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RESEARCH ARTICLE

Measuring experiences of interest-related pursuits in connected learning

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Abstract This paper describes an effort to develop a survey instrument capable of measuring important aspects of adolescents' experiences of interest-related pursuits that are supported by technology. The measure focuses on youths' experiences of *connected learning* (Ito et al. in Connected learning: an agenda for research and design. Digital Media and Learning Research Hub, Irvine, 2013), an emerging model of learning across settings supported by digital media. Specifically, the instrument aims 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 also elicits information regarding the 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 two rounds of field-testing, in which we evaluated the validity and reliability of the instrument and compared results with evidence from interviews with youth. 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.

Keywords Connected learning · Survey · Measurement · Interest development

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Introduction

Today, young people with an interest in nearly any topic can use technology to connect with others who share their interests, to make or produce things, and to share their productions with others (Ito et al. 2009, 2013; Jenkins 2009). These new capabilities are consequential for both learning and educational systems. The fact that young people can pursue interests and learn across a variety of settings indicates there is a need to consider how educational opportunities across different settings might be linked to one another in order to promote better connected learning ecologies (National Research Council 2015; Traphagen and Traill 2014). This fact draws our attention to new dimensions of equity as well, particularly to the diversity of pathways through which all youth might follow interest-related pursuits (Ito et al. 2013; Penuel et al. 2014).

To date, there have been few attempts to develop and evaluate measures of youths' experiences of technology-supported interest-related pursuits across multiple settings. 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 how interest and learning develop across settings. Such measures can also support investigations into the kinds of supports and resources needed to promote equity of opportunity to engage in interest-related pursuits.

In this paper, we present 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 13–16 years old, aims to measure multiple dimensions of youths' experiences of *connected learning* within their interest-related pursuits. Connected learning is an emerging, synthetic model of learning whose principles are consistent with those of positive youth development (Catalano et al. 2004), sociocultural learning theory (Engeström and Sannino 2010; Gutiérrez et al. 2000; Lave and Wenger 1991; Rogoff et al. 1995), and findings from 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).

Digital media plays a significant role within 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. 2009, 2010; Buechley et al. 2013; Kafai and Peppler 2011). These media-supported practices take place in and across a range of settings, including schools (Salen et al. 2011), homes (Dugan et al. 2010; Stevens et al. 2008), and community organizations such as libraries (Barron et al. 2014).

According to Ito and colleagues, connected learning is characterized by six principles. 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 the results of this measurement study.

Recent research on technology supports for interest-related pursuits

New technological infrastructures have made it possible for young people to discover and develop an ever-widening array of interests and to connect to others who share their interests and engage in a range of activities. For example, today young people can find people online who share their interest in a popular film or television program and develop elaborate "fanfiction" texts for others to read and critique (Black 2005). Other young people are using new technologies to support their participation in politics (Garcia and Morrell 2013; Goldman et al. 2008; Jenkins 2012). Still others are using technology to develop skill in creative and artistic pursuits (Polman et al. 2010).

A notable characteristic of many of these pursuits is that young people engage in them across multiple settings. For example, a girl interested in the game *The Sims* may play the game at home with friends, online with virtual partners, and may meet up with others outside the game context to socialize and discuss strategies for "modding" the game both in person and through social media or online communities (Gee and Hayes 2010). In many cases, the cross-setting nature of such pursuits is by design: for example, developers of games like *The Sims* aim to support engagement across multiple media (Jenkins 2010).

The ubiquity and popularity of these technology-supported opportunities among youth has gained the attention of educators and educational researchers, and there is now a growing body of research that explores the potential of supporting learning across settings through educational game play, digital media production, and digital activism (Burke and Kafai 2014; Gee 2007, 2010; Middaugh and Kirshner 2015; National Research Council 2011). Much of the research has taken the form of compelling case studies and rich ethnographic accounts of how young people leverage new digital tools to pursue interests across settings (for a representative collection, see Ito 2009). At present, however, there is a need for quantitative measures of young people's experiences of technology-supported and interest-related learning opportunities that could be used for purposes of research and evaluation across different types of educational programs. Through the use of such measures, researches and evaluators can make comparisons of experiences and opportunities across sites and activities.

Concern about equity is another reason to invest in efforts to measure young people's experiences of technology-supported, interest-related learning. Access to and participation in interest-related learning opportunities online are shaped by youth's social networks and by class, culture, and nationality (Ünlüsoy et al. 2013). Caregivers in upper income households are able to spend more for their children on resources and structured learning opportunities that take advantage of new technologies than caregivers in lower income households (Ito et al. 2009; Watkins 2011; Zickuhr 2013). Large-scale survey studies can explore the degree to which access to opportunities to pursue interests across settings is equitable, and such studies can also help identify programs that are helping to expand access to youth from nondominant communities. They may help, too, to identify sites for more in-depth study, where young people from lower income families are exhibiting resourcefulness with the limited access they have to new technologies (cf., Schwartz and Gutiérrez 2013).

The current study

The purpose of the current study was to develop a measure of important aspects of youths' experiences of connected learning. The research questions guiding our efforts were as follows:

1. Can youths' experiences of the six principles of connected learning be measured validly and reliably?
2. How does information obtained from the survey instrument compare with qualitative accounts from youth?
3. How can the model of connected learning be refined in light of evidence from the development of this measure of connected learning?

Approach to instrument design

In this research, we employed an iterative, *construct-centered* approach to developing a measure of youths' experience of connected learning. Such an approach begins 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 *construct maps* that described successive levels of depth of experience for each of the principles of connected learning. The elaborated construct definitions then served as a basis for item design. For this effort, we employed tools and structures afforded by evidence-centered design (ECD; Mislevy and Haertel 2006), a construct-centered approach that provides specific means for defining key features of items. The next step was to use psychometric models to administer the items to an appropriate sample of youths, and evaluate the extent to which our efforts to design appropriate items 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.

Following the first iteration of construct mapping, designing items, and evaluating the instrument, the feedback gained and lessons learned were leveraged to make revisions to

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

the construct maps and rewrite many items. We then administered the revised survey to a second sample of youths and again employed psychometric models to help evaluate the extent to which the revisions had resulted in improvement of the measure.

Target constructs: the six principles of connected learning

Ito et al. (2013) identified six core principles of a connected learning experience. Youths should experience connected learning as being (1) interest powered, (2) peer supported, (3) academically oriented, (4) production centered, (5) shared in purpose, and (6) openly networked. Each of these principles is described in further detail below and defined in Table 1. At present, the model of connected learning 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 study aims to advance our understanding of the former, by elaborating each of the constructs into different levels of depth of experience of connected learning.

Interest powered principle

Interest powered experiences are ones that are centered or organized around a young person's interest and that allow her or him 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.

Relevant observable behaviors 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

Young people who experience pursuits as "peer supported" fluidly contribute, share, and give feedback to one another. Peers in a peer-supported experience also provide encouragement and support for successful movement across different social worlds.

Relevant observable behaviors Experiencing a pursuit as being peer supported is 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

The connected learning model recognizes the importance of academic success for intellectual growth and as an avenue towards economic and political opportunity. Of particular relevance are the ways in which peers and adults recognize the value of school, encourage school success, and provide recognition for accomplishment in school.

Relevant observable behaviors 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. Production centered experiences may include designing games, writing fan fiction, and producing documentaries and podcasts not just for those involved in the production but also for a broader audience. These productions may include efforts to critique existing media portrayals of youth, to resist injustice, or to work for social justice in one's community.

Relevant observable behaviors Experiencing a pursuit as being production centered is expressed via critiquing and producing artifacts, and 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, young people do not participate in so-called adult activities as co-participants, but rather spend most of their time in child-focused activities (Rogoff 2003). The shared purpose principle also entails the side-by-side participation of adults and youth in authentic, shared endeavors. Within these endeavors, adults can be guides or mentors, or they can be co-participants in joint work to change conditions in communities. The image of joint work—in which youth and adults have a common 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.

Relevant observable behaviors Experiencing shared purpose within a pursuit is expressed via reports of a strong sense of a common purpose, equitable participation, and opportunities for youth to lead and contribute meaningfully to the activity.

Openly networked principle

Digital media tools are essential 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 toward the possibility that these tools also serve as "boundary objects" (Star and 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.

Often adults must help broker access to learning resources for young people. Thus, a key aspect of the openly networked principle is the availability of adults with sufficient knowledge of available resources and an inclination to help facilitate access to those resources.

Relevant observable behaviors 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 in which they do or would like to pursue it.

Sample

The data we use to address our research questions come from two field tests of the survey, conducted in spring 2013 and spring 2015. The first study sample was comprised of 479 young people 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 second sample was comprised of 258 students from the same program sites. The great majority of youths were from US based programs; however, some were located in South America, Australia, Asia and Europe. The average age of youth in

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 %)

the sample was 15. Just under half (46.5 % of the first sample and 44.6 % of the second sample) were female. The samples were ethnically diverse: 26.2 % identified as Mexican, Mexican–American, or Chicano; 21.6 % as African American; 14.6 % as White; 11.1 % 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, with a median income of $46,178, slightly below the estimated 2012 median income of the US, which was $51,017 (DeNavas-Walt et al. 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 number of programs and survey respondents. Table 2 summarizes key features of the offerings across the 19 programs in the survey sample.

Developing the measures

We developed construct maps to help facilitate the conceptualization of experiences of the connected learning principles as continuous quantitative variables and elaborate on the observable behaviors associated with variation in these variables. A construct map is a particular type of theory representation, which involves conceptualizing the variable as a continuum along which individuals may be ordered (Wilson 2005). Construct maps also express an ordering of the observable behaviors (i.e., items), in this case representing hypotheses about the depth with which an individual must experience each of the connected learning dimensions in order to be likely to endorse an item (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 Tables 3, 4), 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.

Table 3 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)

Table 4 Construct definition and sample items 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[a]	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

[a] The highest level is represented at the top part of the construct map. We describe this level as the "deepest" form of connected learning, because opportunities for experiencing the principle are rich and diverse

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. After collecting data, the application of the Rasch model (Rasch 1960) allowed us to simultaneously test our hypotheses about the levels of experience and the items mapped onto those levels.

The final survey, as used in the second wave of data collection, is given in "Appendix". The survey as given here is slightly rearranged compared to what students received: the principles are ordered here so as to facilitate cross-referencing with the results displayed below, and item numbers are given within each principle for the same reason. Students responded to a digital version of the survey that automatically populated certain fields with the name of their activities and sites. Finally, for clarity, the principles are named here ("shared purpose principle," etc.), but were not named in the version completed by students.

Survey administration

Once the research team finalized the list of participating programs, we conducted webinar trainings with volunteers from the program staff. Volunteers were trained on how to access the web-based survey, log users in, and submit the survey, as well as how to work with youth to curate a list of activities that would be appropriate for the scope of the survey.

Surveys were first administered and collected over a 2-month period during spring 2013; this procedure was then repeated during the second iteration in spring 2015. In addition to the age requirements, youth needed to have been involved in the program for no less than 2 months to be selected. 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

Interviews were conducted to triangulate against the evidence produced by the survey. Interviews were conducted in five sites that volunteered to participate in youth-led research. Youth participants who had volunteered to recruit and interview their peers conducted a total of eighty-two semi-structured interviews. 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, and the formation of new social ties through participation in connected learning.

Two researchers 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 % 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 variable, 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).

Partial credit Rasch models (Masters 1982; Rasch 1960) were fit to the initial wave of survey response data ($n = 479$) as a method of investigating these hypotheses, and then again to the data from the second wave ($n = 258$). 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 tests our initial hypothesized levels of experience for each of the six principles of connected learning.

Evaluation of overall model fit (i.e., the extent to which the actual responses patterns for each of the six principles 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 principle*, 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. All models were fit using ConQuest v2.0 (Wu et al. 2007); all parameters were estimated via marginal maximum liklihood.

In addition to the six unidimensional Rasch models (i.e., one for each principle), we fit a multidimensional Rasch model to the data from all six principles simultaneously. For all models, we compared item parameter estimates (which can be visually represented using Wright maps, available upon request) for each principle to the relevant construct map, and instances of severe deviation from theory-based expectations were flagged for further review. Additionally, we examined item fit (i.e., infit and outfit mean-square) statistics. When examining the initial wave of survey data, we flagged and discussed all items with any amount of misfit (according to either fit statistic) that was statistically significantly different from zero ($p < .01$), beginning with those showing the most severe positive misfit and progressively moving into the items with less severe misfit. For the second wave of data, we focused on examining items for which either fit statistic was outside the range (.82, 1.18), and was statistically significantly different from zero. This tolerance range reflects an estimated 95 % interval for the expected value of the outfit statistic under the null hypothesis that the true value is 1 (i.e., that the item perfectly fits the Rasch model; Wu and Adams 2012), and is more stringent than any other recommended tolerance range of which we are aware. 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 pursed one or more of several options: (a) revision of the definition of the

Table 5 Reliability estimates by dimension

Dimension	Final reliability
Academically oriented (7 items)	.22
Production centered (6 items)	.79
Shared purpose (10 items)	.83
Openly networked (14 items)	.80
Interest powered (9 items)	.75
Peer supported (16 items)	.86

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.

Comparison to interview data (Question 2)

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.

The comparison of the two data sources focuses on the *peer supported* principle, because this particular principle was salient in the interview data analyzed. For each site, a researcher on the team used thematic coding to identify the most salient youth experiences 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 survey-based 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, 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. Table 5 summarizes estimated reliabilities associated with each principle. Table 6 displays the estimated item parameters (i.e., the item difficulty of endorsement or "severity," or the average severity for polytomous items), and the outfit (i.e., unweighted, or outlier-sensitive) and infit (weighted) statistics for each item, for the final (multidimensional) calibration of the second wave of data.[1] Item-step level parameters and fit statistics for the polytomous items were examined but are not displayed here for the sake of brevity.

[1] Parameter estimates and fit statistics from the first wave of data are not discussed here, but are available from the authors upon request. Item parameter estimates from the unidimensional models of individual principles and the multidimensional models are nearly identical.

Table 6 Item parameter estimates and fit statistics from the final model

Item	Estimate	Outfit (unweighted)	Infit (weighted)
Shared purpose			
Item 1	.05	***1.32***	*1.23*
Item 2	1.10	*1.16*	*1.08*
Item 3	.52	*1.13*	*1.11*
Item 4	.53	***1.24***	*1.18*
Item 5	−.40	.96	.97
Item 6	.41	***1.37***	*1.28*
Item 7	−.41	*.83*	*.86*
Item 8	−.48	*.86*	.88
Item 9	−.57	***.80***	*.83*
Item 10	−.77	*.82*	.90
Production centered			
Item 1	.30	1.02	1.03
Item 2	.24	.94	.98
Item 3	.57	.99	1.03
Item 4	−.45	1.12	1.11
Item 5	−.32	*1.13*	*1.12*
Item 6	−.33	.99	.99
Openly networked			
Item 1	−.17	.93	.94
Item 2	−.36	*.83*	.87
Item 3	−.52	.91	.96
Item 4	1.23	1.04	1.05
Item 5	1.53	1.09	1.06
Item 6	2.13	1.11	1.06
Item 7	−.64	.96	1.02
Item 8	−1.32	.90	.99
Item 9	−.98	1.01	1.01
Item 10	.70	***1.63***	*1.39*
Item 11	−.11	***1.29***	*1.21*
Item 12	−.55	1.14	1.04
Item 13	−.41	1.05	1.00
Item 14	−.58	.96	.98
Interest powered			
Item 1	−1.24	1.10	*1.08*
Item 2	−1.44	1.13	*1.10*
Item 3	2.00	1.11	1.00
Item 4	2.44	1.04	.99
Item 5	.93	1.01	.99
Item 6	2.14	.92	.97
Item 7	−.12	1.10	1.08
Item 8	1.48	***1.21***	1.04
Item 9	−1.23	1.03	1.03
Item 10	−.27	1.02	1.02

Table 6 continued

Item	Estimate	Outfit (unweighted)	Infit (weighted)
Item 11	−1.19	.90	.91
Item 12	−1.40	.92	.92
Item 13	−.72	1.03	1.02
Item 14	−1.34	.95	.94
Peer supported			
Item 1	−1.17	1.13	1.09
Item 2	−1.14	1.12	1.06
Item 3	−.70	***1.23***	*1.17*
Item 4	−1.11	.94	.95
Item 5	−1.23	.98	.94
Item 6	−1.12	1.02	1.01
Item 7	1.02	***1.32***	1.24
Item 8	.42	1.02	.99
Item 9	.22	.95	.94
Item 10	.29	.95	.94
Item 11	.04	1.15	1.12
Item 12	.63	1.04	1.01
Item 13	.69	1.05	1.03
Item 14	1.25	1.00	.98
Item 15	1.20	1.03	1.02
Item 16	.26	.99	.97
Item 17	.50	.96	.95

Fit statistics significantly different from zero ($p < .01$) are italicized. Outfit statistics outside the tolerance range of (.82, 1.18) are in bold. The items for each principle are given in "Appendix"

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 reliability was estimated as .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. Accordingly, this dimension was dropped from the second version of the measure.

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 "had 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.).

A fairly large number of items failed to display adequate fit to the model. Specifically, the Likert items over-fit the model (i.e., displayed less randomness than expected), while the non-Likert items displayed often under-fit the model (i.e., displaying more randomness than expected). The most plausible explanation for this finding seemed to be the difference in response options (i.e., forced-choice endorsement vs. responding on a Likert scale); thus this could be interpreted as a method effect. 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 a method effect remained (as expected) the two new items displayed good fit and empirical ordering in line with theoretical expectations. The reliability was estimated as .79 for this principle.

In the second version of the measure, the items were retained with fairly minimal modifications. The finding regarding over-fit of Likert items and under-fit of non-Likert items was replicated. The overall reliability was estimated as .83. 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 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.

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 a "reversal" in mean person location and was also estimated to be the most severely misfitting item. We deemed this item unsalvageable and eliminated it. The overall reliability was estimated as .49.

After discussion, revisions were made to the construct map, and several items were re-written for the second version of the measure, which included a total of six items. The empirical ordering of items was now consistent with the construct map and all items displayed acceptable fit, with the possible exception of a question asking whether students used tools that professionals used. The estimated reliability improved to .79. We interpreted these results as evidence that significant progress has been made, though more item development work—and probably theoretical work—is still needed.

Openly networked principle

The twelve items initially 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 were available to others, while the second group was chiefly about whether the youth had access to relevant technology. When a unidimensional model was fit to all twelve items,

the items in the first group displayed extreme under-fit while the items in the second group displayed extreme over-fit; 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 removed the first group of items from further analysis, and slightly revised 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 .61.

In the second version of the measure, eight new items were written regarding the ease or difficulty of finding information and other forms of support from others (e.g., "it's easy for me to find people who share my interests in the activity," with the options "true for me" and "false for me"), along with revised versions of the six items pertaining to access to technology. One item displayed extreme over-fit; this was determined to be due to confusions resulting from the wording of the item: the sentence "I hear about cool things people do when engaged in the activity, but I don't know how I can start to do those things" is double-barreled, meaning that a student might disagree for more than one reason. Otherwise; items mainly conformed to model expectations; the reliability was estimated as .80. We interpreted these results interpreted as tentative supporting evidence in support of the hypothesized measurability and structure of an openly networked construct.

Interest powered principle

We initially 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 under-fit the model. This, again, could be interpreted as a method effect due to the difference in response options (i.e., selecting specific activities vs. responding on a Likert scale). The reliability of this scale was estimated as .77.

Slight modifications were made to several items and a new item was added in the second version of the measure. All items displayed acceptable fit; the overall reliability was estimated as .75. Taken in whole, we interpreted this as tentative evidence in support of the hypothesized measurability and structure of an interest powered principle.

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 a Rasch model was fit to the data, all ten of the non-Likert items displayed severe under-fit, and the Likert items displayed severe over-fit. 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. Additionally, it was discovered that 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 .67.

In the revision, a new item was written asking youths to identify persons who "encourage you to participate in this activity." Unfortunately, this item did not fit the model, possibly due to formatting issues. Apart from this, the items on the second version fit the model well; the reliability was estimated as .86. Taken in whole, we interpreted these results as tentative evidence in support of the hypothesized measurability and structure of a peer supported construct.

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. For the second version of the measure, the estimated correlations ranged from .33 to .72 (Table 7). This was in line with expectations; also, importantly, there was no indication that any of the features were so highly associated as to be considered empirically redundant.

Comparison to evidence from interviews: peer supported principle

Site-level comparison of scores on the peer supported principle to evidence from peer interviews suggest some consistency between salient features elicited on the initial version of 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) for the interviews. 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 (9), youth indicated that friends had been critical

Table 7 Estimated correlations among dimensions

	Shared purpose	Production centered	Peer supported	Openly networked	Interest powered
Shared purpose	1.00				
Production centered	.47	1.00			
Peer supported	.66	.48	1.00		
Openly networked	.56	.46	.45	1.00	
Interest powered	.57	.54	.72	.34	1.00

All correlations are significant ($p < .01$)

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 (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 (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 suggested some potential refinements to both the peer supported principle definition and to survey items. In light of these, we included additional language and items about friends who co-participated in the focal pursuit on the second version of the survey, which may have contributed to the improvements in reliability and other psychometric properties discussed in the previous section.

Notably, some important differences across sites evident in the interviews were not evident in overall 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

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, to various degrees, for the measurability of five of the initial six principles in the connected learning model. Of these, the measures of the shared purpose, interest powered, and peer supported principles worked fairly well initially, and were additionally improved in the revision; the empirical ordering of item responses was in good alignment with expectations based on the construct maps for each of these constructs, and the estimated reliabilities for all three constructs, were acceptably high. The production centered and the openly networked principles initially displayed poor correspondence between item response patterns and the construct maps, and significant revisions to both the construct maps and items were made for the second version. The revised versions displayed significantly better fit and higher reliability estimates.

We found moderate 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 (or five) principles, we conclude that all of the dimensions should be measured on the survey.

Consistency of quantitative and qualitative findings

In a preliminary analysis comparing quantitative and qualitative findings with respect to youths' experiences of the peer supported principle of connected learning, we found 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. This is consistent with both our construct map and evidence from survey responses. Additional longitudinal research and 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 future orientation. We have some preliminary evidence from longitudinal analyses that changes in peer brokering are positively related to changes in future orientation among youth (Dadey et al., under review).

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. The reliability of the measure of the academically oriented construct was unacceptably low. In our view, one issue is with the mapping of items to the construct definition. We included a number of items related to a broad range of academic subjects, from language arts to mathematics. But it is unlikely that any particular interest would be so broad as to result in a young person asserting that their interest supported their academic learning in all of the subjects we queried. Nor would we expect any particular subject to be affected by the broad range of interest-related pursuits named by youth in our sample. Thus, revised items that focus more broadly on how interest-related pursuits benefit youths' academic careers are needed for a next version of the survey. 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.

At this time, we do not see the failure to measure the original construct reliably as a fatal flaw for our measurement enterprise, because many of the other constructs are integral to the process of learning. For example, a number of scholars have argued that making and production with technology can benefit the process of learning (e.g., Duffy and Jonassen 1992; Harel and Papert 1991; Soep 2006). Even so, given the importance to the model of connecting interest-related pursuits to success in work, civic life, in addition to school, reworking of the construct definition is warranted. We have developed a new construct map and associated items that are focused more sharply on youth's perceptions that their experiences support their school-related activities and are currently testing these items in the field.

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. In particular, peers also play a significant role in motivating sustained engagement in a pursuit. Also, gaining new friends may be a valued (at least to youth) outcome of connected learning as well.

Conclusion

Measure development studies like this one 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 et al. 2012). In addition to outcome measures, program-specific measures of 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.

The survey of connected learning is particularly relevant to contexts where young people can earn digital badges for developing skills in out of school settings. Digital badge ecosystems are a mechanism by which young people can earn recognition for demonstrating knowledge and skill acquired through participation in interest-related issues (Davis and Singh 2015; Riconscente et al. 2013). The survey of connected learning may be used within badge ecosystems to understand better pathways young people follow, including whether badge systems skew young people's pursuits toward activities for which they can earn badges (Abramovich et al. 2012; Devedžić and Jovanović 2015). Already, the survey is in use to help assess youth experiences in a program called FUSE Studios being implemented in dozens of school sites in the Chicago area (Penuel et al. 2015). FUSE Studios is a program that presents a set of technology-based "challenges" focused on science, technology, engineering, art, design, and mathematics (STEAM), with the aim of promoting interest discovery.

The survey of connected learning can also be used in the many programs funded through the Digital Media and Learning initiative of the MacArthur Foundation and the federal Institute of Museum and Library Services. These include the Hive Learning Networks, a collaborative of organizations and institutions working together to help young people explore their interests in Chicago, New York City, and Pittsburgh (Larson et al. 2014). They also include a large number of re-designed library spaces that have been organized to support youths' developing skills with new digital media (Barron et al. 2014; Sebring et al. 2013; Subramaniam et al. 2015; Tripp 2011). More recently, MacArthur Foundation in fall 2015 spun off a new, independent nonprofit organization focused on scaling programs that support connected learning. The nonprofit (https://www.lrng.org/) will replicate an effort in Chicago to create a "City of Learning" in several large cities; these are digital platforms that link youth to programs that seek to foster interest discovery and development in large cities. Each of these different contexts are in need of tools for assessing youth experiences in them, and for understanding how program experiences relate to opportunities to pursue interests beyond the programs' walls.

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Appendix: Survey of principles of connected learning

Think of an activity that:

- You enjoy doing
- You get better at doing, the more you engage in the activity

What is that activity?

How long have you been doing this activity?

____ years _____ months

The rest of the questions are about the activity you listed above.

Shared purpose principle

In the past 6 months, when participating in the activity, have you:

	Yes	No
1. Completed a group project?	☐	☐
2. Had the chance to lead others or take a leadership role?	☐	☐
3. Taken part in a performance, presentation, or competition?	☐	☐
4. Had an opportunity to use your judgment about a decision?	☐	☐

Say how much you agree or disagree with each statement below.

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
5. In the activity, there are clear goals.	☐	☐	☐	☐	☐
6. In the activity, everyone is trying to achieve the same goals.	☐	☐	☐	☐	☐
7. People in the activity make sure that everyone has the opportunity to participate and contribute.	☐	☐	☐	☐	☐
8. In the activity, everyone gets a say.	☐	☐	☐	☐	☐
9. I feel like my ideas count in the activity.	☐	☐	☐	☐	☐
10. I contribute to the activity.	☐	☐	☐	☐	☐

Production centered principle

When making or designing things while you are engaged in this activity, how often do you:

	Never or hardly ever	1–3 times a month	Once a week	More than once a week
1. Think about what will be interesting for other people?	☐	☐	☐	☐
2. Design or create something that can be seen by 10 people or more?	☐	☐	☐	☐
3. Design or create something that has a message about how to make a difference in the world?	☐	☐	☐	☐

When you engage in the activity, how often do you:

	Never or hardly ever	1–3 times a month	Once a week	More than once a week
4. Get help from adults on how to use tools to create or design things?	☐	☐	☐	☐
5. Use tools that professionals use?	☐	☐	☐	☐
6. Learn about the ways that professionals use tools to create or design things?	☐	☐	☐	☐

Openly networked principle

When you are making or doing things in or at the activity:

	Strongly agree	Somewhat agree	Neither agree nor disagree	Hardly ever or never	Does not apply
1. I have access to hardware that I need.	☐	☐	☐	☐	☐
2. I have access to software tools that I need.	☐	☐	☐	☐	☐
3. I can get help with technology when I need it.	☐	☐	☐	☐	☐

When creating or designing things with technology when you are engaged in the activity, can you:

	Yes	No
4. …get access the tools and work you need for this activity wherever you want to?	☐	☐
5. …use the internet to communicate with others about this activity?	☐	☐
6. …get feedback and support from others engaged in this activity from others?	☐	☐

For each of the statements below, say whether it is true or false for you.

	True for me	False for me
7. Someone I know has helped me find other people who share my interests in the activity.	☐	☐
8. It's easy to learn about places where I can engage in [activity].	☐	☐
9. It's easy to find out the requirements for participating in all the activities at [site].	☐	☐
10. I hear about cool things people do when engaged in the activity, but I don't know how I can start to do those things.	☐	☐
11. I don't really know where I could go to get better at the activity.	☐	☐
12. It's easy for me to find information about new places to engage in the activity.	☐	☐
13. It's easy for me to find people who share my interests in the activity.	☐	☐
14. People help me figure out where else I can do this activity.	☐	☐

Interest powered principle

Where are all the places you pursue the activity?

	Yes	No
1. At home	☐	☐
2. At my school	☐	☐
3. At a different school from my own school	☐	☐
4. At a museum or cultural center	☐	☐
5. At a youth organization in the community	☐	☐
6. At a church, synagogue, temple, or other faith-based center	☐	☐
7. On the internet	☐	☐
8. Other	☐	☐

Please tell us if you have done the following things since you started participating the activity:

	Yes	No
9. Looked for information related to this activity on your own (e.g., looked on the web, checked out a book?	☐	☐
10. Looked for other people, in real life or online, who are interested this activity?	☐	☐

Say how much you agree or disagree with each statement below.

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
11. The activity is related to what I want to do for work in the future	☐	☐	☐	☐	☐
12. By participating in the activity, I discovered a talent or an interest I didn't know I had	☐	☐	☐	☐	☐
13. The activity changed my mind about what I wanted to do in the future	☐	☐	☐	☐	☐
14. The activity helped me become more curious about things I wasn't interested in before	☐	☐	☐	☐	☐

Peer supported principle

Say how much you agree or disagree with each statement below.

	Strongly agree	Somewhat agree	Neither agree nor disagree	Hardly ever or never	Does not apply
1. When I get stuck I can get helpful suggestions from someone about how to solve the problem.	☐	☐	☐	☐	☐
2. When others see something in my work that could get better they give me good ideas.	☐	☐	☐	☐	☐
3. People who also participate invite me to try doing new things that push me to grow.	☐	☐	☐	☐	☐
4. When someone who engages in this activity does really well everyone is happy.	☐	☐	☐	☐	☐
5. People who mage this activity want everyone to be able to pursue what they are interested in	☐	☐	☐	☐	☐
6. If you are not doing well in this activity someone is there to listen to you.	☐	☐	☐	☐	☐

7. Is there anyone who encourages you to participate in this activity?

☐ A parent
☐ A mentor
☐ A brother or sister
☐ A cousin
☐ An uncle or aunt
☐ A grandparent
☐ One or more friends
☐ No one encourages me to participate

For each of the following kinds of people, please tell us if you have had the following experiences because of your current or recent involvement with this activity. MARK ALL THAT APPLY.

	A parent or guardian	A teacher or teachers	A program leader or leaders	A friend or friends	Nobody
8. Because of my participation in this activity I developed or improved a relationship with:	☐	☐	☐	☐	☐
9. Because of my participation in this activity I had good conversations with:	☐	☐	☐	☐	☐
10. Because of this activity I came to feel more supported by:	☐	☐	☐	☐	☐

How does each of the people listed below help you in the following ways when you are taking part in the activity? MARK ALL THAT APPLY.

	A parent or guardian	A teacher or teachers	A program leader or leaders	A friend or friends	Nobody
11. These people teach me new things about the activity.	☐	☐	☐	☐	☐
12. These people work with me on a project related to this activity.	☐	☐	☐	☐	☐
13. These people help me find information related to my interests in this activity.	☐	☐	☐	☐	☐
14. These people sign me up for things that are related to this activity.	☐	☐	☐	☐	☐
15. They buy or give me things I need to help me pursue this activity.	☐	☐	☐	☐	☐
16. They give me advice related to this activity.	☐	☐	☐	☐	☐
17. They let me teach them about what I know about this activity.	☐	☐	☐	☐	☐

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