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Hietajärvi, Lauri

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Dimensions of adolescents' socio-digital participation

Lauri Hietajärvi*, Juuso Seppä*, Kai Hakkarainen*

Abstract

This investigation aimed to theoretically conceptualize the components of socio-digital participation (SDP) supported by data collected using a novel SPD-inventory as well as a semi-structured interview -tool. We carried out a pilot study in a Finnish comprehensive school with both quantitative (n=284; age 12-15) and qualitative data (n=35). We identified six conceptually separate dimensions of SDP. *Social networking* was conceptualized to be more likely to be friendship-driven, and, *knowledge-* and *media-oriented* as interest-driven. *Academic participation* was conceptualized as a separate boundary-crossing dimension between autonomous and controlled study activities. Further, we identified two separate dimensions of gaming: *recreational games* and *action and sports* games. Based on the results we propose that in cultivating novel pedagogical practices, the heterogeneity should be recognized instead of one-size-fits-all mentality, and, further, that it is critical for the educational system to deliberately facilitate students appropriating of advanced digital practices of working with knowledge and media.

Keywords: digital technologies, socio-digital participation, technology-mediated learning

* Faculty of Education, University of Helsinki.
Corresponding Author: lauri.hietajarvi@helsinki.fi



Introduction

This study focused on examining dimensions of adolescents' practices of using socio-digital technologies, i.e. the integrated system of digital tools mediating everyday activities. We are talking about socio-digital practices as most aspects of using new digital technologies are socially mediated (Rheingold, & Weeks, 2012), and use the concept of *Socio-digital Participation* (SDP; Hakkarainen, Hietajärvi, Alho, Lonka, & Salmela-Aro, 2015) to characterize diverse digitally mediated ways of social participation. The current school children are among the first cohorts of adolescents socialized to use social media from the very beginning of their lives. Most adolescents appear to use socio-digital technologies more intensively outside than within school. In spite of advanced technological infrastructure of Finnish school, technology-mediated learning and instruction are not very intensively practiced in our classroom. A new instrument for assessing adolescents' socio-digital participation was developed so as to examine hypothesized gaps between their schooling and informal digital activities that appear to hinder many students' motivation and engagement (Hakkarainen et al., 2015; Hietajärvi, Nuorteva, Tuominen-Soini, Hakkarainen, Salmela-Aro, & Lonka, 2015; Hietajärvi, Tuominen-Soini, Hakkarainen, Salmela-Aro, & Lonka, 2015).

When examining adolescents' socio-digital participation (SDP), friendship-driven practices of hanging out with peers have been distinguished from interest-driven practices of seeking, creating, and sharing knowledge and media (Ito et al., 2009). When friendship-driven activities are focused on interacting mostly with already known friends, interest-driven activities are, in turn, centered on a mutual interest and often involve interacting with expanded social and knowledge networks. Hence, SDP provides adolescents multifaceted affordances for personal and collaborative creation of knowledge and artefacts by integrating processes of autonomous self- and co-regulated learning, making, and sharing (Hakkarainen et al., 2015; Bereiter, & Scardamalia, 2006; Shirky, 2010) and also through participation in digitally mediated cultural practices (e.g. Jenkins, 2009) as well as associated locally emerged ecologies of learning and participation (Hakkarainen, 2009; Hakkarainen et al., 2000; Barron, 2006).

The present way of conceptualizing adolescents' socio-digital activities was inspired by Ito's and her colleagues' (2009) way of distinguishing three levels of SDP: a) friendship-driven use of digital technologies for 'hanging out' with peers, b) interest-driven 'messing around' with technology and media oriented toward developing associated competencies, and c) 'geeking out' for cultivating expertise related to technologies or creative working with media. Although only a few adolescents are expected to be "geeking out", practices of most adolescents are expected to fluctuate across diverse forms of friendship- and interest-driven activities so that their SDP may involve elements of all these practices. Therefore, we assume that adolescents' practices of SDP are heterogeneous in nature as suggested by some previous studies also (e.g. Eynon, & Malmberg, 2011; Kennedy, Judd, Dalgarno, & Waycott, 2010; Thompson, 2013; van den Beemt, Akkerman, & Simons, 2011).

Consequently, the present study aims at tracing and conceptualizing different dimensions of SDP both quantitatively and qualitatively. Towards that end, we pilot a novel instrument based on revising some previous instruments (e.g. Hakkarainen et al., 2015; Barron, 2004; Barron, Martin, & Roberts, 2007). This study was aimed at examining *what kinds of dimensions of adolescents' socio-digital participation (SDP) can be identified?* Even though we had a priori expectations of the dimensional structure, the research aim was an open empirical question. The more detailed research questions we addressed were:

1. What kinds of dimensions of SDP can be identified? How are they related and distributed?
2. How the students describe their SDP with regards to: The identified dimensions? Related social network relations? Complexity of activities?

1. Method

1.1. Participants

This pilot study is a part of a longitudinal project funded by Academy of Finland. The study was conducted in a multicultural school in Fin-

land on two parts: collecting data through a self-report questionnaire (SRQ), supplemented by semi-structured interviews of a subsample. The SRQ data was collected in the spring of 2013 from 284 adolescents from Grades 6-9 (see Table 1). The response rate was 82.2%. A gender-balanced (M=19, F=16) subsample of 35 students from grade 6 (n=15) and grade 7 (n=20) were selected for semi-structured interviews carried out in the fall of 2013. The participants were selected according to their SRQ-responses to represented different technology users from average users to gamers and creative users.

Table 1. Sample characteristics

		F	%
Gender	Male	104	41.1
	Female	149	58.9
Grade	6 th	47	18.6
	7 th	76	30.0
	8 th	63	24.9
	9 th	67	26.5
Nationality	Finnish	199	78.7
	Other	49	21.3
Mother tongue	Finnish	117	46.8
	Other	130	53.2

1.2. Socio-digital participation-inventory

For the quantitative part of the study, we administered an SDP-inventory (SDPi) constructed to assess the participants' SDP by relying on some earlier items (Hakkarainen et al, 2000; Barron et al., 2007) and developing a number of new items concerning the evolving socio-digital practices. The initial inventory consisted of 35 items which were aimed at assessing the use of social networking services or "hanging out" (e.g. "How often do you follow profiles, pictures, and activities of your friends?"); composing and sharing media artifacts (e.g. "How often do you share music you have created or remixed?"); knowledge-

oriented participation (e.g. “How often do you update your own blog or share your writings?”); academic-oriented participation (e.g. “How often do you discuss school-related issues on the internet?”); and type of games played (e.g. “How often do you play adventure games?”). In the context of each item, a Likert-type scale from 1 (never) to 7 (all the time) was used.

A series of exploratory factor analyses (EFA) were conducted for the SDPi items using Unweighted Least Squares extraction with Promax rotation. The accepted minimum loading per factor for each item was $>.32$ (Tabachnick, Fidell, & Osterling, 2001), and items with crossloadings $>.32$ were eliminated. Pearson correlations as well as descriptive statistics were examined.

1.3. Socio-digital participation interview

The interviews addressed the participants’ friendship-driven practices of hanging out with their peers, their possible interest-driven practices and competencies of using digital technologies as well as various ways of using these technologies to support school learning. Participants were interviewed face-to-face in Finnish; the interviews were audio recorded and took approximately 20-30 minutes.

Qualitative content analysis (Krippendorff, 2004) was performed on interview data using the SDP-dimensions (SDPi) as an analytic framework for categorization. The interview data was first partitioned to text segments according to smallest meaningful main ideas. Then, the second author categorized the identified ideas according to the dimension of SDP they were related to the most. All independent ideas were categorized separately and the categories were mutually exclusive.

2. Results

2.1. Questionnaire results

First, the items assessing digital activities were subjected to EFA. With eigenvalues $>.1$ the test suggested a seven factor solution. However, after running the data with also 8, 6, 5 and 4 factor solutions it was

selected the six-factor solution as it was the most interpretable and supported by the scree plot. The final solution (see Table 2) explained 51.1% of the variance, which is a little low, but as the phenomenon is highly complex it was deemed adequate.

Table 2. Latent factor loadings of Exploratory Factor Analysis with Un-weighted least squares estimation and Promax rotation

Item	Factor					
	1	2	3	4	5	6
1. Update and go to see my own profile page (e.g. Facebook)	.87					
2. I follow profile pages, pictures, and activities of my friends	.85					
3. I go to community services (e.g. Facebook)	.77					
4. Report my feelings and activities to my friends	.68					
5. I chat (WhatsApp, kik)	.48					
6. I share photos I have taken	.42					
7. Surf the internet without specific aim and hope to find something interesting	.33					
8. I read and follow microblogs (e.g. Twitter)		.79				
9. I write microblogs (e.g. Twitter)		.76				
10. I keep my own blog or share my writings		.62				
11. I read and follow blogs (blogs related to hobbies and those of my friends)		.61				
12. I share videos I have taken or edited			.76			
13. Share material I have myself created related to my hobbies and interests			.71			
14. I share music I have created or remixed			.64			
15. Modify and remix material I find (texts, videos, photos, music)			.35			
16. I ask my friends to help me in school work related issues				.81		
17. I discuss school-work related issues in the internet				.80		
18. I give help to my friends in school-work related issues				.78		

Item	Factor					
	1	2	3	4	5	6
19. Seek information of issues related to my school work				.57		
20. How often do you play exercise (training) games					.87	
21. How often do you play music, rhythm and dance games					.73	
22. How often do you play party games					.64	
23. How often do you play puzzle games					.33	
24. How often do you play shooting games						.85
25. How often do you play adventure games						.68
26. How often do you play role games						.67
27. How often do you play driving games						.60
28. How often do you play strategy and simulation games						.59
29. How often do you play sport games						.51

We conceptualized the latent factors as: 1) *Social networking* consisting of items measuring using social networking services for communication with friends, 2) *Knowledge-oriented participation* that consists of items measuring participation in seeking and sharing knowledge, 3) *Media-oriented participation* which consists of items measuring both creating and sharing media artifacts, 4) *Academic-oriented participation* consisting of items measuring peer interaction related to academic issues, 5) *Recreational gaming* consisting of items measuring intensity of playing music and exercise related games, and 6) *Action and sports gaming* for action and sport related games.

Finally, mean scores of the items loading on each factor were computed for examining the distributions and correlations between the dimensions (see Table 3). Social networking was by far the most popular dimension, whereas media-oriented the least. Other dimensions were more evenly distributed. The correlational patterns revealed small to moderate correlations between all the dimensions except action and sports games which interestingly did not have a correlation with knowledge-oriented nor academic oriented-participation.

Table 3. Variable correlations, internal consistencies and descriptive statistics

	1	2	3	4	5	6
1. Social networking	-					
2. Knowledge-oriented	.35**	-				
3. Media-oriented	.32**	.32**	-			
4. Academic-oriented	.31**	.23**	.39**	-		
5. Recreational games	.21**	.33**	.25**	.19**	-	
6. Action & sports games	.16**	.09	.29**	.10	.44**	-
Mean	4.22	2.12	1.78	2.82	2.14	2.35
Means SD	1.31	1.29	1.11	1.37	1.18	1.30
Cronbach's Alpha	.83	.76	.76	.83	.75	.83
n	237	269	246	262	249	252

Note. ** = Correlation is significant at the <.01 level.

2.2. Interview results

Then, we analyzed the interviews using the SDP-dimensions as analytic categories (see Table 4 for descriptions of categories and Table 5 for excerpts of data). All of the dimensions identified via the SDPi were also represented in the participants' interview responses, and all of their descriptions fit the analytic categories, so no new categories emerged in the interview analysis.

All the interview participants mentioned using digital technologies for *social networking* that varied from occasional social media contacts to intensive daily participation in virtual communities. They communicated mostly with peers from their school and neighborhood so that there were overlapping online and offline relations. Communication with friends was done mostly by using different popular social networking services, such as direct messaging services. Few of the participants were more active and reported using multiple services quite actively (see Table 5: Excerpt 1). Some participants (n=7) also reported using digital technologies to connect with associates reaching beyond face-to-face friends (see Excerpt 2).

Table 4. Analytic categories, their descriptions and typical examples

Category	Description	Typical examples	n ₁	f ₂
Social networking	Communicating with friends, using social media.	"I mostly use Kik with my smartphone" (M17).	35	46
Knowledge-oriented participation	Seeking, creating and sharing knowledge on a topic.	"...like from the internet I can find instructions on how to act and behave in dog (conformation) shows" (F01).	23	26
Media-oriented participation	Creating and sharing media artefacts such as drawings, video and music.	"I draw with it (smartphone) too, for like 2, 3, 4 hours a day" (F02). "I've made three football – videos (and shared online)" (M09).	10	17
Academic-oriented participation	Using digital technologies in support of schoolwork.	"Usually, when I do schoolwork at home, I have the computer next to me, and if there's something I don't know, I don't use books, I look it up online as it's faster" (M17).	34	44
Gaming-oriented participation	Playing games or participating in gaming related activities.	"... Sims, we play it together, she has an avatar and I have an avatar there, so we talk. And she helps me and I help her with tasks there some times" (F02).	23	31

Note: 1 = number of participants that mentioned the activity, 2 = frequency of total different mentions for activities in this category.

Most of the participants (n=23) reported using digital technologies for *knowledge-oriented* participation. These activities were mainly interest-driven, related to their hobbies, and varied from, for instance, learning a dance by watching videos to seeking practical advice from peers (see Excerpt 3). Four of the participants described their knowledge-oriented participation happening in an extended network, such as previously unknown members of different online communities. Three of the participants, that appeared to be more active in SDP overall, reported that their knowledge-oriented participation involved also creating and sharing knowledge related to, for instance, programming (see Excerpt 4).

Less than third of the participants described *media-oriented participation*. However, these mentions were heterogeneous, ranging from creating drawings and sports videos to written stories. The descriptions also included mentions of creating short movies and sharing them online to using SDP to support “real-life” creative activities (see Excerpt 5). Further, six participants described engaging in media composing that explicitly reaches from their friendship network to a more extended network. One participant described creative digital practices that appeared to be both so intense and complex, that by Ito et al (2009) she might be considered being geeking out. The activities she describes (see Excerpt 6) include media composing and sharing, creating new network connections, social learning and sharing of feedback.

All but one of the participants reported using digital technologies for *academic participation*. Most of them mentioned (n=28) using some technologies in doing tasks at schools, but many of the participants (n=14) reported also using technologies to do schoolwork outside of school. Almost all of the participants (n=31) described using digital technologies in giving and receiving help from their peers. The data suggests that peer help is parallel to that of teachers, sometimes even preferred. It appears that academic-oriented participation is a meaningful part of the students' learning and most often self-regulated or co-regulated between the students (see Excerpt 7). These types of autonomously sparked practices are crucial in bridging the possibilities provided by the novel digital tools with academic goals. The data also indicates that social media has been implemented semi-officially as a mediating space for a whole class to support peer learning (see Excerpt 8).

Two thirds of the participants reported *gaming* with at least some device. Some reported playing alone (n=5) but many reported social gaming (n=9) that, however, differed in quality from a hanging out type of recreational gaming to a more competitive action or sports gaming that reminisces team-sports. A few of the participants (n=6) that described social gaming also reported that their gaming activities happen in an extended network beyond their school friends (see Excerpt 9). One participant (see Excerpt 10) appeared to be so deeply

involved in gaming and facilitating other people’s gaming so that his activities could be considered as reaching towards the level of geeking out (Ito et al, 2009). Overall, most of the participants play games with different devices, but only a few of play intensively or with an extended network.

Table 5. Excerpts of interview data

Category	Excerpt number	Data
Social networking	Excerpt 1	<i>“Instagram, Twitter, YouTube, I also have Tumblr account, but I’m not so active there, WeHeartIt. And then I have Kik and WhatsApp” (F16).</i>
	Excerpt 2	<i>“...I also have the game, in which you can get acquainted with some people, I met this female there in the summer, and I’m still in connection with her, in Russian Facebook, and then I talk with her in Skype also” (F09)</i>
Knowledge-oriented participation	Excerpt 3	<i>“...like, do I color with wooden colored pencils or with watercolors, so I look up (from a related discussion forum) like which is easier and like easier to learn, so I like acquire knowledge in how they (more experienced members) do it and then... ..and some people tell that colored pencils are cheaper, so I pick them as they are easier and cheaper”(F02).</i>
	Excerpt 4	<i>“I’ve been sharing instructions online. If you yourself can do something that others don’t, then I of course would like to share it to others so they can learn it too” (M11).</i>
Media-oriented participation	Excerpt 5	<i>“Yea, we (a band) watch YouTube –videos, and sometimes if we can’t come up with a song, we take a song from YouTube and start playing it” (F10).</i>
	Excerpt 6	<i>“It’s this smartphone application, DrawCast, and the on the computer DeviantArt (a website), so there I can share also, DrawCast is easier though, as it is on your phone so you have it all the time with you... ..for example in DrawCast I’ve met this female, she’s Arabic too, but she lives in another country, but I have gotten to know her a little... (F02).</i>

Category	Excerpt number	Data
Academic-oriented participation	Excerpt 7	"Well, for example this Mike, so I send him for example in Kik some picture, and tell him what's the assignment, and the he tells me how to do it, and if I can't then he helps me more" (F03).
	Excerpt 8	"P: ...we have this group, in which we talk about homework and tests and what not, yesterday someone asked about Swedish homework, and how to do it and you know. I: So you have a Facebook -group? P: Yea, but it's like, secret group. There can only be people from our class" (F03).
Gaming-oriented participation	Excerpt 9	"Playing PlayStation mostly. But not like we've seen each other (in person), but communicate via PlayStation, as we both have mics and then we can talk" (M15).
	Excerpt 10	"P: Me and my friend have this game. It this kind of a game server, in which other players can play. So, we are administering that. You meet a lot of new people there. I: Do you feel like you're a part of an online community? P: I do. Our server is quite big in ranking, so I'm quite well known in there (online). Many people know me by the server, even though I don't want to use my own name there. I: (Have you found people) with which you share similar interests? P: Well, that my friend, that I met through this hobby. We started thinking that we could do something like this, as we get a little money out of it also" (M11).

Note: I = Interviewer, P = Participant

3. Discussion

The aim of this study was to enhance the conceptualization of adolescents' SDP and empirically examining its multidimensional nature. Relying on both previous research as well as our own empirical data we were able to identify dimensions of friendship-driven and interest-

driven activities that consisted of six conceptually distinct yet empirically related dimensions identified in both the quantitative and qualitative analyses.

3.1. Dimensions of socio-digital participation

Social networking

First, we defined social networking as comprising of activities that are centered on communication with friends by the use of social networking services. These activities are conceptualized as mostly being friendship-driven (Ito et al., 2009). In this sample, this was clearly the most popular form of SDP as was evident also in the interviews. Our previous studies (see Hietajärvi et al., 2014; 2015) as well as international studies have found the same conclusion (e.g. Eynon, & Malberg, 2011; Thompson; 2013). Social networking using digital media appears to be an important part of the participants' social interaction, knowledge flow, and maintaining geographically distributed friendships. Also, some are engaged in more intensive and complex ways of interacting with various social media that might gradually deepen to an enhanced working with some special interest. To them, social networking using digital media appears also to be a way of broadening their networks.

Knowledge-oriented participation

Second, we defined activities that are focused on seeking, sharing, and creating information as knowledge-oriented participation, which can be defined as interest-driven. In this sample most students reported at least some level of knowledge-oriented participation and the interview data explicated varying degrees of engagement from seeking to sharing knowledge. The data also provided us with examples of the altruistic culture of participating in sharing knowledge and artifacts with previously unknown people (Jenkins, 2009; Shirky, 2010). Thus, we conceptualize knowledge-oriented participation as a continuum from a shallower knowledge seeking to a gradually deepening process of creating and building knowledge in informal social networks (Li, Hietajärvi, Palonen, Salmela-Aro, & Hakkarainen, 2016).

Media-oriented participation

Third, we defined activities focused on creating and sharing media artifacts as media-oriented participation. This, despite being an activity least frequently reported by adolescents in both our SRQ and interview results, has been recognized in prior studies also (e.g. Eynon, & Malberg, 2011; Ito et al., 2009; Jenkins, 2009). The data in this study provided more insight in the power of creative SDP practices in adolescents learning, by, for instance, supporting the development of various competencies and widening of networks. Such activities are, by definition, interest-driven in nature so that it can also be viewed as a potential, gradually deepening and often collaboratively oriented learning process similar to knowledge-oriented participation.

Academic-oriented participation

Fourth, we consider spontaneous pursuit of academic interests as a valuable dimension of SDP. Such autonomous, personally or jointly initiated self-organized study activities are related to school learning, in spite of not being controlled by teachers or educational institutions. These include, for example, using digital technologies to support social learning by interacting with other students, artefacts, and knowledge distributed across the internet. Using technology to co-regulate self-directed learning activities in an informal setting with friends was evident both on the SRQ data and the interviews. This can also be partially interest-driven, depending on the motivational factors driving one's academic efforts, and as such it is a reassuring finding from the educational point of view. As the data shows, creating a semi-formal platform for students' academic-oriented participation appears to support the co-regulation of the learning activities that might otherwise be facilitated only through the students' informal personal networks. Therefore, as academic participation appears to be a boundary-crossing activity between students informal SDP and institutional schoolwork, it also provides educators with avenues to support the appropriation of new knowledge practices with novel digital tools.

Gaming

Fifth, we consider gaming-related activities to constitute an essential aspect of concurrent SDP, even though it can be also addressed as a

separate construct and culture (e.g. Gee, 2007; Gee, & Hayes, 2011; Granic, Lobel, & Engels, 2014). The results of this study suggest that adolescents participate in both recreational gaming and action and sports games alongside their other socio-digital practices with varying degrees of engagement. Action and sports games showed an interesting correlational pattern as it in this sample only correlated moderately with media-oriented participation (and recreational games), and in that way differed from the other dimensions. In future studies it would be important to better examine these interrelations and digital gaming as its own of adolescent culture.

4. Methodological reflections

Piloting the SDPi instrument can also be considered an aim in this study, as SDP has evolved so rapidly that we had to develop new measures. Yet, it is likely that some relevant aspects were not captured. There could be considerable differences between, for instance, age cohorts that cannot be accounted for by the present relatively small sample, hence, the inventory should be developed further and validated with multiple samples (for work already conducted, see Hietajärvi et al., 2014; 2015). Self-reports have their other biases too, for instance, it is possible that some participants overestimated their intensity of participation or their level of digital competencies (compare Hakkarainen et al., 2000). Despite this, the piloted factor model was consistent with the interviews and supported our conceptualization and, thus, provided promising results.

Regarding the interview analysis, the second author, who at that point had not been involved in designing the SDPi or in the statistical analyses, carried out the content analysis. Although the interviews provided content-rich material regarding various socio-digital activities, the participants did not give too detailed descriptions of their practices. The interviewees were also relatively young (12-13-year old) and did not indicate very deep involvement in the most complex technology-mediated activities. It appears essential to complement SRQs and interviews with process-sensitive methods, such as diaries or repeated sampling of contextual experiences (e.g. Hakkarainen, 2009; Litmanen et al., 2012).

5. Implications for education

It can be concluded that most of the students participated in friendship-driven socio-digital activities rather intensively. Content-wise these friendship-driven activities were mostly centered on communication with friends. However, some adolescents, even at this age, have developed SDP practices that are already reaching out to a wider audience, such as sharing their art, or providing a game server to facilitate other people's gaming activities, and building an extended network of developing expertise in the process (see Li et al, 2016). Further, the creative socio-digital activities some of these students are engaged in require advanced technical expertise, creative thinking, social networking, teamwork and an open mind towards a culture of sharing, all of which can be recognized as 21st century skills (Binkley et al., 2012).

Simultaneously, interrelations between informal and formal activities may be complex. The responsibility for building 21st century skills (Binkley et al., 2012; Scardamalia, Bransford, Kozma, & Quellmalz, 2012) appears to lie on the educational system because most students use technology only in friendship-driven hanging out. It is critical to deliberately facilitate adolescents appropriating of advanced practices of working with knowledge and media by engaging students in challenging multi-faceted investigative study projects from the very beginning of education (e.g. Hakkarainen, 2009). Also, prior studies reveal that even very young adolescents, supported by socio-digital technologies and teachers, are able to engage in collaborative projects that require sustained creation and building of knowledge (Bereiter, 2002; Bereiter, & Scardamalia, 2006; Paavola, & Hakkarainen, 2014; Scardamalia, & Bereiter 2006).

Moreover, it appears possible to bring elements of maker culture in school in terms of engaging students in using socio-digital technologies for designing complex artifacts under teachers' and experts' support (Blikstein, 2013; Seitamaa-Hakkarainen, & Hakkarainen, 2016). Toward that end, it is critical to integrate different studies across science, technology, engineering, arts and mathematics (STEAM) and engage students in appropriating authentic scientific practices that play crucial role in pursuit of knowledge creation and making of innovations. Fail-

ing to transform teacher centered and acquisition oriented educational practices may lead to an increasing gap between adolescents' informal socio-digitally enriched practices and the conventional practices of schooling. Although Finnish students are performing academically very well there are also many who's motivation and interest in schooling are at a low level (e.g. Salmela-Aro, Muotka, Alho, Hakkarainen, & Lonka, 2016) and recent PISA ranking (OECD, 2013) results suggest that Finnish students are less likely to be engaged and like school than students in most other countries. Further, some evidence has already been presented indicating that students' school motivation is related to both their SDP practices as well as digital competence (Hietajärvi et al., 2015). This is a topic that needs to be addressed further, and, in order to improve understanding of adolescents' school engagement, we are collecting longitudinal data of their learning, wellbeing and digital activity. When developing productive practices of using socio-digital technologies at school it should be taken into consideration that the practices adolescents have cultivated elsewhere cannot be directly transferred to schools, and, that there are various risks in these kinds of pursuits. Adolescents may experience that their culture is misappropriated if incorporated too strongly by schools (Selwyn, 2006). Moreover, in cultivating novel pedagogical practices, the heterogeneity should be recognized instead of on-size-fits-all mentality. Novel paradigms, such as connected learning (Ito et al, 2009; Kumpulainen, & Sefton-Green, 2012), are built on the pursuit of bridging the gaps between the adolescents learning experiences across digitally and physically distributed environments and may prove to be a good way forward.

In future studies we should not only focus on individuals but also their social networking relations hand-in-hand with the SRQ data (see Li et al., 2016). Socio-digital activities are changing rapidly as a function of changing tools and practices; longitudinal studies are needed for tracing trajectories of SDP as well as the underlying motives directing the digital activities. Further, person-oriented studies aiming to identify latent subgroups of SDP should be conducted. It is critical in conjunction with developing SRQ instruments to collect new qualitative data of heterogeneous digital activities and carry out in-depth studies of SDP of various subgroups of users.

References

- Barron, B. (2004). Learning ecologies for technological fluency: Gender and experience differences. *Journal of Educational Computing Research*, 31(1), 1-36.
- Barron, B. (2006). Interest and self-sustained learning as catalyst of development: A learning ecology perspective. *Human Development*, 49, 193-224.
- Barron, B., Martin, C. K., & Roberts, E. (2007). Sparking self-sustained learning: Report on a design experiment to build technological fluency and bridge divides. *International Journal of Technology and Design Education*, 17(1), 75-105.
- Bereiter, C. (2002). *Education and mind in the knowledge age*. Hillsdale, NJ: Erlbaum.
- Bereiter, C., & Scardamalia, M. (2006). Education for the knowledge age: Design-centered models of teaching and instruction. In P. A. Alexander, & P. H. Winne (Eds.), *Handbook of educational psychology* (pp. 695-713). Mahwah, NJ, US: LEA.
- Binkley, M., Erstad, O., Herman, J., Raizen, S., Ripley, M., Miller-Ricci, M., & Rumble, M. (2012). Defining twenty-first century skills. In P. Griffin, B. McGaw, & E. Care (Eds.) *Assessment and teaching of 21st century skills* (pp. 17-66). Netherlands: Springer.
- Blikstein, P. (2013). Digital fabrication and “making” in education: The democratization of innovation. In J. Walter-Herrmann, & C. Buching (Eds.), *FabLabs: Of machines, makers, and inventors*. Bielefeld: Transcript.
- Eynon, R., & Malmberg, L. (2011). A typology of young people’s internet use: Implications for education. *Computers & Education*, 56(3), 585-595.
- Gee, J. P. (2007). *Good video games and good learning: Collected essays on video games, learning and literacy*. New York: P. Lang.
- Gee, J. P., & Hayes, E. R. (2011). *Language and learning in the digital age*. London: Routledge.
- Granic, I., Lobel, A., & Engels, R. C. (2014). The benefits of playing video games. *American Psychologist*, 69(1), 66-78.
- Hakkarainen, K. (2009). A knowledge-practice perspective on technology-mediated learning. *International Journal of Computer Supported Collaborative Learning*, 4, 213-231.
- Hakkarainen, K., Hietajarvi, L., Alho, K., Lonka, K., & Salmela-Aro, K. (2015). Socio-digital revolution: Digital natives vs digital immigrants. In J. D. Wright (Ed.), *International encyclopedia of the social and behavioral sciences* (2nd ed., Vol. 22, pp. 918-923). Amsterdam: Elsevier.

- Hakkarainen, K., Ilomäki, L., Lipponen, L., Muukkonen, H., Rahikainen, M., Tuominen, T., et al. (2000). Students' skills and practices of using ICT: Results of a national assessment in Finland. *Computers & Education*, 34(2), 103-117.
- Hietajärvi, L., Nuorteva, M., Tuominen-Soini, H., Hakkarainen, K., Salmela-Aro, K., & Lonka, K. (2014). Kuudesluokkalaisten nuorten sosiodigitaalinen osallistuminen, kiinnostuksen kohteet ja kouluhyvinvointi. [Sixth-graders' socio-digital participation, interests and academic well-being]. *Kasvatus [The Finnish Journal of Education]*, 45, 429-443.
- Hietajärvi, L., Tuominen-Soini, H., Hakkarainen, K., Salmela-Aro, K., & Lonka, K. (2015). Is student motivation related to socio-digital participation? A person-oriented approach. *Procedia – Social and Behavioral Sciences*, 171, 1156-1167.
- Ito, M., Baumer, S., Bittanti, M., Cody, R., Stephenson, B. H., Horst, H. A., ..., & Perkel, D. (2009). *Hanging out, messing around, and geeking out*. Cambridge, MA: MIT Press.
- Jenkins, H. (2009). *Confronting the challenges of participatory culture: Media education for the 21st century*. Cambridge, MA: MIT Press.
- Kennedy, G., Judd, T., Dalgarno, B., & Waycott, J. (2010). Beyond natives and immigrants: Exploring types of net generation students. *Journal of Computer Assisted Learning*, 26(5), 332-343.
- Krippendorff, K. (2004). Reliability in content analysis. *Human Communication Research*, 30(3), 411-433.
- Kumpulainen, K., & Sefton-Green, J. (2012). What is connected learning and how to research it? *International Journal of Learning*, 4(2), 7-18.
- Li, S., Hietajärvi, L., Palonen, T., Salmela-Aro, K., & Hakkarainen, K. (2016). Adolescents' Social networks: Exploring different patterns of socio-digital participation. *Scandinavian Journal of Educational Research*, 1-20.
- Litmanen, T., Lonka, K., Inkinen, M., Lipponen, L., & Hakkarainen, K. (2012). Capturing teacher students' emotional experiences in context: Does inquiry-based learning make a difference. *Instructional Science*, 40, 1083-1101.
- OECD (2013). *PISA 2012 results: Ready to learn (Volume III) students' engagement, drive and self-beliefs*. Paris: Author.
- Paavola, S., & Hakkarainen, K. (2014). Triological approach for knowledge creation. In S.-C. Tan, H.-J. Jo, & J. Yoe (Eds.), *Knowledge creation in education* (pp. 53-72). Education Innovation Series by Springer. Singapore: Springer.
- Rheingold, H., & Weeks, A. (2012). *Net smart: How to thrive online*. Cambridge, MA: MIT Press.

- Salmela-Aro, K., Muotka, J., Alho, K., Hakkarainen, K., & Lonka, K. (2016). School burnout and engagement profiles among digital natives in Finland: A person-oriented approach. *European Journal of Developmental Psychology, 13*(6), 704-718.
- Scardamalia, M., & Bereiter, C. (2006). Knowledge building. In K. Sawyer (Ed.), *The Cambridge handbook of the learning sciences* (pp. 97-115). Cambridge, MA: Cambridge University Press.
- Scardamalia, M., Bransford, J., Kozma, B., Quellmalz, E. (2012). New assessment and environments for knowledge building. In P. Griffin, B. McGaw, & E. Care (Eds.), *Assessment and teaching of 21st century skills* (s. 231-300). Dordrecht: Springer.
- Seitamaa-Hakkarainen, P., & Hakkarainen, K. (2016, accepted for publication). Learning by making. In K. Peppler (Ed.), *The SAGE Encyclopedia of Out-of-School Learning*.
- Selwyn, N. (2006). Exploring the 'digital disconnect' between net savvy students and their schools. *Learning, Media and Technology, 31*(1), 5-17.
- Shirky, C. (2010). *Cognitive surplus: Creativity and generosity in a connected age*. New York: Penguin.
- Tabachnick, B. G., Fidell, L. S., & Osterlind, S. J. (2001). Using multivariate statistics. Boston: Pearson/Allyn & Bacon.
- Thompson, P. (2013). The digital natives as learners: Technology use patterns and approaches to learning. *Computers & Education, 65*, 12-33.
- Van den Beemt, A., Akkerman, S., & Simons, R. (2011). Patterns of interactive media use among contemporary youth. *Journal of Computer Assisted Learning, 27*(2), 103-118.