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Studying Triggers for Interest and Engagement Using Observational Methods

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In this article, we discuss the contribution of observational methods to understanding the processes involved in triggering interest and establishing engagement. We begin by reviewing the literatures on interest and engagement, noting their similarities, differences, and the utility to each of better understanding the triggering process. We then provide background information about observational methods and a case illustration of their use in a post hoc analysis of observation records collected during an out-of-school biology workshop. In conclusion, we consider the advantages and limitations of observational methods. We suggest that they can offer unique insight into the triggering process. In the post hoc analysis, this includes information about multiple, co-occurring triggers for interest and variation in responses to triggers based on learner characteristics. It is acknowledged that observational methods are not sufficient, but they are necessary; they provide essential detail, especially for understanding the triggering process.

"I think I see a bug! What kind of bug is it? Hey! I found one!"
"Hey! What's that?"
"Hey! Look at this! What?! Ooh! Let me see!"
"Hey! I found a worm! Two worms! Three worms! Four worms! Four worms!" (Observation record, July 11)

Deisha[1] says, "Ok, I'm going to touch it. One, two, three." Then she touches the worm! And then she screams. Brandon pretends to be a news reporter with a microphone. "This just in. Deisha just touched a worm!" Deisha then says, "I just want to pick it up so I won't be scared." Then she picks up the worm. "I broke the family curse: the one where you're not supposed to touch nasty stuff. Now I'm not scared to touch it." She is clearly very proud of herself. She goes around telling everyone, "Look, I picked up a worm! I touched a worm!" (Observation record, July 12)

Spencer is looking at his worm. At first he is scared, but he does the dissection anyway because he is so curious. . . . He has a conversation with Keith while looking at his worm. Spencer: "Have you opened up a worm before?" Keith: "Yes." Spencer: "You're a scientist." About ten minutes later, when Spencer has progressed further in his dissection

of the worm, and is looking inside its head, the conversation continues. Spencer: "I want to grow up to be a scientist." Keith: "You want to do more of this?" Spencer: "Yeah." (Observation record, July 13)

Interest and engagement are both initiated when something catches the attention of a learner (Dewey, 1913; Hidi & Baird, 1986). As illustrated in the preceding excerpts from observation records collected during an out-of-school science workshop, learners can have their interest triggered (and engagement initiated) by the novelty of exploring a wooded area and touching worms or through the opportunity to discover for themselves what the inside of a worm looks like. The triggering of interest establishes engagement. The triggered interest may be fleeting, but there is the possibility that it will develop and lead to the kind of productive participation that characterizes more-developed interest (Guthrie et al., 2006; Harackiewicz, Durik, Barron, Linnenbrink-Garcia, & Tauer, 2008; Mitchell, 1993; Palmer, 2004).

Researchers and educators alike need to better understand the triggering process: which triggers for interest are likely to be effective and which features of the environment enable a triggered interest to be sustained (see discussion in Ainley, 2012). However, answering such questions is made complicated, at least in part, because studies of both interest

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[1]All participant names have been replaced with pseudonyms.

and engagement rely predominantly on self-report measures. Experiences that trigger interest are often—by definition—unexpected and ephemeral, and participants may not be reflectively aware that their interest has been triggered. As such, they also are not necessarily in a position to provide full reporting on the triggering process.

In this article we consider the use of observational methods to study the process of triggering. We first overview research on both interest and engagement. Following this, we provide background information about observational methods and then present a case illustration drawn from our own post hoc analysis of observation records collected during an inquiry-informed, out-of-school biology workshop for at-risk[2] middle-school-aged participants. We conclude by pointing to advantages and limitations of observational methods in the study of triggers for interest and engagement.

INTEREST AND ENGAGEMENT

Although interest researchers use the term "engagement" to define interest, and engagement researchers speak of "interest" as relevant to engagement, studies of interest and engagement are almost entirely distinct. There is very little cross-referencing between the two literatures even though the two variables reference the same phenomena. The scope and focus of studies on each reflect different purposes (see Järvelä & Renninger, 2014). Interest is a cognitive and affective motivational variable (Hidi & Renninger, 2006), whereas engagement is typically studied as cognitive, affective, *or* behavioral (e.g., Fredricks, Blumenfeld, & Paris, 2004; see also Sinatra, Heddy, & Lombardi, this issue). The study of each type of engagement considers interest, conditions of the environment, and purposes of the learner (Christenson, Reschly, & Wylie, 2012). In their epilogue to the *Handbook of Research on School Engagement*, Reschly and Christenson (2012) noted, "We speculate that... engaging or disengaging students cognitively and affectively precedes changes in students' behavior and academic engagement" (p. 9). Research on interest corroborates their hunch: Interest represents the cognitive and affective motivational components of engagement to which they point even though interest theory describes the two components as coordinated rather than separate (Renninger, 2000). On the other hand, both interest and engagement researchers would predict that it is possible for a person with low interest to be behaviorally engaged, suggesting that behavior is considered separately in both literatures. Even so, triggering interest and supporting its development are likely to be essential to whether an engagement intervention will have the power to change behavior.

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[2]In this study, participants are African American and of low socioeconomic status. They attend schools in an inner-city school district ranked among the lowest in the state.

Interest

Interest describes both the psychological state of a person during engagement with particular content (e.g., science) and the motivational predisposition to return to engagement with that content over time (see reviews in Hidi & Renninger, 2006; Renninger & Hidi, 2011). Renninger and Hidi (2011) pointed out that interest has five characteristics. First, interest always occurs with respect to a particular class of objects, events, or ideas. Second, interest has both cognitive and affective components that co-occur and shift with the development of interest. As knowledge about content develops, valuing for and feeling about the content of interest are enhanced. Third, interest develops in relation to the learning environment and is malleable: The support of a teacher or peer, participation in out-of-school activities, and the features of a task are all characteristics of the learning environment that can contribute to interest development. Fourth, a person may or may not be aware of the triggering process, either because he or she has so little interest that there is no expectation of interest or because he or she is so caught up in the experience of interest. Finally, interest has been shown to have a neurological basis; learners are hardwired to want to reengage and develop their understanding of contents of interest over time. Research indicates that the presence of interest optimizes the possibility that learners will seriously engage with content, solve challenging problems, set goals, and/or and self-regulate personal behaviors (e.g., Harackiewicz et al., 2008; Sansone, Smith, Thoman, & MacNamara, 2012).

Engagement

Engagement is defined in terms of learners' active involvement, or participation, in school or extracurricular activities and their commitment to related goals (see Christenson et al., 2012). Engagement may describe particular involvement with content (e.g., science) but more typically references a broad range of cognitive and affective experiences as well as social and academic behaviors (e.g., following rules, completing assigned tasks; see Fredricks et al., 2004; Fredricks & McColskey, 2012). Engagement includes both interest and the forms of participation and self-regulation needed to attain "desired academic, social, and emotional learning outcomes" (Christenson et al., 2008, p. 1099; see also Ainley, 2012; Azevedo, diSessa, & Sherrin, 2012; Christenson et al., 2012; Skinner & Pitzer, 2012). It is possible to be behaviorally engaged but not interested, whereas it is not possible to have an interest in something without being engaged in some way (e.g., behaviorally or cognitively).

Background on Interest and Engagement Research

The roots of research on interest and engagement differ. Presumably because of its central role in promoting success

in school, interest has a long history in both educational and psychological research. For example, early educators such as Pestalozzi (1898/2004), Herbart (1806/1965), and Dewey (1913) pointed to the centrality of interest for supporting learning. They noted the importance of interest in encouraging effort, focused attention, and persistence to understand and that the design and/or sequencing of tasks was likely to promote learners' interest in content to be learned.

The thinking of early educators and psychologists provided the groundwork for studies suggesting that classroom organization, task features, and attributes of activity can support the development of interest. For example, Hidi, Weiss, Berndorff, and Nolan (1998) observed that when students worked in groups and were assigned roles and responsibilities for their visit, their interest for and attention to exhibits in a science museum was triggered and increased. Durik and Harackiewicz (2007) reported on the basis of experimental findings that learners with less developed interest are more likely to respond to novelty in a mathematics task, whereas learners with more developed interest are more likely to respond to challenge when working with similar types of tasks. Finally, Dohn (2013) used descriptive analysis and informal interviews to demonstrate that most middle school-aged learners can have their interest triggered by open-ended, design-based, engineering tasks.

Study of engagement is a more recent literature that describes learners and their characteristics in response to their environment. Research on engagement was first undertaken to understand adolescent disengagement with school and to provide descriptions of school contexts, both to enable effective intervention and to reduce dropout rates (e.g., Finn, 1989; Fredricks et al., 2004; Reschly & Christenson, 2012; Shernoff, 2013). As a result, studies of engagement have tended to center on student resilience in relation to the school context, the nature of the variables that characterize resilience, and how teachers might be supported to effectively meet the needs of their students. Such studies suggest that engagement is malleable, responsive to the environment, and influenced by personal characteristics (e.g., Gresalfi, 2009; Skinner & Pitzer, 2012). For example, the work of Skinner and her colleagues (see Skinner & Pitzer, 2012) provided a systematic analysis of students' academic coping behaviors and suggests that the same characteristics that enable engagement (e.g., feelings of competence) also inform responses to setbacks or challenges. Using data from a large-scale survey, Martin, Ginns, Brackett, Malmberg, and Hall (2013) reported on the reciprocity of resilience or buoyancy and psychological risk factors such as academic anxieties, need for control, emotional instability, and failure avoidance. Finally, Turner, Warzon, and Christensen (2011) suggested that promoting teacher understanding of student motivation can lead to positive changes in instructional practice, thereby positively impacting student engagement.

Similarities Between Interest and Engagement

The research literatures on interest and engagement each point to the environment (e.g., the exhibit, the workshop, the classroom) and to educators (e.g., the docent, the workshop facilitator, the teacher) as critical to whether and how learning occurs. Both literatures describe possibilities for change and recognize that educators are potential supports for (but also can be constraints on) learning. In addition, interest and engagement are considered variables that can develop. They are each what Gresalfi (2009) would describe as an "individual-with-context theory" (p. 330; see also Sinatra et al., this issue): They develop in the relation or interaction between a person and the environment (e.g., Appleton, Christenson, & Furlong, 2008; Barron, 2006; Hidi & Renninger, 2006; Nolen, 2007; Pressick-Kilborn & Walker, 2002; Reschly & Christenson, 2012).

Research on interest and on engagement each point to differences among participants based on their phase of interest and/or level of engagement, and to the possibility that interest and engagement can be supported to develop (e.g., Hidi & Renninger, 2006; Price, 2006; Serrell, 2006; Skinner & Pitzer, 2012). A learner with a more developed interest is likely to be engaged with or to independently seek engagement with particular content, whereas a learner with a less developed interest may or may not be engaged and is likely to need support from others and/or from the design of the environment (e.g., activities, programming, etc.) to engage. Without support, a learner with less developed interest may not even recognize the opportunities for engagement that exist in a given environment (Renninger, 2010).

Differences Between Interest and Engagement

Interest and engagement differ with respect to their focus and expectations about learner meta-awareness. Interest is a psychological variable that is always content- or object-specific, meaning that a person has an interest in a particular activity, set of questions, or field of study (see Krapp & Prenzel, 2011). Interest is a dynamic variable that changes in relation to triggers for the generation of and/or further development of interest (Renninger & Hidi, 2011). It has been found to have a reciprocal relation with other motivational variables such as goal setting (e.g., Harackiewicz et al., 2008), self-efficacy (e.g., Hidi, Ainley, Berndorff, & Del Favero, 2007), and self-regulation (e.g., Sansone et al., 2012); this suggests that (a) as interest develops, feelings of self-efficacy and the ability to set goals and self-regulate develop and (b) supports for self-efficacy, goal setting, and self-regulation are important, especially in earlier phases of interest development. In earlier phases of interest, triggers for interest are primarily external (e.g., from features of the environment, tasks or activities, other people), and in later phases of interest development, triggers are more likely to

be self-generated based on a person's curiosity questions (Hidi & Renninger, 2006; see discussion in Renninger & Hidi, 2011).

Although studies of engagement may also address on one or another particular content, they are a contrast to studies of interest because they are focused more generally on participation and related goals in relation to the classroom (e.g., Davis & McPartland, 2012; Gresalfi, 2009) or family (e.g., Bempechat & Shernoff, 2012; Raftery, Grolnick, & Flamm, 2012), and their influence on achievement motivation (e.g., Anderman & Patrick, 2012), identity (e.g., Crick, 2012), mind-set (e.g., Brooks, Brooks, & Goldstein, 2012), motivation (e.g. Schunk & Mullen, 2012), and/or triggers for interest (e.g., Ainley, 2012). Thus, whereas interest is conceptualized as a psychological variable that develops in relation to the environment, research on engagement describes the learner in the learning environment and the contribution or impact of other variables that may include, among others, interest and motivation.

As previously stated, research on interest indicates that learners may or may not be aware of their interest. In the earlier phases of developing interest, learners may not recognize that their interest has been triggered. In later phases of interest development, learners may be more focused on their activity and their self-set goals than on their interest in the activity (Renninger & Hidi, 2011). Meta-awareness and students' assumption of responsibility for their learning can contribute to the development of interest from one phase to another (see Renninger & Su, 2012). When interest is supported to develop (through the design of the environment and tasks and/or scaffolding from others), the learner begins to formulate his or her own questions, to articulate his or her own goals, and to self-regulate in order to satisfy his or her curiosity and/or to accomplish self-set objectives (e.g., Harackiewicz et al., 2008; Pressick-Kilborn, 2015; Sansone, Thoman, & Fraughton, 2015).

Interventions designed to support engagement assign a central role to self-reflection and the need for the learner/worker to assume responsibility for himself or herself (e.g., Christenson & Reschly, 2010; Crick, 2012; Skinner & Pitzer, 2012). They also acknowledge and account for the role of learner characteristics in this process, which interest researchers have not. In their data-driven, personalized, and structured "Check and Connect" intervention, for example, Christenson and her colleagues have described a model for working with students and their families to help them set goals that promote each student's school success and engagement (e.g., Anderson, Christenson, Sinclair, & Lehr, 2004; Christenson & Reschly, 2010). The success of the intervention draws on available information (data) about students' activity and their characteristics, and it builds on connections that are made between students and teachers and between teachers and the family.

In interest research, the cognitive and affective components of interest are described as co-occurring and shifting in their relation to each other as interest (and engagement) develops (Renninger & Hidi, 2011), whereas in engagement research the experience of the learning environment is typically discussed as being composed of multiple and distinct components, for example, cognitive, affective, and behavioral (e.g., Fredricks et al., 2004; see Christenson et al., 2012; Fredricks & McColskey, 2012). Research on engagement has not addressed distinctions among phases of interest (earlier and later) and their implications for the development of engagement, possibly because studies of engagement in which interest is referenced focus on feelings and value and have not also considered knowledge, which is essential for the deepening of feelings and value that characterizes more developed interest (Hidi & Renninger, 2006).

Interventions to support engagement have also not emphasized the importance or relevance of triggers for interest as positioning the learner to engage and to set goals for participation that are productive. However, research on interest has now established that interest develops beginning with its initial triggering, and that if it is sustained, it can support the development of interest and, by definition, engagement to develop (e.g., Harackiewicz et al., 2008). Of importance, it is the psychological state during engagement that may (or may not) be triggered. Whether the psychological state is triggered and then also supports the development of a motivational predisposition to reengage (interest research), or engage (engagement research), is dependent on the person and on the given environment.

Triggers for Interest

For researchers and educators of both interest and engagement, understanding more about the triggering of interest is essential. As Ainley (2012) pointed out, there is evidence that a responsive educator and an appropriate environment can enable a person to become more engaged (e.g., Christenson & Reschly, 2010; Fredricks, 2014; Pressick-Kilborn, 2015; Shernoff, 2013). She also noted that there is evidence that some learning environments do not meet the needs of learners; rather they constrain the possibility that interest will develop and that engagement will be sustained (e.g., Skinner, Furrer, Marchand, & Kindermann, 2008; Turner, Krackar, & Trucano, 2015). Better understanding of how participants respond to and work with activities would help researchers to better articulate the relation between the triggering process and its context. Such understanding would also support educators to more effectively design and facilitate learning environments that are responsive to learners' needs (see Blumenfeld, Marx, & Harris, 2006).

To date, studies of the generation or triggering of interest have tended to be experimental, or to be conducted using an experimental lens that constrains them to focus on one or another particular feature as a trigger for interest (e.g., novelty or challenge). They are probability statements about

the likelihood of persons to have their interest triggered. Because experimentation requires that variables be isolated, triggers are typically treated in the interest literature as independent occurrences that trigger the interest of all persons in the same way. Questions about whether it might be appropriate to describe triggers as co-occurring with one or more other triggers have not been addressed, nor has the potential for interactions among triggers been considered. Controlled experimental settings have not led interest researchers to address questions about whether triggers work the same way for all learners, at all times, in a variety of settings, with different content, as components of different activities, and so on. These types of questions could be important to consider when working to successfully scaffold learner engagement.

Observational (ethological) records that provide detail about what learners are actually doing as they engage with an activity provide a complement to self-reported information about learners' interest in such activities. In fact, Fredricks and McColskey (2012) noted that a distinct advantage of observational methods is that they can provide rich description of different levels of engagement in the learning context. However, observational data have been used neither to study questions specific to the triggering process at the level of the activity nor to compare learners' engagement across activities.

OBSERVATIONAL METHODS

Observational methods include taking notes, keeping running records, and filming video. They can chronicle language, audience, activity, and/or routines and can supplement information provided by experimental methods. They may be used to assess individual- or group-level engagement using either descriptive techniques or predetermined coding categories (see Fredricks & McColskey, 2012).

Although sampling is typically not random, as observation often focuses on an existing participant group and there may or may not be a control group that looks like that of an experimental study (see discussion in Altmann, 1974), observational methods are rigorous and reflect an articulated set of decisions. For example, considerations include how obtrusive the method of data collection is, how much time is needed to have a valid observation (Waxman, Tharp, & Hilberg, 2004), and whether interpretive behavior categories should be part of the record or if running records (cf. Carini, 1975) should be collected instead (Altmann, 1974). Observational methods include precautions for bias in both planning and analysis (Cochran, Moses, & Mosteller, 1983). Establishing the validity of observational data includes addressing its internal consistency or plausibility as well as its external consistency—whether the data

collected can be verified (e.g., Altmann, 1974; Heath & Street, 2008; Waxman et al., 2004).

As Varenne and McDermott (1999) suggested, observational methods provide a starting point for looking closely at learning activities and their structure, and for possibly noticing new indicators on which to focus. They also can suggest emergent patterns that warrant further attention (Dyson & Genishi, 2005) or that challenge working understanding based on experimental evidence. Because they are grounded in practice, observational methods can also be a first step in developing the type of understanding of learner engagement that is likely to be useful to practitioners. They can be used purposefully to provide deep understanding of a particular case, albeit with the recognition that they will not necessarily generalize to different social or cultural contexts (Dyson & Genishi, 2005).

Case Illustration

For purposes of illustrating the utility of observation records as a data source, we describe a post hoc study we undertook to understand features of activities as triggers for interest in an out-of-school biology workshop. The observation records were initially collected as part of a larger multimethod study of workshop participants (Renninger, Bachrach, & Posey, 2008).

Rationale

Initial goals for the larger study included using multiple methods to track the development of science literacy and self-efficacy for science among participants who were identified as having little if any interest in science. As such, assessment interviews addressed participants' abi enough idea is captured by the first sentence in this section. a complements would reference actually being active in the lities to see themselves as possible scientists as well as their understanding of science; interviews included questions and tasks reflecting three models of science learning: Science-as-Theory Change, Science-as-Practice, and Science-as-Logic (Lehrer & Schauble, 2006; see Renninger et al., 2014). Participants were interviewed during the week prior to the start of the 5-week summer program and again 5 weeks following the program's completion.[3]

Participants' responses to the follow-up interview questions showed little improvement in either science literacy or self-efficacy for science. Anecdotally, however, program instructors and the researcher compiling the observation records of workshop activities agreed that the participants

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[3]Because there are a number of studies of this out-of-school workshop context as a learning environment, we should clarify that the cohort of participants referenced in this article later served as a control group for participants who received the ICAN Intervention in a subsequent iteration of the workshop (see Renninger et al., 2014).

were generally interested and productively engaged in the workshop activities and wondered if the observation records held insight about whether some activities were more likely than others to trigger participants' interest in science and sustain their engagement. Workshop instructors were particularly interested in learning about possible differences among the activities of the workshop and how participants engaged with them. We undertook a post hoc analysis of the observation records to consider the instructors' questions, using the conceptual framework and assumptions of interest research, which suggested a focus on the role of the environment and potential differences among learners but did not, like the engagement research, take potential differences in learner characteristics as a starting point of its research. Based on our emergent findings, the post hoc analysis became a two-part study, taking learner characteristics and the literature on engagement into consideration more explicitly.

Observation Records

The data on which we drew are continuous anecdotal observation records (cf. Carini, 1975) that were collected each day of the workshop. The records chronicled instructors' and participants' conversations and their observable behaviors. Immediately following each workshop session, the researcher met with the workshop instructors to review the notes collected for that session. This allowed the researcher to confirm that the written record was accurate and to add clarifications to the record (e.g., information about what happened on the other side of the room from where the researcher was positioned).

The observation records were gathered prior to the identification of the questions for this study. Therefore, during the collection of this data there was no way that either the researcher or the workshop instructors could have anticipated the questions to be considered in this study.

Research Questions

Informed by grounded theory (Strauss & Corbin, 1998), Part 1 of the study was designed to allow the tracking of triggers for interest in workshop activities and addressed two questions:

1. Which of the triggers for interest identified in the research literature can be identified in the naturally occurring context of an out-of-school science workshop?
2. Given available data, what can be said about when triggers for interest work or do not work?

As evidence from the observation records was collected and analyzed, it became apparent that great variability existed in the ways in which the participants responded to triggers for interest.

Emergent findings from Part 1 of the study suggest that the triggering process needs to account for both the possibilities of the activities in which the learners participate as well as the characteristics of the learners. Part 2 was therefore designed to allow further exploration of the relation between triggers and learner characteristics. Research questions for Part 2 included the following:

1. Of the learner characteristics identified in the research literature, which can be observed to influence whether triggers for interest will work or not work in the naturally occurring out-of-school science workshop context?
2. Given available data, what can be said about the relation between learner characteristics and triggers for interest?

Each part of the study included two steps. First, we identified relevant variables and developed methods for data reduction; we then used these to analyze the observation records.

Data Reduction

Data reduction was undertaken using directed content analysis (Hsieh & Shannon 2005; Potter & Levine-Donnerstein, 1999). This analytical strategy draws on existing research and theory to inform data reduction and allows identification of emergent categories. Data reduction for each part of the study was iterative, was parallel, and included five steps. The process used to identify the triggers in Part 1 of the study follows.

First, literature addressing interest, collative variables, and affordances was reviewed in order to compile a preliminary list of triggers. Relevant articles, chapters, and books were identified using PsycINFO. Concepts and terms on this preliminary list were wide ranging and included, for example, visual stimuli (e.g., shapes, colors, photos, vivid imagery; see Durik & Harackiewicz, 2007; Hidi, 2001; Hidi & Anderson, 1992; Schraw & Lehman, 2001; Wade, 1992); topics (e.g., death, danger, chaos, destruction, disease, injury, power, money, sex, romance; see Schank, 1979); character identification (Hidi, 2001); entertaining style (Wade, Buxton, & Kelly, 1999); humor (Schraw & Lehman, 2001); fantasy (Durik & Harackiewicz, 2007); collative variables (e.g., surprise, change, incongruity, uncertainty, conflict, complexity; see Berlyne, 1960); suspense (Schraw & Lehman, 2001); puzzles, computers, group work, meaningfulness (Mitchell, 1993); activity level (Hidi & Anderson, 1992); hands-on, competence, belongingness, social interaction, games (Bergin, 1999), and many more. Terms reflected a number of different types of triggers, including those that are text based, task based, knowledge based, feeling related, value related, emotional, cognitive, environmental, sensory, and so on.

Second, informed by the preliminary list of triggers, observation records were read in their entirety, and all evidence of triggers for interest—anything that corresponded to something on the preliminary list—was marked. For example, we marked all activities that involved group work or social interaction (e.g., participants working together to collect worms) or hands-on activity (e.g., dissecting a worm); all instances of instructors' instructional conversation, or of their provision of scaffolding or external support to help participants reach new understanding (Yamuchi, Wyatt, & Carroll, 2005); all evidence of new realizations by participants (e.g., "I didn't know we had that kind of bones" [Observation record, July 25]) or of participants encountering and/or overcoming challenge (e.g., participants were visibly frustrated while trying to understand the logic of isolating variables during an experiment designed to identify what seeds need in order to grow). However, later, "Amber gets the right answer when Shawna asks her what she can learn from a particular set of seed germination bags, and she is so excited. They do a high-five, and Amber is glowing" Observation record, July 5).

Third, the initial, comprehensive list of triggers was amended to include only those terms that were noted in the observation records. The list was pared down by consolidating terms that represented related constructs and that could not be distinguished from one another based on observation. For example, terms such as coherence, discrepancy, a hole in the schema, surprise, unexpectedness, variety, and visual stimuli could all be said to refer to novelty. Meaningfulness was subsumed by personal relevance, which was identified by participants' verbal references to past experiences as relating to workshop activity; more specific information about participants' internal connections to and valuing of workshop activity could not be observed and was not inferred. In addition, terms that originally were studied in different content areas such as reading, writing, or math were adapted for the science workshop context.

Fourth, theoretical and empirical research literature on each of the identified triggers was reviewed with attention to different disciplinary contexts and theoretical traditions (e.g., cognitive, educational, social psychological). The *Encyclopedia of Education*, the *Oxford English Dictionary*, and Dictionary.com were also consulted, to obtain both academic and colloquial understandings of the terms. This was done to confirm decisions about the mapping of variables in the literature to the workshop activities. We wrote working definitions for each of the triggers on the consolidated list, taking into account theoretical considerations, empirical findings reported in the literature, and observations from the workshop.

Fifth, we reread the observation records using the working definitions for coding purposes. We rereviewed the literature, refined working definitions, and finalized a set of triggers for interest that could be studied in the workshop context.

Eight triggers for interest were identified that could be studied in the workshop context: autonomy, challenge, computers/technology, group work, hands-on activity, instructional conversation, novelty, and personal relevance.

In Part 2, the same approach to reviewing the literature and considering its use in the workshop context was used to develop a set of learner characteristics. The learner characteristics identified were activity level, awareness, emotionality, independence, mood, openness, reactivity, and sociability.

ANALYSIS

Following the identification of triggers for interest and learner characteristics for study in the workshop context, analysis of the observation records was undertaken. First, triggers for interest were tracked (Part 1) and then learner characteristics relevant to each trigger were identified (Part 2). Multiple sources of additional data from the larger study (workshop artifacts, participant interviews, caretaker interviews, and educator reports) were also available to the researchers as reference material for purposes of validating findings.

The post hoc study was designed to focus on triggers (and subsequently types of learner characteristics in relation to those triggers) at the level of the activity. Thus, analyses were undertaken at the level of the group as a whole, rather than for each individual participant (see Stake, 2005).

Part 1

In Part 1 of the study, each recorded instance (including the lack of an instance) of each of the eight triggers was marked and tallied, and then patterns in the occurrence of each were noted. Participants were judged to respond to triggers when the researcher characterized their engagement as reflecting positive affect and/or other intense emotional response, and/or they continued to engage. Interrater reliability for this analysis was high.

This analysis suggests that the process of triggering is complex and idiosyncratic—triggers that worked one day did not necessarily work the next day, and a trigger that worked for one student did not necessarily work for the next student. Emergent data from Part 1 suggest that the participants' responsiveness to triggers may be affected by their personality or temperament. For example, in the following excerpt from the observation records, differences are evident in the way in which the participants engaged instructional conversation and group work while observing crabs:

Deisha, Sierra, Abria, and Brandon do most of the talking. Alana talks a lot too, but she is a little more quiet. Amber has some good questions, but she is more reserved and seems only to ask her questions when she has the attention of an adult. She doesn't just blurt ideas out as much. Spencer is his usual quiet self, not saying much at all. Sean is having a bad day and is off sitting by himself, not participating. (Observation record, July 18)

Similarly, observation records from the walk in the woods revealed learner characteristics not evident in the classroom:

At the beginning of the walk, many of the girls were scared, and there was much screaming. Deisha zipped up her sweatshirt and tied her hood on tight. Abria held her field guide over her head. They were very clear that they did not like bugs. Especially Deisha was very scared about going into the woods, and she kept talking about how it wasn't something that she wanted to do. . . . Every so often I would see her face light up with interest, but she still spent a lot of time complaining about how she was scared and telling everyone about how she didn't like bugs. She said her mom didn't like bugs either. . . . There was one point when everyone was just off the path looking at a lot of worms under a log, and she said, "Why does it have to be over there?" She wanted to be a part of the excitement and to see the cool things, but she didn't want to walk toward the overturned logs. (Observation record, July 7)

The records suggest that triggers for interest may not be generalizable. They also point to dynamic quality of the participants' interactions with the environment. To predict the success of triggers, it appears that one would need knowledge and understanding of both the activities in the learning environment and information about the learner. Part 2 of the study was designed to allow exploration of this emergent hypothesis.

Part 2

In Part 2, each recorded instance of each trigger identified in Part 1 was reread, and the relevance of each of eight learner characteristics to each trigger was coded. For each trigger, relevant learner characteristics were then tallied. We found evidence suggesting that learner characteristics can affect when and how triggers work. However, not all triggers were affected by the same learner characteristics, nor were they affected to the same extent; some learner characteristics were found to have a greater effect on engagement with certain activities than with others. For example, one's level of awareness (a learner characteristic referring to the ability to draw on past experiences) could render certain content or activities more or less personally relevant (a trigger for interest).

Moreover, it appears that learner characteristics sometimes shifted from one session to the next, influencing whether a trigger would work. Deisha demonstrated little openness (a learner characteristic referring to willingness to try new things) during the first walk in the woods; as a result, she did not respond to challenge, experience the novelty of touching a worm, or participate in hands-on activity. During the second walk in the woods, she was more open and experienced all three of these triggers.

DISCUSSION

Data from analysis of the observation records provide insight about the nature of triggers that occur in a particular inquiry workshop and those triggers' relation to learner characteristics. These data suggest that there is a range of ways to trigger learner interest and to support learners to engage different activities. They point to the role that learner characteristics play in this process and the interaction of learner characteristics with triggers for interest and engagement. As such, these data also underscore the utility of working collaboratively with the participant to set goals for engagement interventions (see Christenson & Reschly, 2010) and point interest researchers concerned with application to this practice.

These data further indicate that activities or features of activities that have previously been assumed to trigger interest may not, or may not in quite the way that was expected. These data also suggest that both the nature of the activity and the characteristics of the learner may cause variation in the way that triggers work. For example, a trigger such as novelty can characterize multiple activities. There are also many ways in which something may be novel; a learner might do a new activity for the first time, learn new information, or be startled by novelty in the environment. Moreover, triggers for interest can also co-occur with one or more other triggers. Thus, for example, a novel activity may have hands-on components, technology, or group work as triggers as well, and it may not be possible to isolate the effect of any one of these features.

Our findings confirm the importance of studying the triggering process. They suggest that were the nature of triggers and the triggering process better understood, this could make a significant contribution to the design of learning environments that will promote all learners to develop interest and be productively engaged. Our findings also indicate that further exploration of the types of engagement established by triggers is needed. For example, it would be useful to know whether each individual is engaging each activity in the same way. It would also be useful to know whether some are engaged cognitively, whereas others are engaged behaviorally, or affectively, and what the impact of different forms of engagement are on continued engagement. Is a trigger that is accompanied by heightened affect more effective? Is a trigger that enables cognitive engagement more likely to enable sustained engagement?

Understanding more about the co-occurrence of triggers for interest would also be useful. Are activities that are more likely to include different types of triggers for interest also those that are most likely to initiate the development of interest and engagement?

Advantages and Limitations of Observational Methods

Observational methods can provide insight about processes that other modes of assessment (e.g., self-reports such as surveys and interviews) cannot. This is especially true if the research question concerns the triggering of interest, because the learner may not be aware of the triggering process. Observational data can also complement and provide opportunities for triangulating data from other sources. Moreover, summary information about triggers for interest in the workshop environment can provide invaluable detail about the triggering process. For example, it was useful to the workshop facilitators to hear that group activity may not trigger or sustain the interest of a participant who is not social. Although, once stated, this finding was obvious to all, its confirmation in the face of regular practices was important. Findings such as these are generative and provided the basis of thoughtful discussion, as can be expected of formative evaluation data. Given that the collection of observational data is labor intensive and expensive (see Waxman et al., 2004) post hoc analyses of this type may not only be appropriate but encouraged.

Observational methods do focus on a particular case, however, and findings may or may not extend to other groups. Two limitations of focusing on activity in a single workshop are: the sample is not random, and the number of participants is small. Even though the corpus of data from continuous running records of participant activity is extensive, a reasonable question is whether and how the findings might have differed if the demography of the participants or the particular learning context varied.

Although a post hoc analysis allows useful exploration of emergent findings, there are limitations to post hoc studies. The observational data were not purposefully collected to address questions about triggering. The sampling and description of learner engagement might, for example, have focused on fewer youth more continuously and/or with a limited set of activities. Had the setting allowed, we might have employed multiple observers, lapel microphones, and/or video data.

With insight gained from the type of post hoc study we conducted, it is possible to develop a protocol for recording observations that includes more detail about participant engagement with potential triggers. Such an observational protocol would include a list of potential triggers and a method for documenting each instance; the number of engaged participants could be chronicled, as well as the type and intensity of their engagement. This type of planned study need not preclude consideration of emergent findings as well, as long as the researcher is attentive to the possibility of these and their potential to extend understanding of the research questions posed.

Concluding Thoughts

In this article, we describe the triggering of interest as essential to both interest development and engagement, despite the fact that there has been very little cross-referencing of this relation in either literature. Our data suggest that one of the strongest features of observational methods is the view that they provide of the triggering process and the possibilities they offer for better understanding of initial phases in the development of interest and engagement. In particular, they suggest that there are multiple triggers for interest and engagement, and that responses to these vary based on learner characteristics.

Our findings raise questions for empirical studies in which the same novel or challenging stimulus is used for learners in different phases of interest development. They also suggest that future empirical work addressing the process of triggering needs to couple observation of the target activity with a study of triggers and consideration of learner characteristics. These findings further suggest the importance for researchers who study either interest or engagement to make efforts to track studies in the other literature, as they have the potential to be complementary and informative. Finally, our findings provide implications for practice that are fine-grained enough to be useful both to the facilitators of the workshop we studied and a model for those working in similar inquiry-based contexts.

Observational data are "inherently interpretive, subjective, and partial" (Heath & Street, 2008, p. 45); they are also purposeful, systematic, and positioned to provide a complement to findings from laboratory data. Although not sufficient on their own, observational methods and the data they yield have good potential to increase understanding of the triggering process and to inform both research and practice concerned with the development of interest and engagement.

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