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# Developing a Measure of Interest-Related Pursuits:

# The Survey of Connected Learning

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# Abstract

This paper describes an effort to develop a survey measure of adolescents’ interest-related pursuits. The measure focuses on youths’ experiences of *connected learning* (Ito et al., 2013)*,* an emerging model of learning supported by digital media. The survey measure includes items and scales intended to measure the depth with which youth are able to engage in an interest-related pursuit, the level of support and encouragement they receive from peers, and the degree to which their pursuit involves performance or media production as an essential feature. The survey items and scales also focus on connections between youths’ interest-related pursuits and academic goals, the involvement of adults as co-participants in pursuits, and youths’ access to technology tools they deem necessary for their pursuits. The paper reports on results from a pilot study and field test of these items, in which we estimated the reliability of scales and compared survey results to evidence from interviews with youth. In developing this analysis, our aim was to investigate the feasibility of an approach to measuring youths’ interest-related pursuits to inform future research and evaluation of initiatives focused on digital media and learning.

# Introduction

Interest is an important catalyst for learning and development. Early interests in particular topics can spark the development of expertise in specific areas when children receive help from others, especially parents (Crowley & Jacobs ,2002). Early interests also influence later decisions about majors in college and careers (Maltese & Tai, 2011; Tai & Maltese, 2010). Studies of adolescents show that youth seek out new resources and opportunities to learn about topics in which they are interested (Barron, 2006; Barron, Martin, Takeuchi, & Fithian, 2009). When individuals have well-developed interests, moreover, they engage in a number of actions typically associated with learning, including posing questions to advance their understanding, persevering through frustration and challenges, and seeking out feedback from others to improve their knowledge and skill (Hidi & Renninger, 2006; Renninger, 2009). An indicator of well-developed interests is that youth pursue them across multiple settings, such as at home and in organized afterschool programs, where they have opportunities to explore these interests and expand the ways they engage with those interests (Azevedo, 2011).

Increasingly, researchers have focused attention on how individuals organize *interest-related pursuits* over time and across settings. For purposes of our study, we define an interest-related pursuit as an activity that young people say they (1) enjoy doing and (2) get better at what they do the more they do it. In this way, our definition is consistent with psychological theories of interest development that consider enjoyment to be a key indicator of interest in an activity (Hidi, Renninger, & Krapp, 2004) and that emphasize the ways that expertise co-develops with interest (Hidi & Renninger, 2006). At the same time, in our conceptual framework and measures, we emphasize the central importance of social supports and material resources in enabling the development of interest within heterogeneous cultural practices (Azevedo, 2006, 2011; Barron, 2006). We emphasize these aspects of interest development, because students living in poverty are likely to have access to and make use of different kinds of resources and social supports for pursuing their interests than are available to and used by more economically advantaged students in their schools and communities (Calabrese Barton, 1998; Margolis, Estrella, Goode, Jellison Holme, & Nao, 2008; Schwartz & Gutiérrez, 2013; Watkins, 2011). In addition, parents and other adults provide different levels of social support and encouragement to boys and girls for interest-related pursuits in some domains such as mathematics and science (Brickhouse, Lowery, & Schultz 2000; Jacobs, Davis-Kean, Bleeker, & Eccles, 2005). Organized activities in informal learning settings, youth organizations, and community centers have sought to expand access and opportunity, and they merit further investigation as to their potential to promote equity and diverse pathways of development (Ito et al., 2013; London, Pastor, Servon, Rosner, & Wallace, 2010; National Research Council, 2009).

To date, there have been few attempts to develop and evaluate quantitative measures of youths’ experiences in interest-related pursuits across multiple settings and over time. This kind of work could advance our understanding of interest-related pursuits, both because attempts to develop measures can themselves yield valuable insights into the ways in which interest and engagement are felt and expressed by youths, and because the availability of valid measures can permit the testing of specific claims developed from theories of interest development. Such measures can also support the investigation of the value and importance of different kinds of supports and resources needed to promote equity of opportunity to engage in interest-related pursuits. Construct-centered approaches to assessment design (e.g., Messick 1994; Wilson 2005), in particular, are valuable for generating evidence related to claims about learning and development. We employ this type of approach.

In this paper, we present initial results from a study in which we developed and evaluated a survey instrument related to youths’ experiences of interest-related pursuits across settings and time. More specifically, the survey, which targets youth 13 to 16 years old, aims to measure multiple dimensions of youths’ experiences of *connected learning* within their interest-related pursuits. Connected learning is an emerging model for understanding youth’s interest-related pursuits, characterized by six principles (Ito et al., 2013). We sought to measure youth’s experiences of these principles in the context of their particular pursuits, with the aims of (a) investigating the extent to which experiences of the six principles of connected learning can be measured validly and reliably, and (b) considering how the connected learning model might be revised in light of results of a measurement study. In addition, we plan to use a revised version of the current survey to study how youths’ experiences of connected learning relate to other outcomes, including civic engagement and success in school.

# Challenges to Measuring Interest-Related Pursuits

The pathways of individual youths’ interests are often not easy to discern. On the one hand, youths’ pursuits are *idiosyncratic;* that is, they are specific to the ways individuals choose to participate or organize their participation in activities where they can explore or develop particular interests (Azevedo, 2011). On the other hand, youths’ pursuits are also deeply shaped by the diverse material and social structures that organize the practices and settings in which they explore their interests (Azevedo, 2013; Barron, 2006; Bell, Bricker, Reeve, Zimmerman, & Tzou, 2012; Hidi, Weiss, Berndorff, & Nolan, 1998). For example, a young person’s pursuit of interests in digital media is framed by opportunities to access the kinds of tools they will need to pursue that interest in various places (e.g., home, school, community centers), as well as by the availability of mentors and teachers to help them learn how to use those tools to communicate with others or create designs (Margolis et al. 2008; Michalchik, Llorente, Lundh, & Remold, 2008; Pryor, Culp, Lavine, & Hochman, 2002). Providing supports and designing opportunities for youth from nondominant communities to engage in interest-related pursuits can be particularly valuable to these youth, because their schools may provide them with few opportunities to experience competence or to leverage knowledge and skills developed within their families and communities (Calabrese Barton, Tan, & Rivet, 2008; Gutiérrez, Morales, & Martinez, 2009).

Studying the idiosyncratic pathways of interest-related pursuits requires longitudinal data, and understanding how social practices in different settings shape those pursuits requires evidence related to how these settings are organized and how youth move across them (Barron, 2010; Penuel, 2014). To analyze these pursuits, many investigators have exclusively used qualitative methods such as interviews and observations to discern and analyze youths’ interest-related pursuits over time and across settings (e.g., Azevedo, 2011; Barron et al., 2009). Such methods enable researchers to produce rich descriptions of how different kinds of activities are organized to catalyze or support learning or to deepen youths’ engagement in a particular topic.

What survey measures may yield are useful inferences about young people’s *experiences* of interest-related pursuits. Practically speaking, it may be difficult for a researcher to be present for significant acts of encouragement by peers or a parent to engage in a pursuit or follow youth into each of the different settings where they engage in that pursuit. Both perceived support and experiences in unobserved settings can have strong and consequential influences on youth’s patterns of engagement and developmental outcomes (Cooper, Cooper, Azmitia, Chavira, & Gullatt, 2002; Cooper, Jackson, Azmitia, & Lopez, 1998). Additionally, it is not always possible to conduct the time-intensive interviews and observations characteristic of qualitative approaches to studying interest development. Resources and time required for such methods are almost always in short supply, especially in large-scale studies. By reducing these demands through the use of a survey measure, across site and across activity comparisons can be made more easily.

What is novel about this particular effort is that we have developed and field-tested a survey that characterizes youth’s experience of interest-related pursuits that span multiple settings. In the past, when research teams have developed and evaluated survey measures of interest development, their efforts have focused principally on youths’ individual preferences and perceptions of a single setting. A common strategy, illustrated by the approach taken by the Science Learning Activation Lab (<http://www.activationlab.org>), is to design items focused on eliciting information about youth’s levels of interest in a single domain (in this case, science) on dimensions of psychological experience (e.g., competency beliefs, perceived autonomy), as well as their perceptions of a single, related setting (e.g., a classroom) (see Moore, Chung, & Bathgate, 2013, for a description of the design and some psychometric properties of survey items from this project). This study, by contrast, attempts to investigate levels of interest in and perceived support for a particular pursuit that is undertaken across multiple settings.

# Context for the Study: Longitudinal Study of Connected Learning

The current study is part of a larger effort to study young people’s experiences of *connected learning* and the effects of their experiences on social development and civic engagement. Connected learning is an emerging, synthetic model of learning whose principles are consistent with those of positive youth development (Catalano, Berglund, Ryan, Lonczak, & Hawkins, 2004), sociocultural learning theory (Engeström, 1987; Gutiérrez, Baquedano-Lopez, & Tejada, 2000; Lave & Wenger, 1991; Rogoff, Paradise, Arauz, Correa-Chavez, & Angelillo, 2003), and ethnographic studies of young people’s interest-related interactions with digital media (Ito, 2009; Salen, 2008). Connected learning is evident when “a young person is able to pursue a personal interest or passion with the support of friends and caring adults, and is in turn able to link this learning and interest to academic achievement, career success or civic engagement” (Ito et al., 2013, p. 4). The experience of Clarissa (a pseudonym, and case described in Ito et al., 2013), a young woman whose interest-related pursuit is fantasy fiction, illustrates what connected learning can look like. Her friends played a critical role in supporting her passion, by introducing her to an online site where she could connect with others who shared her passion. At the site, she and others collaboratively wrote and critiqued one another’s writing. Over time, she honed her writing skills and developed confidence in sharing her skills in schools and on her college applications. She attributes her admission into two liberal arts colleges to her connected learning experience.

Digital media plays a significant role within the connected learning. In particular, practices that employ digital media can foster self-expression; link home, school, community, and peers; broker connections based on shared interests; and expand youths’ access to new activities (Barron et al., 2010; Barron et al., 2009; Buechley, Peppler, Eisenberg, & Kafai, 2013; Kafai & Peppler, 2011). As we detail in the section on our sample, these media-supported practices take place in and help to link a range of settings, including schools (Salen, Torres, Wolozin, Rufo-Tepper, & Shapiro, 2011), homes (Dugan, Stevens, & Mehus 2010; Stevens, Satwicz, & McCarthy, 2008), and community organizations such as libraries (Tripp, 2011).

# Methods

A key requirement for our longitudinal study of connected learning was to first develop a measure that could be used in the study. Accordingly, the primary research questions that we address in this paper are:

1. Can youths’ experiences of the six principles of connected learning be measured validly and reliably?
2. How do these experiences vary and cluster by type of pursuit?
3. How can the model of connected learning be refined in light of evidence from the development of this measure of connected learning?

## A Construct Construct-Centered Approach

In this research, we employed a *construct-centered* approach to developing a measure of interest-related pursuits. According to Messick (1994),

A construct-centered approach [to assessment design] would begin by asking what complex of knowledge, skills, and other attributes should be assessed, presumably because they are tied to explicit or implicit objectives of instruction or are otherwise valued by society. Next, what behaviors or performances should reveal those constructs, and what tasks or situations should elicit those behaviors? Thus, the nature of the construct guides the selection or construction of relevant tasks as well as the rational development of construct-based scoring criteria and rubrics. (p. 17)

Although the construct-centered approach is most frequently encountered in the context of academic tests of knowledge and skill, the principles can also be applied to the study of attitudes, the features of developmental settings, and participation in learning activities. Our particular application extends construct-centered approaches to the study of youth experience of an interest-related pursuit as embodying each of the principles of connected learning.

A construct-centered approach differs from more typical approaches to developing measures in the ways that the construct is defined, measured, and modeled. In a construct-centered approach, researchers begin by elaborating upon the definition of the construct, sometimes in ways that articulate qualitatively distinct levels of the construct (Wilson, 2005). In our study, we created specific *construct maps* that described different levels of depth of experience for each of the principles of connected learning. In a construct-centered approach, the elaborated construct definitions serve as a basis for item design, which can involve a fairly elaborate effort to define the kinds of items that are needed to reveal aspects of the construct. For this effort, we employed tools and structures afforded by evidence-centered design (ECD; Mislevy & Haertel, 2006; Mislevy, Steinberg, & Almond, 1999), a type of construct-centered approach that provides specific means for defining key features of items. The next step in construct-centered approaches is to use psychometric models to evaluate the extent to which the first three steps have been successful. Such models include but go beyond measures of reliability from classical test theory (e.g., Cronbach’s alpha); in our case, these models allow us to investigate systematically whether item responses conform to our hypotheses on the ordering of levels of experience as represented in our construct maps.

We elaborate on the steps of the measure development process below, defining key terms and tools we used along the way. As is evident from our description, the process of construct-centered survey development is iterative, and it benefits from feedback from sources such as cognitive interviews and expert review panels as well as the output of psychometric analyses.

## Target Constructs: The Six Principles of Connected Learning

Ito and colleagues (2013) identified six core principles of a connected learning experience. Youths should experience connected learning as: (1) interest powered; (2) peer supported; (3) academically oriented; (4) production centered; (5) shared in purpose; and (6) openly networked. Each of these is described in further detail below and defined in Table 1 below. At present, the model does not specify what constitutes a deep experience of a particular principle, nor does it specify which elements must be present for an experience to count as connected learning. Our measurement study aims to advance our understanding of the former, by elaborating each of the constructs into different hypothetical levels of “depth” of experience of connected learning.

Table 1.

Definitions of Constructs: Connected Learning Principles

|  |  |
| --- | --- |
| Principle | Pursuit Is Experienced As… |
| Interest Powered | Centered on youths’ own interests, enabling the development of knowledge and skill related to those interests |
| Peer Supported | Encouraged by peers who also provide help and feedback as part of their co-participation in the pursuit |
| Academically Oriented | Recognized by teachers and supportive of success in school |
| Production Centered | Involving making, production, or performance for an external audience |
| Shared Purpose | Adults participate alongside youth in a common endeavor in which youth have a say in the goals and structure of activity |
| Openly Networked | Well-resourced, in terms of access to tools and guidance in using tools needed for the pursuit |

Below, we define each principle and specify observable behaviors in the construct that we hypothesize constitute a deep experience of that principle.

**Interest powered principle.** Interest powered experiences are ones that are centered or organized around a participant’s interest and that allow a young person to develop knowledge or skill related to that interest. As such, the experience is one in which interest catalyzes the search for knowledge, and knowledge in turn helps to deepen a person’s interest in a particular pursuit (Barron, 2006, 2010; Barron et al., 2010).

*Observable behaviors related to the interest powered principle:* Experiencing a pursuit as being interest powered is expressed via participation in the pursuit across multiple settings, seeking out new settings in which to pursue the activity, and discovery of new related interests.

**Peer supported principle.** One important meaning of the term “connected” in connected learning is that it characterizes the way a young person experiences supportive connections to others as they pursue particular interests. Young people who experience pursuits as “peer supported” fluidly contribute, share, and give feedback to one another (Chávez & Soep, 2005; Soep & Chávez, 2010). Peers in a peer-supported experience also provide encouragement and support for successful movement across different social worlds (Cooper et al., 1998).

*Observable behaviors related to the peer supported principle:* Experiencing a pursuit as being peer supported is behaviorally expressed via reports of peers brokering access to new learning opportunities related to the pursuit, and reports of peers assigning tasks or responsibilities in activities.

**Academically oriented principle.** Connected learning recognizes the importance of academic success for intellectual growth and as an avenue towards economic and political opportunity. Thus, another meaning of “connected” pertains to strong, mutually reinforcing institutional (e.g., from school, family) supports about the importance of intellectual growth and academic achievement. What particularly matters are the ways that peers and adults recognize the value of school, encourage school success, and provide recognition for accomplishment in school from longitudinal analyses of youth development indicate that out-of-school pursuits, such as sports, can in fact enhance young people’s success in school (Eccles & Gootman, 2002; Weisman et al., 2003).

*Observable behaviors related to the academically oriented principle* Experiencing a pursuit as being academically oriented is expressed via teachers displaying awareness of the skills developed in the pursuit (whether they are developed in or outside of school), and via students reporting that they feel supported by teachers.

**Production centered principle.** Connected learning is designed around production, that is, around providing tools and opportunities for youth to produce, circulate, curate, and comment on media. These practices, importantly, depend on advances in social media and easily accessible digital authoring tools that make media more participatory, blurring the lines between producers and consumers of content (Jenkins, 2006). Production centered experiences may include designing games, writing fan fiction, and producing documentaries and podcasts not just for themselves but also for a broader audience (Denner, Werner, & Ortiz, 2011; Gee, 2010; Jenkins, Purushotma, Clinton, Weigel, & Robison, 2008). These productions are often oriented toward external audiences, and they may include efforts to critique existing media portrayals of youth (e.g., Goodman, 2003), to resist injustice (e.g., Soep, 2011) or to work for social justice in their communities (e.g., Goldman, Booker, & McDermott, 2008).

*Observable behaviors related to the production centered principle:* Experiencing a pursuit as being production centered is expressed via critiquing and producing artifacts, and/or creating performances with the purpose of reaching others with a message of how to make a difference in the world.

**Shared purpose principle.** An experience of connected learning is one in which youth participants have a say in the purposes and structure of activity. Such activities are uncommon in contemporary Western cultures, because for much of their day, children and youth do not participate in so-called adult activities as co-participants but spend most of their time in child-focused activities (Rogoff, 2003). Shared purpose also entails the side-by-side participation of adults and youth in authentic, shared endeavors (Banks et al., 2007). Within these endeavors, adults can be guides or mentors, or they can be co-participants in joint work to change conditions in communities (Kirshner, 2008). The image of joint work—in which youth and adults have a vested interest in the outcomes of youths’ activities and provide not only support but also help make decisions—captures well the principle of “shared purpose” in connected learning.

*Observable behaviors related to the shared purpose principle:* Experiencing shared purpose within a pursuit is expressed via reports of a strong sense of a common purpose, more equitable participation, and increased opportunities for youth to lead and contribute meaningfully to the activity.

**Openly networked principle.** Digital media are essential tools for the openly networked principle. To say that a young person experiences a pursuit as openly networked is to assert that resources, tools, and materials for learning are diverse, accessible, and discoverable across the different settings of a young person’s life. This principle points beyond the role of digital tools to support production and toward the possibility that these tools also serve as “boundary objects” (Star & Griesemer, 1989) that help connect and coordinate people, activities, and settings. When functioning well, these tools make up largely invisible layer of infrastructure that supports youths’ interest-related pursuits, regardless of where they are physically.

For learning resources to be accessible to youth often requires that adults help broker access to those tools (Barron et al., 2009). Thus, a key aspect of the openly networked principle is access to adults with sufficient knowledge of available resources and an inclination to help facilitate access to those resources (Gutiérrez et al., 2000; Jarrett, Sullivan, & Watkins, 2005).

*Observable behaviors related to the openly networked principle:* Experiencing a pursuit as being openly networked is expressed via reports of access to diverse learning resources, tools, and materials that youth perceive to be necessary for them to engage in the pursuit in the settings where they do or would like to pursue it.

## Study Samples

**Pilot samples.** In our pilot study, we solicited survey responses from two population subgroups of youth likely to have experienced connected learning. One subgroup was made up of youth who participated in gifted and talented programs that engaged youth directly in the use of digital media, while the other participated in community-based organizations that used digital media primarily as a means of communication. These two samples drew youth from different racial and socioeconomic backgrounds, with the former subgroup being primarily White and economically advantaged, and the latter being primarily Latino and much less economically advantaged. We conducted semi-structured cognitive interviews with 7 students from the first subgroup and 4 students from the second. These interviews aided in the revision of the items and construct definitions.

**Field test sample.** The data we use to address our research questions come from a field test of the survey conducted in spring 2013. The study sample was comprised of 479 youth aged 13-17 from 19 different program sites that provide opportunities for youth to pursue activities that reflect many of the principles of the current model of connected learning. The great majority of respondents were from US based programs, however respondents from South America, Australia, Asia and Europe were also part of the sample. The average age of youth in the sample was 15. Just over half (50.3%) were female. The sample was ethnically diverse: 32% identified as Mexican, Mexican American, or Chicano; 26% as African American; 18% as White; 17% as other Hispanic or Latino; 10% as Asian or Asian American; and 5% as Native American. In the US, youths came from zip codes reporting median household incomes between $14,586 and $192,250. The median income households in these zip codes was $46,178, which is slightly below $51,017, the estimated 2012 median income of the US (DeNavas-Walt, Proctor, & Smith, 2012).

Each of the 19 programs dedicated at least one of their staff to serve as the on-site survey administrator. To better understand youths’ responses and the contexts in which connected learning occurs, we also surveyed the program support staff at each site. We received 21 responses from a total sample of 23 support staff surveys. Some sites had multiple staff assisting with survey administration, which accounts for the difference in programs and survey respondents. Table 2 on the following page summarizes key features of the offerings across the 19 programs in the survey sample, developed from surveys conducted of staff in each of the programs.

## Developing and Administering the Measures

We employed an iterative approach to instrument development, involving the articulation of theories regarding how each of the six connected learning principles could be treated as measureable attributes of youths, and how items could be designed to elicit evidence of youths’ locations along each of these attributes. As part of this process, we reduced the number of items from well over 200 in an initial version to around 60 in the administered version, and incorporated feedback from a number of sources to help shape the language of survey items to be maximally accessible to the target population. This iterative process produced initial validity evidence based on survey content (through our construct definitions and detailed design patterns) and response processes (from cognitive interviews).

Our survey design process began with the development of initial definitions of each construct and associated survey items. We then solicited feedback from members of the Connected Learning Research Network on these initial definitions and items, and revised accordingly. We then conducted cognitive interviews with youths from the target population, and further revised the items and construct definitions based on the results. The survey items were then field tested with the sample of 479 youth described previously, and data were analyzed using unidimensional and multidimensional partial-credit Rasch models. Feedback from these analyses and other sources were then considered together, as we reflected on next steps.

**Initial construct definitions and items.[[1]](#endnote-1)** Initial definitions for connected learning principles (described previously) were drawn primarily from the wealth of ethnographic work on connected learning (e.g., Ito et al., 2013) and from literature on similar phenomena (Buckingham, 2008; Salen, 2008). Specific items were either adapted from pre-existing instruments, principally from the field of youth development, or were written by the team. As an example of the outcomes of this work, Figure 1 shows the initial construct and subconstruct definitions for the *peer supported* principle.

**Connected Learning Research Network expert review.**We then asked members of the Connected Learning Research Network to review the initial design patterns, and we made substantial revisions based on their feedback. In particular, experts were asked to review the construct definitions and to select items that they felt would provide the best evidence related to the construct.

Table 2.

Program Offerings for Sample Sites (Number Offering by Frequency)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | *Every week* | | *2-3 times a month* | | *Monthly* | | *Every few months* | | *Annually* | | *Hardly ever or never* | |
| Participate in community service | 7 | (32%) | 2 | (10%) | 4 | (19%) | 2 | (10%) | 2 | (10%) | 4 | (19%) |
| Organize and engage in political action | 3 | (14%) | 0 | (0%) | 3 | (14%) | 5 | (24%) | 2 | (10%) | 8 | (38%) |
| Write stories or poems (for print) | 10 | (48%) | 3 | (14%) | 2 | (10%) | 0 | (0%) | 0 | (0%) | 6 | (28%) |
| Write stories, blogs, or poems (online) | 11 | (52%) | 3 | (14%) | 3 | (14%) | 2 | (10%) | 0 | (0%) | 2 | (10%) |
| Put on dramatic performances | 1 | (5%) | 1 | (5%) | 2 | (10%) | 4 | (20%) | 1 | (5%) | 11 | (55%) |
| Learn basic computer skills | 17 | (85%) | 1 | (5%) | 0 | (0%) | 0 | (0%) | 0 | (0%) | 2 | (10%) |
| Play video games | 8 | (38%) | 0 | (0%) | 2 | (10%) | 4 | (19%) | 0 | (0%) | 7 | (33%) |
| Write fan fiction | 8 | (40%) | 0 | (0%) | 4 | (20%) | 0 | (0%) | 0 | (0%) | 8 | (40%) |
| Share strategies for game play with others | 10 | (47%) | 0 | (0%) | 2 | (10%) | 0 | (0%) | 0 | (0%) | 9 | (43%) |
| Design games | 7 | (33%) | 3 | (14%) | 1 | (5%) | 0 | (0%) | 1 | (5%) | 9 | (43%) |
| Design web sites | 5 | (24%) | 2 | (10%) | 5 | (24%) | 2 | (10%) | 2 | (10%) | 5 | (24%) |
| Design graphics/animations | 9 | (42%) | 2 | (10%) | 3 | (14%) | 1 | (5%) | 1 | (5%) | 5 | (24%) |
| Create/edit movies or mashups | 12 | (56%) | 2 | (10%) | 1 | (5%) | 4 | (19%) | 0 | (0%) | 2 | (10%) |
| Artwork/ Craft objects | 11 | (51%) | 1 | (5%) | 0 | (0%) | 2 | (10%) | 1 | (5%) | 6 | (29%) |
| Homework help | 12 | (58%) | 2 | (10%) | 1 | (5%) | 0 | (0%) | 0 | (0%) | 6 | (27%) |
| Doing science activities and experiments | 7 | (35%) | 0 | (0%) | 1 | (5%) | 3 | (15%) | 0 | (0%) | 9 | (5%) |
| Making collages/photo editing | 15 | (71%) | 3 | (14%) | 1 | (5%) | 0 | (0%) | 0 | (0%) | 2 | (10%) |
| Compose music | 11 | (51%) | 2 | (10%) | 1 | (5%) | 2 | (10%) | 0 | (0%) | 5 | (24%) |
| Play music | 13 | (62%) | 0 | (0%) | 0 | (0%) | 1 | (5%) | 0 | (0%) | 7 | (33%) |
| Play sports | 5 | (23%) | 1 | (5%) | 1 | (5%) | 0 | (0%) | 0 | (0%) | 14 | (67%) |
| Other | 9 | (56%) | 0 | (0%) | 0 | (0%) | 0 | (0%) | 1 | (6%) | 6 | (38%) |

Figure 1. *Construct Definition and Construct Map for Peer Supported Principle*

|  |
| --- |
| **Construct Definition** |
| Learning in the context of peer interaction is engaging and participatory. Research shows that among friends and peers, young people fluidly contribute, share, and give feedback to one another, producing powerful learning. Connected learning research demonstrates that peer learning need not be peer-isolated. In the context of interest-related activity, young people welcome adult participation. Although expertise and roles in peer learning can differ based on age, experience, and expertise, everyone gives feedback to one another and can contribute and share their knowledge and views. |
| **Subconstructs** |
| *Sharing:* Students share ideas and products with peers.  *Feedback:* Feedback in CLEs refers to mutual, constructive response to contributions. A key quality of such feedback—when it results in learning—is that it is activity- rather than person-focused, and it is improvement- rather than performance-focused.  *Sites of Peer Relationships:* Peer relationships can be characterized in terms of their “place,” that is, whether contact is single-mode (e.g., online or face-to-face) or multimodal (e.g., both online and face-to-face). |

This review and revision process was conducted twice before the administration of the final survey.

**Cognitive interviews.**Next, we conducted two sets of semi-structured cognitive interviews. In these interviews youth read each item aloud, answered the item, and then explained why they chose that answer (Desimone & Le Floch, 2004). Because of the length of the survey, we chose to focus on 12 items that were identified by the Network and other team members are particularly important or potentially problematic. In addition, guiding questions were also used for the activity question, as it was particularly important. A single graduate student conducted each interview. That graduate student and an additional graduate student took notes during the interview. Instead of coding each set of responses and synthesizing across the results (e.g., Karabenick et al., 2007), we revised and refined the language for the items between each interview. In this way, the subsequent interview served as a check on the changes made based on the prior interview.

**Construct maps.** To facilitate the conceptualization and modeling of experiences of the principles of connected learning as continuous quantitative attributes, we developed construct maps once our construct definitions had become sufficiently precise as to support theories of the meaning and observable consequences of interpersonal variation in these constructs. A construct map is a particular type of theory representation, which involves conceptualizing the construct as a continuum along which individuals may be ordered (Wilson 2005). Construct maps also express an ordering of the items, in this case representing hypotheses about the extent to which an individual must experience each of the connected learning dimensions in order to be likely to endorse an item (i.e., with some items being easier to endorse than others). For each of the six principles, we created maps that described how an individual might experience that principle at varying levels of depth. For example, for the peer supported principle (as shown in Figure 2), we hypothesized that the shallowest or most minimal form of experience was that youths believe that their peers provide limited or no peer support for participation in their activity of choice and the deepest or richest experience of peer support is when youths’ believe that their peers help broker access to new opportunities to deepen and pursue interests.

In addition to describing levels of the construct, a construct map also facilitates the development of hypothesis about what constitutes evidence for an individual being at each level of the construct map. For each level of the construct we identified or created items that should indicate that youth responding positively to those items should be at that level of the construct or higher. The application of the Rasch model (Rasch, 1960) allows us to simultaneously test our hypothesis about the levels and items mapped onto those levels.

Figure 2. *Construct Definition and Construct Map for Peer Supported Principle.*

|  |  |
| --- | --- |
| **Construct Definition:** ***Among friends and peers, young people fluidly contribute, share, and give feedback to one another, producing powerful learning. In the context of interest-related activity, young people welcome adult participation. Although expertise and roles in peer learning can differ based on age and experience, everyone gives feedback to one another and can contribute and share their knowledge and views.*** | |
| **Level\*** | **Items** |
| *Peers broker access to new opportunities to deepen and pursue interests.* | A friend or peer signs me up for things that are related to my interests.  A friend or peer gives me advice related to my interests.  A friend or peer introduces me to people who know more about my interests.  A friend or peer gives me responsibilities, jobs, or tasks related to my interests. |
| *Peers provide strong support through teaching and helping within the activity.* | A friend or peer teaches me new things.  One or more friends encourage me to pursue the activity.  A friend or peer helps me find information related to my interests.  They let me teach them about what I know about my interests.  They buy or give me things I need to help me pursue my interests. |
| *Peers provide modest support through teaching and helping within the activity.* | A friend or peer works with me on a project. |
| *Peers provide limited or no peer support for participation in the activity.* | No one encourages me to pursue the activity, I just like to do it. |

**Characteristics of the administered survey.** As noted earlier, identifying an activity likely to elicit connected learning is a key to the survey. The question used in the final survey to get at this activity was:

*Can you think of an activity you do here at [Program or Community Name] that you really enjoy and you are getting better at the more do it?*

*Yes. What is that activity? Please type in only one activity.*

*No. What is the activity that you spend the most time doing while here? Please type in only one activity.*

The activity from this question was used throughout the entire survey: all questions were phrased in relation to this particular activity, except for questions about youths’ backgrounds. Table 3 below provides a count of the items by connected learning principle.

Table 3. Scale Reliability and Percent Total Construct Variance for Each Principle Explained by Type of Pursuit

|  |  |  |
| --- | --- | --- |
| **Construct** | **Final Scale Reliability** | **Percent Variance Explainedby Type of Pursuit (*p* -value)** |
| Academically Oriented  (7 items) | 0.22 | **--** |
| Production Centered  (16 items) | 0.49 | 7% (0.000) |
| Shared Purpose  (10 items) | 0.79 | 6% (0.178) |
| Openly Networked  (12 items) | 0.61 | 7% (0.060) |
| Interest Powered  (8 items) | 0.77 | 4% (0.608) |
| Peer Supported  (16 items) | 0.67 | 5% (0.270) |

**Survey administration**. Once the research team finalized the list of participating programs, we conducted webinar trainings with the program staff who volunteered to serve as the points of contact for the survey. Program staff were trained on how to access the web-based survey, log users in, and submit the survey. In addition to the basic features of the survey, staff were trained on how to work with youth to curate a list of activities that would be appropriate for the scope of the survey.

Surveys were administered and collected over a two-month period during spring 2013. In addition to age requirements, youth needed to have been involved in the program for no less than two months. This was to ensure that they had received adequate exposure to the activities in question such that they could make evaluative statements. All responses were collected using SNAP survey software. Upon completion of the survey, youth were provided with a gift card in recognition of their time.

**Comparison to evidence from interviews.** We also gathered data from interviews as part of the measurement study, to triangulate against the evidence produced by the survey. Our purpose was to gain insight into how youth’s experiences as reported in interviews compared to experiences as reported in the survey. Our comparisons focused on five sites that volunteered to participate in youth-led research at their own sites. The primary source of qualitative data was a set of 82 semi-structured interviews conducted by youth at each site. These youth were participants at the site and volunteered to recruit and interview peers for the study. The youth researchers also adapted an interview protocol developed by the research team for eliciting details about long-term, interest-driven pursuits, the development of expertise in an area of interest to them, and the formation of new social ties through participation in connected learning.

Two coders working independently systematically coded these interviews via a multi-step process, which included the development, testing and refinement of codes throughout a series of coding summits. The coding process was largely inductive, rather than theory-driven, so as to complement the more theoretically-driven survey; in that way, we hoped to identify salient themes (Lemke, 1983) with respect to youth’s interest-driven pursuits that might suggest needed additions or refinements to the connected learning model. The coding scheme for descriptor and thematic codes was iteratively refined until at least 80 percent agreement was achieved for each code between pairs of independent raters (as calculated using Cohen's kappa; Cohen, 1960).

## Analysis of Field Test Results

As discussed previously, we initially hypothesized that each of the six dimensions of “experiences of connected learning” could be modeled as a continuous quantitative attribute, and could be measured via responses to survey items. Additionally, the six initial construct maps imply more specific hypotheses concerning the ordering of the items (e.g., which items should be harder or easier to endorse).

The Rasch model (Rasch, 1960) was fit to the survey response data as a method of investigating these hypotheses. The Rasch model can be viewed as formalizing the hypothesis that variation in a continuous quantitative attribute of persons is causally, but stochastically (i.e., not deterministically) responsible for variation in their responses to survey items. In our case, the Rasch model is a kind of formal test of our initial hypothesized levels of experience for each of the six principles of connected learning. In this application we use the partial credit (Masters, 1982) parameterization of the Rasch IRT model (Rasch, 1960).

Evaluation of overall model fit (i.e., the extent to which the actual responses patterns for *each dimension* conform to what would be expected if the model is true) provides feedback relevant to the hypothesis regarding the measurability and quantitative structure of each dimension, and evaluation of individual item parameter estimates and item fit estimates (i.e., the extent to which response patterns for *each item* conform to model expectations) provides feedback relevant to the item-response-specific hypotheses entailed by the construct maps. Psychometric analyses were conducted using ConQuest v2.0 (Wu, Adams, Wilson, & Haldane, 2007).

We first fit the unidimensional partial-credit Rasch model to the scored response pattern data for each of the six connected learning dimensions individually and estimated parameters using marginal maximum likelihood. Following this, we fit a multidimensional Rasch model to the data from all six principles simultaneously. For both models, we compared item parameter estimates (which can be visually represented using a Wright map, available upon request) for each dimension to the relevant construct map, and instances of severe deviation from construct map expectations were flagged for further review. Additionally, we examined item fit (i.e., infit and outfit mean-square) statistics, beginning with those showing the most severe misfit (e.g., outside the tolerance range of 0.75 to 1.33 recommended by (Adams & Khoo, 1997) and progressively moving in to the items with less severe misfit. We also inspected the mean estimated person location for each possible item response with an eye for instances of “reversals” (i.e., in which a response hypothesized to be associated with a higher level of the construct was estimated to be associated with lower average person location than other responses). Finally, we examined the person-separation reliability of each scale.

We then discussed these initial results internally, triangulating interpretations with results from cognitive interviews from our pilot sample and theoretical discussions with other scholars interested in connected learning. Rather than eliminating misfitting items out of hand, we regarded instances of misfit as potential falsifications of the hypotheses (both construct-level and item-level) implied by the construct maps. Depending on the nature of the misfit, we considered several options: (a) revision of the definition of the relevant dimension of connected learning, (b) revision of the construct map (which could take a variety of forms), (c) rescoring of the item, (d) temporary removal of the item with intent to revise in a future iteration of instrument design, and finally (e) permanent removal of the item from the survey.

**Analyzing variation by type of pursuit (Question 2).** To model variation by type of pursuit, we first coded activities listed by the student were coded into a list of 25 different possible primary activities (see Table 4). This categorical variable was coded as a series of indicator variables specified as fixed effects in an unconditional means model (i.e., a one-way ANOVA with random effects; Raudenbush & Bryk, 2002), in which expected a posteriori person estimates for each of the dimensions of connected learning from the Rasch models served as the outcome variable. The proportion of total variance in person estimates explained by type of pursuit was computed by computing the intra-class correlations of the unconditional models. Proportions of variance explained are given in the last column of Table 3.

Table 4.

Types of Pursuits Identified by Youth on Survey

|  |  |  |
| --- | --- | --- |
| **Category** | **Examples** | *n* |
| Creating or performing art | Playing music, drawing, writing poetry | 104 |
| Making and tinkering | Fashion design, building models | 32 |
| New Media Arts | Creating web sites, making digital movies | 133 |
| Gaming | Creating video games, playing multiplayer online games | 36 |
| Youth leadership and civic engagement | Serving on a teen advisory board, peer mediation | 25 |
| Research | Taking field trips and mapping the community for a project | 20 |
| Sports | Soccer, track, basketball, golf | 40 |
| Traditional school work | Math, geography, homework | 22 |
| Hanging out | Posting on social networking sites | 10 |
| Unspecified computer related activity | Using technology | 9 |
| Other | Typing, helping animals, planning an event | 46 |

**Comparison to interview data.** To compare interview and survey data, we focused on site-level comparisons. We did so for both theoretical and practical reasons. Theoretically, we sought to analyze the different contributions that survey and interview data might make to an understanding of site-level experiences of connected learning. We also sought to identify aspects of youth’s experiences of the principles of connected learning that might not be adequately reflected in the survey questions. Practically, we focus on site-level comparisons, because it was not possible for us to link the two data sources at the individual level, due to human subjects agreements. Two different research teams collected the data, but the inter-institutional agreement regarding data sharing prohibited sharing unique identifiers that would have enabled linkages across the data.

The comparison of the two data sources focuses on one principle, the *peer supported* principle, because this particular principle was salient in the interview data analyzed. For each site, a researcher on the team identified the most frequent thematic codes to identify the most salient themes with respect to this particular principle. For each site, case descriptions were developed for these sites, and contrasts among the site identified through a matrix. We then compared these to both scale scores (for the peer supported principle) and individual items relating most closely to the codes. We present summaries of these findings in the results section below.

# Results

## Measurability of the Principles

Below, we present the results of our analyses of items related to each of the six principles of connected learning. We present them roughly in the order of what we consider to be the least promising evidence in support of the measurability of the principle to the most promising. (Note this order contrasts the order with which we present the principles above, which is the order in which they are introduced in Ito et al. 2013).

**Academically oriented principle.** The seven items designed to measure the academically oriented principle largely failed to conform to model expectations. The empirical ordering of the item severities bore little if any correspondence to the expectations of the construct map, and the overall scale reliability was estimated as 0.22. We inspected misfit patterns closely, but the patterns appeared to be essentially random. We interpreted these results as a falsification of the overall hypothesis of the measurability of an academically oriented construct, at least as this construct is currently conceived.

**Production centered principle.** The seven items designed to measure the production centered principle all displayed acceptable fit to the Rasch model, and the empirical ordering of these items was generally in line with the expectations of the construct map. One exception to this was an item that asked youths about how often they used professional tools in their work, which were empirically much easier to endorse than had been expected. Additionally, one reverse-coded item (asking whether a youth “use[d] tools mainly designed for children and youth”) displayed “reversal” in mean person location and was estimated to be the most severely misfitting item. We deemed this item unsalvageable and eliminated it.

After discussion, we made revisions to the construct map, and we re-estimated the model with five items. The empirical ordering of items was now consistent with the construct map and all items displayed acceptable fit, with two possible exceptions: an item asking whether a youth “make[s] or design things when [he or she is] in an activity” was significantly easier to endorse than expected, and a question asking whether a youth “analyze[s] or critique[s] things other people have made” still displayed questionable fit (i.e., an infit mean square of 1.26). The overall reliability was estimated as 0.49. We interpreted these results as evidence that significantly more item development work—and probably theoretical work—would be necessary before a production centered construct could potentially be considered measurable.

**Shared purpose principle.** We designed ten items to measure the shared purpose principle. Four of these were dichotomously-scored (endorse/not-endorse) items (e.g., whether the youth “ha[d] had an opportunity to use [his or her] judgment about a decision”), and six were statements about a youth’s perception of their peers (e.g., “everyone is trying to achieve the same goals”) with Likert response options (e.g., “strongly disagree,” “disagree,” etc.).

As with the other scales involving Likert items, the Likert items displayed severe positive misfit, while the non-Likert items displayed severe negative misfit. The empirical ordering of the items was roughly in line with theoretical expectations.

Team discussion failed to yield a consensus regarding the proper reaction to these findings. We decided that two Likert items designed to measure the peer supported construct more naturally fit with the shared purpose construct (“when someone who engages in the activity does really well, everyone is happy,” and “people in the activity want everyone to be able to pursue what they are interested in”). We added in these items and re-estimated the model; while the evidence of method effects remained (as expected) the two new items displayed good fit and empirical ordering in line with theoretical expectations. The reliability was estimated as 0.79 for the scale linked to this principle.

In the absence of a resolution to the issue of fit, it is difficult to draw a strong conclusion about the measurability of the shared purpose principle, despite strong evidence of the scale’s reliability. As with the other scales, future work will need to clarify the nature of the theoretical connections between variance in the construct and variation in the particular kinds of responses elicited from youths.

**Openly networked principle.** The twelve items designed to measure the openly networked principle fell into two distinct groups: the first group was chiefly about whether the products of a youth’s work was available to others, while the second group was chiefly about whether the youth had access to relevant technology. When we fit a unidimensional model to all twelve items, the items in the first group displayed extreme positive misfit while the items in the second group displayed extreme negative misfit; this could be interpreted as evidence that the two groups of items fail to measure a common construct. Additionally, the empirical ordering of item severities showed several instances of inconsistency with the expectations of the construct map, particularly for the first group of items.

In light of these results, we dropped the first group of items from further analysis, and we revised slightly the construct map for the remaining items. We again estimated the Rasch model; the empirical ordering of the items was now much more closely in line with model expectations, and the fit statistics were all in an acceptable range. The reliability of this scale was estimated as 0.61. We interpreted these results interpreted as tentative supporting evidence in support of the hypothesized measurability and structure of an openly networked construct; however, at minimum, more item development work will be necessary.

**Interest powered principle.** We designed eight items to measure the interest-powered principle. Of these, six were behavioral statements with Likert response options; the other two were (a) an item that pertained to the number of settings in which a youth reported pursuing activities related to his or her primary interest, and (b) the number of settings in which a youth had looked for additional opportunities to pursue their interest.

The empirical ordering of the items was consistent with theory-based expectations. The two non-Likert items displayed positive misfit to the model. The most plausible explanation for this finding seemed to be the dramatic difference in response options (i.e., selecting specific activities versus responding on a Likert scale); thus this could be interpreted as a method effect. The reliability of this scale was estimated as 0.77.

Taken in whole, we interpreted this as tentative evidence in support of the hypothesized measurability and structure of an interest powered principle; however, future scale development work will need to attend more closely to the theoretical connections between variance in the construct and variation in the particular kinds of responses elicited from youths.

**Peer supported principle.** The sixteen items designed to measure the peer supported principle initially included ten dichotomous (endorse/not-endorse) items regarding peer support (e.g., “a friend or peer helps me find information related to my interests”) and six Likert items regarding the youth’s perception of their social environment (e.g., “when I get stuck doing the activity I can get helpful suggestions from someone about how to solve the problem”). When we fit a Rasch model to the data, all ten of the non-Likert items displayed severe positive misfit, and the Likert items displayed severe negative misfit. These results could be interpreted as indicating that the two types of items measure distinct constructs, or that local item dependence is induced in each item set due to common item format (i.e., a method effect). Based on triangulation with cognitive interviews and theory, we judged the latter interpretation to be more plausible; furthermore, youths generally seemed to respond more thoughtfully and deliberately to the non-Likert items.

We made revisions to the construct map and made a decision to drop the Likert items. When the Rasch model was re-specified on the new item set, all items displayed acceptable fit to the model and the empirical ordering of the items was in line with theoretical expectations, with two exceptions: an item asking whether “a friend or peer buys or gives me things I need to help me pursue my interests” was very seldom endorsed by anyone, whereas an item asking whether “a friend or peer gives me advice related to my interests” was more commonly endorsed than expected. The reliability of the scale was estimated as 0.67.

Taken in whole, we interpreted these results as tentative evidence in support of the hypothesized measurability and structure of a peer supported construct. As with the interest powered construct, future scale development work will need to attend more closely to the theoretical connections between variance in the construct and variation in the particular kinds of responses elicited from youths; additionally, a larger total number of items will be needed.

**Multidimensional models.** Following the specification of models for each construct individually, a multidimensional model was fit to the full data set (given the revisions yielded from the work described above). This model allowed the estimation of inter-dimension correlations, disattenuated for measurement error. The estimated correlations ranged from .07 to .61 (Table 6). There was thus no indication that any of the features were so highly associated as to be considered empirically redundant.

## Variation in Scores by Type of Interest-Related Pursuit

Interestingly, only a small proportion of variance in scores were associated with type of pursuit for any of the principles measured. The specific pursuit listed by the student explained between 4% and 7% of the total construct variance, depending on the construct. Among the principle, only the production centered measure yielded significant a significant pursuit-related variance. Most of the variance was associated with individuals, rather than with pursuit. Table 5 shows the percent of variance explained by type of pursuit, as well as the reliabilities for each scale.

Table 5: Correlations among Scales

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Shared endeavors | Production Centered | Peer Supported | Openly Networked | Interest Powered |
| Shared Endeavors | 1.00 |  |  |  |  |
| Production Centered | 0.53 | 1.00 |  |  |  |
| Peer Supported | 0.30 | 0.17 | 1.00 |  |  |
| Openly Networked | 0.66 | 0.43 | 0.07 | 1.00 |  |
| Interest Powered | 0.61 | 0.48 | 0.23 | 0.35 | 1.00 |

***Note****.* All correlations are significant (p<.01).

## Comparison to Evidence from Interviews: Peer Supported Principle

Site-level comparison of scores on the peer supported principle to evidence from peer interviews suggest that some consistency between salient features elicited on the survey and reports from interviews. For example, peer helping and assistance is the focus of several survey items, and “forms of help within the site” emerged as a frequently occurring descriptive code (52 instances). On the survey, youth were also asked about whether friends or peers helped to broker access to new opportunities to pursue interests, and in several interviews (*n* = 9), youth indicated that friends had been critical in helping them to gain access to the site. This particular pattern of responses is consistent with what we might have predicted on the basis of our construct map: we would expect peer help within the site to be far more common than peers brokering access to new learning opportunities, something that would require far more investment of time on the part of a peer to do.

At the same time, friendships were salient in the interviews in ways that the survey did not elicit. For example, there were several instances (*n* = 14) where youth mentioned making new friends as either a motivation for becoming part of activities at a particular site or as a salient consequence of taking part in site activities (*n* = 11). In another three instances, youth cited interest in maintaining friendships as a reason for pursuing a particular activity at the site. Although we included a survey question about whether peers encourage young people’s named interest-related pursuit, we did not anticipate the need to measure how strongly friendship would figure as both motivation and consequence of participation in site activities (this, despite evidence from earlier ethnographic research that would have indicated the need to consider this fact; Ito et al. 2009). This particular difference between the qualitative and quantitative evidence suggests some potential refinements to both the peer supported principle definition and to survey items.

Notably, some important differences across sites evident in the interviews were not evident in overall scale scores for the principles. We noted significant differences across sites in the patterns of peer support reported by youth through interviews. However, the site level means for the five sites that participated in the youth research were close to one another. These discrepant findings may be linked to the greater salience of friendship evident in interviews than anticipated by the study team, or they may due to other factors, such as sampling or method effects (peers interviewing peers with whom they may be friends).

# Discussion and Conclusion

In this final section of the paper, we summarize key findings from our initial measurement research and point to future work planned to refine both our measures and the model of connected learning for interpreting youth’s experience of interest related pursuits.

## Measurability of Principles

We found supporting evidence for the measurability of three principles in the connected learning model: shared purpose, interest powered, and peer supported. The empirical ordering of item responses was in good alignment with expectations based on the construct maps for each of these items. In addition, for all three constructs, there was good scale reliability. At the same time, as described above, the peer supported principle definition used in the survey may need refinement, given patterns reported by youth in interviews about the nature and importance of peer interactions in interest-related pursuits.

For two constructs—the production centered principle and the openly networked principle—significant revisions to both the construct maps and items are needed. There was poor correspondence between item response patterns and the initial construct map. Though the revised map showed better fit, the revised map must be tested with a new sample of respondents. In addition, additional items aligned to the new construct map may be needed to improve scale reliability. The openly networked items showed poor fit to our expectations as reflected in an initial construct map. As with the production centered principle, a revised construct map based on a reduced item set focused on the accessibility of tools needed to engage in an interest-related pursuit better aligned with item responses. Though the reliability was adequate, certain aspects of the existing definition of this construct—such as the visibility and accessibility of pathways to deepen one’s interest and knowledge related to the pursuit—are no longer reflected in the items that remain. Additional revisions to the construct map and new items designed to elicit responses that would allow inferences about the experience of this principle are needed.

We found small- to medium-sized correlations among the constructs, but they were not so large as to suggest the need to combine different principles for purposes of measuring the experience of connected learning. Substantively, we interpret this finding to mean that young people experience each of the principles in ways that are distinguishable from one another. Thus, to the extent that connected learning does encompass all six principles, we conclude that all of the dimensions should be measured on the survey.

## Variation by Type of Pursuit

There is limited variability associated with type of pursuit (e.g., new media arts, youth leadership activities), in terms of youths’ experience of connected learning. Sites varied significantly with respect to scores on the production centered principle scale. What is striking about this finding is that youth reported on a wide variety of pursuits that might be expected to afford very different kinds of experience. Yet there was in fact, little measured variability across pursuits with respect to any of the principles. Most of the variation was associated with individuals’ reported experiences of connected learning.

There are many possible explanations for this finding that will need to be investigated in future research. One is that the finding is entirely consistent with the notion that interest pathways may be both socially mediated but also idiosyncratic (Azevedo, 2011). That is, we should not expect to see a strong influence of type of pursuit, because our unit of analysis is an interest-related pursuit that is pursued across a range of settings. In addition, sites were purposefully recruited so as to increase the likelihood of finding young people who had experienced connected learning as articulated in the model. Even though the activities were varied that young people reported, then, they all shared some common characteristics. At the same time, the failure to distinguish among activities with respect to connected learning principles might reflect flaws in both our construct maps. We may have too few elements in construct maps to pick up salient aspects of activities that distinguish them from one another in ways that could be consequential for youth outcomes. From the standpoint of preparing young people for engagement in the civic and political sphere it may matter—in ways we do not yet understand—that the production of a video for a public audience is quite different from producing game modifications in an online gaming community for others to try. We need to investigate further whether and how activity type matters both for the experience of connected learning and its outcomes.

## Consistency of Quantitative and Qualitative Findings

In a preliminary analysis comparing quantitative and qualitative findings with respect to youth’s experience of the peer supported principle of connected learning, we find some evidence that aligns closely with our initial expectations. Particularly encouraging is the finding in our interview analysis that friends’ brokering access for youth to new opportunities for engaging in their interest-related pursuit was especially salient for some youth, but also less frequent than more general forms of peer helping available in the setting. That is consistent with both our construct map and evidence from survey responses. Of course, “rarely endorsed” is not the same thing as “deeper connected learning.” Additional qualitative evidence may be needed to understand if and when peer brokering results in a deepening of interest in a pursuit or another valued outcome, such as civic engagement or a positive sense of the future. In addition, we will need to conduct additional analyses of other constructs, as well as analyses that compare responses of individuals and not just of site-level data.

## Refinements to Model of Connected Learning

At present, a key conclusion of our initial measurement research is that the construct definition for the academically oriented principle needs to be revised. “Academics” encompasses a wide range of possible connections between an interest-related pursuit and school success, which may explain why there was such poor reliability for this scale. Items asked youth to report about how much their pursuit helped in different school subjects. But some interest-related pursuits might be expected to help with academics in some subjects and not others. In addition, there are many more factors associated with success in school beyond deep engagement in an interest-related pursuit with a clear tie to academic subject matter. In retrospect, it should not have been surprising that the pattern of results was not easily interpreted, but given the importance to the model of connecting interest-related pursuits to success in work, civic life, and school, reworking of the definition is warranted.

An extension of the construct definition of the peer supported principle may also be needed to encompass the variety of ways peers can support an interest-related pursuit. Encouragement and help are but two ways that peers matter, as indicated by our interview data. Specifically, peers also play a significant role in motivating sustained engagement in a pursuit. Though it might not be part of a survey scale focused on the experience of connected learning, gaining new friends may be a valued (at least to youth) outcome of connected learning as well.

## Implications and Next Steps

Our approach begins with the premise that the unit of analysis for is the experiences a young person has of a pursuit over time and across multiple settings. This premise is different from the starting point of other projects that seek to measure interest as a relatively stable characteristic of a person or as an aspect of experience in a single setting (e.g., Linnenbrink-Garcia et al., 2010; Moore et al., 2013). Up to now, researchers who study interest-related pursuits in the way we have approached them in this study have employed principally qualitative methods to study those pursuits and youth’s experience of them. The idea that one could measure that experience is both novel and largely untested. The evidence gathered from the present study so far suggests that much more work lies ahead, if we are to answer with greater confidence the question of whether we can support claims about youth experience of interest-related pursuits with evidence from quantitative survey measures.

We plan to continue to refine and investigate the measures used in this study. Specifically, we plan to administer a revised version of the survey to an additional sample of youth recruited to the study in three new sites. For this revised version, we will take into considerations both the results of the study reported above and the analyses of other researchers investigating connected learning. We also plan to conduct a second survey of the youth in the sample, using a mixture of items included in the original survey and new items. As part of this survey, we will also incorporate measures of outcomes that emerge as important to the networks of sites that are implementing connected learning. A key aim of this survey will be to develop evidence about the relationship between the experience of connected learning and outcomes such as sense of the future, civic engagement, and social capital. The longitudinal data analysis that is planned will allow us to explore if and how the investment in developing quantitative measures of interest-related pursuits can yield results, both in terms of evidence of whether and how experiences of these pursuits are related to valued outcomes and in terms of refinements to theories of interest development.

Measurement development studies like ours are important to advance not only our particular aims but also the field of digital media and learning. Many initiatives require the development of new measures of learning that target the particular learning goals of those initiatives, because standardized measures of achievement are poorly aligned to those goals (e.g., Shute, Ventura, & Torres, 2012). In addition to outcome measures, measures of program implementation are needed, since claims about the impact of initiatives depend on evidence that programs have been implemented with some integrity to the principles underlying the model. Finally, additional measures like the ones we are developing as part of our study are needed that capture variation in young people’s experience of learning with media across settings. With a variety of such measures in place, we can accumulate knowledge about when, how, and for whom innovations supported by digital media make a difference.

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1. [↑](#endnote-ref-1)