clips. We discuss the study findings and affordances and limitations of online discussion formats.

Keywords: Physics Education Research, video analysis, electronic discussion boards, teacher education, identity.

PACS: 1.40.E-, 1.40.eg, 1.40.Fk, 1.40.G-, 1.40.J-, 1.40.Jc, 1.50.ff

INTRODUCTION

Prior research on the Physics and Everyday Thinking (PET) [1] curriculum has shown that when students analyze video of children learning similar content to what they are learning in class, they show evidence of developing pedagogically-relevant physics content knowledge [2]. Specifically, the pre-service teachers enrolled in PET demonstrated their content knowledge by restating children's ideas in more academic language. Physics content knowledge was required to tease out valuable ideas from the children's discourse. These findings align with other work that shows that analyzing video of children learning science facilitates teachers' ability to develop useful science knowledge for teaching [3,4,5]. Much of this research indicates that the discussion surrounding the video is as important as the video itself. In many courses, however, limited time prevents sufficient discussion of videos of children learning. With the goal of retaining the valuable experience of talking about the video while conserving class time, we have experimented with moving the discussion of video onto an electronic discussion board.

In this study, undergraduates (pre-service teachers) in a physics course analyzed video of both children and other undergraduates learning and then posted their reactions and answered questions on an online discussion board. We analyzed these postings to understand how holding discussions electronically affected the learning experience. We found that the participants posted narratives in which they communicated stories about their own learning and positioned themselves as moving along toward a more expert-like understanding of the science content. Personal narratives are understood to be a tool for constructing identities [6] and thus the stories that the students told are evidence of shifting identities. We hypothesize that the video episodes facilitated this process by establishing known points of comparison.

METHODS & CONTEXT

The interactive hands-on nature of the previously mentioned curriculum, Physics and Everyday Thinking (PET) and its companion curriculum, Physical Science and Everyday Thinking (PSET) [7] requires equipment and a classroom set up to facilitate discussion among students in small groups. Such

requirements preclude many institutions from offering PET/PSET or similar courses even if they desire to. To meet the space and equipment constraints of such institutions, Learning Physical Science (LEPS) is being developed. LEPS uses technology such as student response systems (“clickers”), videos of experiments, and online discussions to maintain many of the inquiry aspects of PET and PSET and allow for instruction in a traditional lecture hall.

LEPS includes learning goals associated with both physics content and with understanding how people learn and how scientists develop new science ideas. In special activities that focus on learning about learning and nature of science learning goals, LEPS students watch videos of children and undergraduates talking about science. The videos of elementary school students are similar to those in PET/PSET. The videos of undergraduates were added because of the broadening of the target audience and to make up for the fact that, in LEPS, scheduling constraints mean that students have fewer opportunities to consider the reasoning of their peers. The LEPS students discussed these videos in an online asynchronous threaded discussion format in activities called “Unit Tasks” which were completed over the duration of each unit.

Research Design

Research Questions. This study was designed to answer the question, “How do prospective elementary teachers demonstrate their understanding of content knowledge when analyzing video tapes of elementary and undergraduate students in online discussions?” This was intended to help us understand the value of the Unit Task Activities.

Data. The data analyzed in this study come from one institution which piloted LEPS in the Spring of 2009. The students (N=34) were mostly juniors and seniors who intended to become elementary teachers. Here we chose to focus on the Unit 2 Task which included video of elementary students talking about forces and friction and undergraduate students talking about the relationship between mass and motion (inertia).

Analysis. We coded the LEPS students’ discussion postings based on the function of the text. Sample codes and examples are included in table 1. In addition to the codes included in Table 1, codes included text that served as social mediating talk such as agreeing and disagreeing with group members. Particular combinations of codes allowed us to identify interesting postings that we analyzed further as narratives. These analyses are explained in greater detail in the findings section.

Table 1: Sample codes and Example text

Code	Example
Direct talk about physics (PHYS)	There is another force that is also acting on the soccer ball, which is making it slow down. This is frictional force.
Analyze other’s ideas- children (AC)	The children understand that the foot is a force acting on the ball
Analyze other’s ideas – undergrads (AU)	This is similar to the undergraduate’s ideas of the force of friction acting on the cart changes the speed of the cart
State own ideas - prior (OI-P)	Before this class ... I used to think that some force was transferred to the ball,
State own ideas - current (OI-C)	However, now I know... The minute contact is lost the force is no longer working on the object.

FINDINGS

Finding 1: Students’ position ideas when posting about others’ ideas

Our primary finding is that the activities provided the opportunity for LEPS students to exhibit their understanding of content knowledge primarily through comparing their own ideas to those of the children and other undergraduates in the video. This occurred largely through a discursive practice common among all the groups that we call *positioning ideas*. We identified this practice through the co-occurrence of the following codes within a given posting: *analyzing other’s ideas* (children’s or undergraduates’) and the code(s) *state own ideas* (current or prior) or *direct physics talk* (which we inferred represented LEPS students’ current ideas). This occurred in posting by 87% (27 of 31) students who posted a response for the analyzed sections of the activity.

Transcript 1 is a sample posting by a LEPS student, “Joanne.” Notice that codes associated with analyzing the ideas of others and codes associated with reflecting on her current and prior ideas tend to alternate. It is at these junctions that comparative wording indicates that she is comparing her ideas to those expressed by the students in the videos. These comparisons are underlined in the example transcript.

Through this practice of positioning their own ideas with respect to others, the students expressed how their current ideas differed from those of the elementary students, thus showing their expertise in the topic. They also discussed how their ideas had changed and developed, sometimes mentioning specific events or discussions in the classroom that led to changing ideas.

Transcript 1: Joanne, U2P1-2

Text	Code
1 It seems that fifth graders are getting force	AC
2 mixed up with energy. They were correct	
3 when they said the force comes from the foot,	
4 however, both groups ... said that the force of	
5 the kick stays with the soccer ball as it	
6 continues to move. This is very logical. The	
7 2 nd /3 rd grader understands that to keep the toy	
8 car moving it needs some sort of power	
9 source, such as a battery or electricity;	
10 otherwise the car will come to a stop. <u>My</u>	OIP
11 <u>ideas about force were similar to both of these</u>	
12 <u>ideas. Now that I have learned about force, I</u>	OIC
13 <u>understand that</u> force is applied, but does not	
14 stay with an object after contact no longer	
15 exists. Therefore, after the foot is done	
16 making contact with the soccer ball, there is	
17 no more force- only energy. <u>Like the 2nd/3rd</u>	
18 <u>grader said, I believe that</u> for an object to	OIC
19 continue to move forward without a direct	
20 force being applied some sort of other power	
21 must be present, unless there is no friction	
22 present. None of the elementary students	AC
23 directly discussed friction. The 2 nd /3 rd grader	
24 did talk briefly about gravity. He said that	
25 gravity helps the car slow down. <u>This would</u>	AU
26 <u>be the same thinking as the last undergraduate</u>	
27 <u>student that spoke.</u> All of the ideas relating to	
28 friction slowing the object make sense..."	

Finding 2: Students' identified common features of their own and children's ideas.

There is evidence in the discussion postings that the LEPS students noticed that the children and other undergraduates had good ideas. For example, one student stated, "The children's ideas about force are very logical. They know that something is happening at the moment that their foot and the ball touch in order for the ball to move." This type of statement in which the LEPS student discussed the logic, intelligence, or the reasonableness of the children's ideas happened in all of the analyzed postings. In all but one of these postings, the LEPS students identified some commonality between the ideas that they themselves began the course with and the ideas expressed by the elementary students in the videos. In the one exception, the LEPS student expressed that she thought the children's ideas were logical but she did not express similarities with her own ideas.

EXPLAINING FINDINGS

We explain how the video facilitated the valuable practice of positioning ideas in two parts. First we

discuss the idea of constructing identity through narratives. Second, we discuss how the video episodes served as a "marker" that the LEPS students could use to make comparisons.

The role of the discussion board: Postings as Narratives

Wortham [6] claims that individuals create and reinforce particular identities when they position themselves with respect to others (people they are talking about or their audience). The LEPS students' responses generated during the threaded discussions contain several narrative-like features. These accounts have a clearly defined teller, tale, and audience; a trajectory that leads the audience to some form of conclusion; and the postings incorporate displacement (descriptions of events removed in time from either the teller or audience), all salient features of narratives [8].

Positioning in narrative analysis is connected to the formation of identity. Wortham pointed out that the tellers of autobiographical narratives have double roles: one role within the story being narrated and one that positions themselves in relation to their audiences. Thus, if the discussion postings are taken as narrative accounts of their physics learning, how the students position themselves in the narrative with respect to their audience (group members) and the characters in their story (students in the videos) provides important information about the student's evolving identity as a physics learner. Auto-biographical narrators create and re-create their selves when they represent and position themselves in multiple ways. In LEPS, students position themselves as knowledgeable in physics with respect to the children in the videos. Perhaps, more importantly, they also position their current selves as experts in relation to their prior selves before they enrolled in the LEPS course.

The role of video: Establishing a referent

We conjecture that the video episodes of others (children and other undergraduates) assist the LEPS students by providing a referential point of comparison for their own ideas. If students are simply asked to articulate how their current ideas compare to their prior ideas, they cannot make very educated estimates of how much their ideas have changed. This is because each estimate is very imprecise. Knowing whether one knows "a lot" or "a little" is difficult when one does not know what there is to learn. As a result, comparing these two assessments of their own knowledge does not result in very specific estimates of their learning (akin to comparing two measurements with very large error bars). Thus the student who is reflecting on her

learning can not be certain of how much she has learned in the scheme of physics knowledge. However, when the student compares her ideas to a known value (e.g., the elementary children's ideas expressed in the video), she can establish her own ideas (pre and post) with more precision. This facilitates a better understanding of the *change* in her ideas.

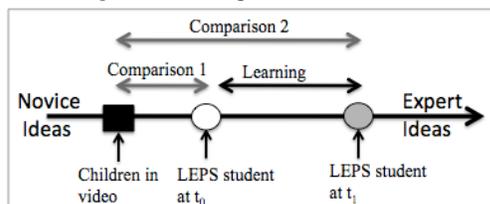


Figure 1: How video facilitates positioning ideas

Figure 1 depicts a continuum of novice to expert ideas. Because the children's ideas are known, the students can locate prior (white circle) and current (grey circle) selves along the continuum by describing this as a distance from the children's ideas. This facilitates a description of their development of physics expertise. Providing two referents (the children and other undergrads) may result in even better estimations of how much one has learned.

DISCUSSION AND IMPLICATIONS

Using an asynchronous electronic discussion board for discussing video of others' ideas seems to have value. In particular, it appears that questions in which students are guided toward positioning ideas which requires both the analysis of others ideas and reflection on their own ideas for helping students develop narratives that position themselves as experts with respect to others (the children) and with respect to themselves earlier in the course.

This study has implications for elementary teacher education. It is well established that elementary teachers do not see themselves as science teachers, but rather as teachers of other subject matter (e.g., literacy, math). This is one of the reasons used to explain the lack of science instruction that aligns with authentic science inquiry at the K-5 level [9]. Helping teachers establish identities as science learners is an important function of the science courses that pre-service elementary teachers take. Integrating this type of activity into science courses may help elementary teachers establish such identities and increase their willingness to teach science through inquiry.

That the teachers identified commonalities between their own ideas and the children's ideas is also important. Elementary teacher educators are challenged to help teachers see their students' ideas as reasonable [10]. Since pre-service teachers are more

likely to see their own prior ideas as reasonable and based on experience, finding commonalities between their ideas and the ideas of children makes it easier to see children's ideas as reasonable.

While all the participants in this particular study were pre-service elementary teachers, we expect that this type of activity would contain value for any student taking an introductory physics or physical science courses. The ability to reflect on one's learning is an important aspect of learning [11]. Using video clips of others as tool for facilitating the positioning of one's ideas may make reflection on learning a more explicit aspect of the learning process.

In this paper we claim only that the online discussions seem to have some value, not that they have more or less value than face-to-face discussions. More research is necessary to compare the relative value of discussion formats.

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