Adolescents' social networks:

Exploring different patterns of socio-digital participation

Muotoiltu: englanti (Yhdysvallat)

Shupin Li[1], Lauri Hietajärvi[2], Tuire Palonen[1],
Katariina Salmela-Aro[3], Kai Hakkarainen[4]

[1.] Department of Teacher Education, University of Turku
[2.] Department of Teacher Education, University of Helsinki
[3.] Cicero Learning, University of Helsinki
[4.] Institute of Behavioral Sciences, University of Helsinki

Acknowledgements
This research was funded by the Academy of Finland's Mind Program project "Mind the Gap - Between Digital Natives and Educational Practices" ~~(~~[grant number 265528~~).~~]. The first author was supported by Finnish Cultural Foundation [grant number 00150534] and Turku University Foundation [grant number 10807] ~~(SPEFICY)~~.

Abstract

The purpose of the study was to assess adolescents' participation in various socio-digital activities by using a self-report questionnaire, a social networking questionnaire and interviews. The participants (*N*=253) were grade 6-9 students from a multicultural lower secondary school in Finland. Three profiles of socio-digital participation were identified: friendship oriented *basic participators* (*n*=161), *gaming-oriented participators* (*n*=61) and *creative participators* (*n*=31) intensively engaged in diverse socio-digital practices. The analyses revealed systematic differences in social networking relations as a function of adolescents' social-digital participation profile and gender. The reciprocal values in hanging out, liking and media multiplexity were highest for creative participators whereas gaming-oriented participators were less socially active than their peers. Socio-digital expertise of creative participators was socially recognized by larger group of peers than that of the other groups. The study produces methodological tools suitable for collecting systematic longitudinal data of socio-digital practices of larger groups of adolescents in future.

Keywords: adolescents, social network, socio-digital participation, basic participators, gaming-oriented participators, creative participators

Introduction

The purpose of the present investigation was to develop methods for examining Finnish adolescents' patterns of socio-digital participation. The recently emerged integrated systems of mobile devices, computers, social media, and the Internet enable

constant and hyper-intensive online interaction and social sharing of all digital activities (Rheingold, 2012; Shirky, 2010). Socio-digital practices appear to have transformed how adolescents live their lives, as well as how they socially relate to one another and the world around them (Vasbø, Silseth, & Erstad, 2014). Socio-digital practices have blurred the boundaries between presence and absence, time and space of interaction, personal and mass communication, private and public, as well as the virtual and real worlds (Baym & boyd, 2012). Many Finnish studies regarding adolescents' skills and practices of using Information and Communication Technologies (ICTs) were carried out before the time of proliferation of smart phones and social media (e.g., Hakkarainen et al., 2000)~~Authors, 2000~~) so that we do not have sufficient up-to-date research-based information regarding emerging socio-digital practices of younger cohorts of adolescents. The investigation aimed at developing methodological tools for tracing various aspects of adolescents' practices of socio-digital participation as well as their social-networking relations. Collection of new information of adolescents' emerging socio-digital practices is important for examining potential discontinuities and gaps between their informal socio-digital engagement and experiences of schooling. Although Finnish students perform very well in international school achievement tests, they do not enjoy school very much. Almost a half of 12-year-old Finnish students express some sort of alienation from school, in terms of male students feeling cynical and inadequate and female ones experiencing exhaustion and stress (Salmela-Aro et al., in ~~preparation~~press~~Authors, in preparation~~). The present investigation functioned as a pilot study for a more large scale longitudinal investigation of 12-, 16 and 20-year old adolescents' learning, wellbeing and socio-digital participation being carried out at Helsinki area (Hietajärvi , Seppä, & Hakkarainen.~~Authors~~, submitted).

Different levels of depth and intensity in socio-digital participation may be distinguished, ranging from mere observation and follow-up to personal participation in creating media (Gee & Hayes, 2011; Ito et al., 2009; Jenkins et al., 2009). Ito and colleagues (2009) conducted a year-long ethnographic investigation of (12-19-year-old) adolescents' engagement with socio-digital practices, distinguishing three genres of participation: a) friendship-driven use of socio-digital technologies for "hanging out" with peers; b) interest-driven "messing around" with technologies and media to engage in learning and complex problem solving; and c) "geeking out" for seriously cultivating expertise related to digital technologies or creatively working with media. An adolescent's practices of socio-digital participation are heterogeneous so that an adolescent's activity may to some degree represent features of all of these genres. The basic assumption of adolescents being driven by either friendship- or interest-related aspects resonates strongly with the results of recent studies (e.g. Eynon & Malmberg, 2011; Kennedy et al., 2010; van den Beemt, Akkerman, & Simons, 2011) that have addressed the variation in adolescents' technology-mediated activities. A central finding is that the largest group of adolescents engages mostly in friendship-driven activities (e.g. chat with friends) mediated by socio-digital technologies, whereas only a relatively small minority frequently participates in more demanding, interest-driven activities via socio-digital participation (e.g. improving

programming skills by intensive participation mediated through socio-digital technologies).Three quarters of adolescents (age 12-17) are mobile internet users in terms of using smart phones, tablets or other mobile devices (Lenhart et al., 2008; Madden et al., 2013). Such devices allow them to be "always on" (Baron, 2008) through intensive texting, instant messaging, emailing, lurking, and commenting on their friends' activities through social media. Young people find ways of maintaining their connection and updating their status numerous times per day, even when separated from one another temporally (e.g., in evenings) or spatially (e.g., being out of their neighborhood when visiting relatives). The present investigation sought to identify currently ~~emerged~~ emerging patterns of Finnish adolescents' socio-digital participation by collecting information of the intensity of their digital activities. Beyond friendship-driven hanging out, we were interested in various activities of messing around with technology for sharing various interests, such as music, media, sports, or civic activities. It was expected that enthusiastic participants of such activities would also be oriented toward enhancing their expertise in using computers (Hakkarainen et al.~~Authors~~, 2000), technological fluency (Barron, 2004) or socio-digital competence (Ito et al., 2009).

Although several studies have investigated adolescents' social networks in relation to their use of technologies (e.g. Cole & Griffiths, 2007; Shen & Williams, 2011; Varma, 2007), there are only a limited number of studies concerning how adolescents' social networks are related to their patterns of socio-digital participation. McPherson, Smith-Lovin and Cook (2001) reviewed a large body of literature and claimed that young people tend to actively interact with peers whose behavioral patterns are similar. From network homophily follows that similar people interact closer, which elicits mutual networking because of easier communication (Thelwall, 2009). Hence, we assume that adolescents network with peers who share similar practices of socio-digital participation. On the other hand, previous studies have revealed that there are strong gender differences in Internet use and online communication (e.g. Correa, Hinsley, & De Zuniga, 2010; Varma, 2007). Because gender constitutes ~~also~~ an important aspect of young people's network homophily during early adolescence, the present study also addressed gender effects on socio-digital participation.

Besides lurking and updating one's own status, the friendship-driven activities rely on giving constant feedback (e.g., "likes") to each other's updates and expecting social recognition in return. In this way, participators are encouraged to build intensive reciprocal and extensive (far-reaching) social networks, including friends from old schools and neighborhoods (Gee & Hayes, 2011; Ito et al., 2009; Rainie & Wellman, 2012). It was formerly assumed that because gaming-oriented participators devote much time to playing online games, they would not have large offline social networks (Lo, Wang, & Fang, 2005; Shen & Williams, 2011; Williams, 2006). However, during early adolescence, young people tend to play with local friends rather than with strangers. Their shared gaming activities may contribute to the formation of long-lasting, highly intimate bonds of friendship, with sustainable levels of self-disclosure and intimacy not traditionally found in other mediated spaces (Cole

& Griffiths, 2007; Hsu, Wen, & Wu, 2009; Iacono & Weisband, 1997; Williams, 2006; Yee, 2002). Hence, frequent game players are not necessarily socially isolated (Lenhart et al., 2008). On the other hand, some gaming-oriented participators spend more time than their peers on online games, leading to a decline in the quantity and quality of offline communication and the size of their personal social networks (Blais, Craig, Pepler, & Connolly, 2008; Cole & Griffiths, 2007; Hussain & Griffiths, 2009a; Kim, Namkoong, Ku, & Kim, 2008). Passionate participation in computer gaming may limit gamers' ability to establish and maintain reciprocal offline relationships (Cole & Griffiths, 2007; Shen & Williams, 2011). It is also possible that intensive participation in other socio-digital activities may have implications for social relations in terms of constraining network relations or expanding networks through like-minded proximal or distant peers.

Parallel use of socio-digital technologies has been called as media multiplexity (Haythornthwaite, 2005), i.e., using multiple media modalities for keeping up virtual and face-to-face social connections. The concept of media multiplexity was launched at the time when parallel media use was not yet a common phenomenon. With interaction by multiple media, including face-to-face interaction and communication mediated by technologies, virtual activities endlessly reshape what occurs in face-to-face context (Baym & boyd, 2012). Social contacts that are maintained by a single medium (e.g. face-to-face interaction) are understood to be "thinner" than the relationships that are connected by several media (e.g. face-to-face and socio-digital technologies). We expected adolescents intensively engaged in diverse socio-digital practices to be more likely to have networking connections supported by multiple media that those who either participate more shallowly or engaged in mere computer gaming. This paper addresses the following research questions:

1. What kinds of profiles of socio-digital participation may be identified on the basis of intensity of participating in various socio-digital activities? Do adolescents of the same social-digital participation profile tend to network with one another?

2. What kinds of gender differences could be found in socio-digital competence and patterns of networking among groups of students representing different socio-digital participation profiles?

3. How do networking patterns vary between different socio-digital participation profiles across networking dimensions (i.e. networks of hanging out, liking and media multiplexity)?

4. How do the personal social networks of various socio-digital participations differ from one another?

We relied on the person-oriented analysis of adolescents' patterns of Socio-Digital Participation (SDP) so as to be able to cluster the participants to different groups, examine between-group differences and stability of the cluster profiles for future longitudinal data collection. First, a series of self-reported instruments for identifying adolescents oriented toward hanging out, sharing gaming-related interests and engaging in intensive use of diverse socio-digital technologies were developed. Groups of adolescents representing qualitatively different profiles of socio-digital participation were then compared across a number of

personal characteristics (gender, socio-digital competence) and social networking practices. Finally, the personal networks of three cases, each representing different SDP profiles, were examined.

Method

Participants

The study was conducted in a multicultural school in Finland. Most of the students came from the suburb in which the school was located. The present study involved 287 adolescents from grades 6-9. The average age of the participants was 13.94 (*SD*=1.61).

The investigation relied on a sequential explanatory design of mixed methods (Creswell, Plano Clark, Gutmann, & Hanson, 2003) with two distinct phases: quantitative followed by qualitative. We firstly collected and analyzed data relying on a self-reported questionnaire (SRQ) and a social networking questionnaire (SNQ). Both the SRQ and SNQ were administered with paper and pens during an ordinary lesson in spring 2013; the response rate for both the SRQ and SNQ was 82.2%. The qualitative data were collected along semi-structured interviews. The qualitative data and their analysis refined and explained quantitative results by investigating participants' deeper views (Creswell, 2003).

Self-report questionnaire of socio-digital participation (SRQ)

The purpose of the SRQ was to identify patterns of adolescents' socio-digital participation. The SRQ was constructed by relying on some earlier measures regarding adolescents' skills and practices when using computers (Hakkarainen et al.~~Authors~~, 2000; Barron, Martin, & Roberts, 2007) and measures that were revised as well as new items that were developed by present authors (for the development of SRQ, see Hietajärvi et al.~~Authors~~, submitted). The revised and new items were to account for the recent emergence of socio-digital participation and the questionnaire was designed to assess two main themes that were social media and Intenet related activities as well as gaming. Accordingly, the questionnaire included 37 items that involved using a Likert-type scale from 1 (*never*) to 7 (*all the time*) to assess the intensity of participation in various socio-digital activities from mere social media presence (e.g. how often do you follow profiles, pictures and activities of your friends?) to various types of gaming (e.g. how often do you play adventure games?) and creative contribution (e.g. how often do you share music you have created or remixed?) Intensity scales were utilized with purpose of assessing time consumed in SDP in comparison with, for instance, schoolwork in subsequent analysis (See Appendix for more detailed content of the SRQ). In addition, the SRQ included a composite variable regarding self-reported advanced socio-digital competencies (involving 9 items, e.g. "I am making computer animations", "I am creating and editing videos", "I am assembling a computer from components"; "I am programming: Visual Basic, Java, C++"). After eliminating 34 cases due to over 5% statistically random missing values (Hietajärvi et al.~~Authors~~, submitted), 253 cases were available for further analysis.

A series of exploratory factor analyses (EFA) were first conducted to empirically

extract the latent variables to be used as composite variables for further analysis. Participants with similar patterns of socio-digital participation were then identified through latent profile analysis (LPA, Pastor, Barron, Miller, & Davis, 2007). Compared to more traditional clustering techniques, a benefit of this model-based method is that it provides a set of fit indices useful in statistically determining the most correct number of profiles. In this study the main fit indices used were Bayesian Information Criterion (BIC) and Vuong-Lo-Mendell-Rubin (VLMR) nested model comparison, which is a rather robust model selection test testing the fit between model k and k-1 (Lo, Mendell, & Rubin, 2001). LPAs were implemented using the variables regarding intensity of socio-digital participation as clustering variables. Prior to entering the LPA, the variables were standardized (M=0, SD=1). After identifying the socio-digital participation profiles, we conducted ANOVAs to examine group differences according to gender and socio-digital participation profile.

Social networking questionnaire (SNQ)

The networking data for each grade (grades 6-9) were collected through a roster social networking questionnaire (Scott, 2000, p. 38; Wasserman & Faust, 1994, p. 45-54). In practice, this meant that each respondent got a list of the names coming from his/her grade (i.e. names of students in his or her class and parallel classes at the same grade) and no participants outside of this list of names could be added by the respondent him/herself. Hence, there were four different lists of names, one for each grade. In each questionnaire, the first column presented the list of names of all students in the same grade organized alphabetically. The other columns ~~(i.e. 2-5 columns)~~ indicated the networking dimensions to be examined: 1) with whom they hang out (hangout network); 2) who they especially like (liking network); 3) with whom they are in contact through socio-digital technology (mobile phone or social media pages; i.e. mobile network); and 4) whom they know to be especially skillful in using socio-digital technologies (using computers, social-media functioning; i.e. social recognition of socio-digital expertise). By assessing to what extent participants' socio-digital competences were socially recognized by peers, we aimed at going beyond mere self-assessment of computer skills. In all columns ~~2-5~~except the column of participants' names, the respondents were asked to indicate the existence of each networking relation with any peer in the grade roster by marking an "x".

Muotoiltu: Fontti: 12 pt

All the responses from the social networking questionnaire were typed as square matrices by the first author. Thus, there were together 16 matrices, each matrix representing one grade network and one networking dimension mentioned above. A tie between participants existed if a student in the grade had reported it in the matrix and we coded "1" for such a reported tie. We used "0" to represent the situation in which there was no tie between two participants. We symmetrized hangout, liking and mobile matrices by using a method of maximum meaning that out of two given values we always took the highest one for each cell of the matrix. ~~meaning that we recognized a tie existed when either student reported it.~~ We did not symmetrize matrices of social recognition of socio-digital expertise because it was used only to indicate peer-reported evaluation of socio-digital competencies, i.e. for nominations.

We then calculated the degree values for each participant in each matrix. Indegree values (Wasserman & Faust, 1994, p. 175) in matrices of social recognition of socio-digital expertise indicated how many peers coming from the same grade recognized a participant's socio-digital expertise. To obtain degree values of media multiplexity for each participant, we summed up the hangout matrix and mobile contact matrix of each respective grade and applied a method of maximum to symmetrize the added matrix~~, meaning that out of two given values we always took the highest one for each cell of the matrix~~.

In order to examine whether adolescents tended to interact with peers from the same SDP profile, a non-metric multidimensional scaling (MDS) analysis was then applied to the hangout matrix of grade 7 with Ucinet 6 (Borgatti, Everett, & Freeman, (2002)~~CINET~~ in order to make networking interactions visible and to possibly distinguish subcultures within the hangout network following the earlier study of Demirand and Urberg (2004). The visualization of non-metric MDS was based on symmetrized adjacency matrix (Borgatti, Everett, & Johnson, 2013, p.91) in the NetDraw program. As all ties were symmetrized, the arrows have not been added to the MDS map. Such visualization from NetDraw presents how participants in the grade network interact with one another. The shorter distance between two students in MDS map, the more closely they interacted together. Eventually, we utilized approach of personal network to examine what kind of networks the individual participants had. A personal network indicates which peer(s) coming from the same grade the student him/herself was connected, and reveals thus his or her personal network resources. As we excluded the person him/herself away from the personal network, what stayed left were the social context and the ties between the network members.

Semi-structured interview

Based on the above mentioned analyses of self-report questionnaire and social networking questionnaire data, a gender-balanced sample of 35 students from grade 6 (n=15) and grade 7 (*n*=20) was selected for semi-structured interview according to the heterogeneity of their profile of socio-digital participation (i.e. basic participators, gaming-oriented participators and creative participator, see below). The interviews addressed the participants' friendship-driven practices of hanging out with their peers, their possible interest-driven practices and competencies in using socio-digital technologies as well as their use of socio-digital technologies to support school learning in and beyond school contexts. We analyzed all interview data using a method of qualitative content analysis (Krippendorff, 2004). Although the main body of this interview data will be reported elsewhere (Hietajärvi et al.~~Authors~~, submitted), in this paper we present the interview results of one basic participator, one gaming-oriented participator, and one creative participator whose ~~size of~~ personal hangout network size ~~as reported in the SNQ~~ was the largest in respective socio-digital participation profile among all interview participants, as reported in the SNQ. A pilot interview assisted in determining the themes and content of the semi-structured interview. Participants were interviewed individually, face-to-face in Finnish; the interviews were audio recorded and took approximately 20-30 minutes.

Figure 1 presents overview of data analyses in the study.

Figure 1 insert here

Figure 1. Various data analyses of the study for self-report questionnaire (SRQ) data, social networking questionnaire (SNQ) data and interview data.

Results

The results section is organized as follows: Identification of the three profiles of socio-digital participation and the results of comparing socio-digital competence and various social networking variables across those three SDP profiles are presented first. The overall hangout network of grade 7 at grade level is then reported. Finally, we present the results of three participants' personal social networks (i.e. the cases).

Assess intensity of socio-digital participation. Six-factor solution (28 items. see Appendix, for detailed analysis see Hietajärvi et al.~~Authors~~, submitted) explained 52.5% of the variance (Factor 1: 20.7%; Factor 2: 9.8%; Factor 3: 8.0%; Factor 4: 5.2%; Factor 5: 3.7%; Factor 6: 3.0%). The share of explained variance was somewhat low but, as the phenomena are highly complex, it was deemed appropriate for purpose. Six sum variables were created to represent these factors by calculating the averages of each item in each construct. On the basis of reliability analysis, one item was excluded from the sum variables. These resulting variables were (see Appendix) social media presence (Factor 1, α=.83), action gaming (Factor 2, α=.84), media composing (Factor 3, α=.79), constructing personal knowledge (Factor 4, α=.85), recreational gaming (Factor 5, α=.79), and social learning (Factor 6, α=.72).

Latent profile analysis (Peugh & Fan, 2013) was applied to extract the different profiles of social-digital participation from the SRQ data across 253 participants (see Hietajärvi et al.~~Authors~~, submitted). The clustering variables used to extract the different socio-digital participation profiles were six sum variables created by factor analysis (i.e. social media presence, action gaming, media composing, constructing personal knowledge, recreational gaming, and social learning), together with the measure of social gaming (α=.79). Results (see Table 1) from LPAs showed that the *BIC* decreased when additional latent classes were added; it was, however, a selected three-profile solution supported by VLMR index, indicating it to be significantly (p<.05) better than the two-profile solution whereas the four-profile solution did not significantly improve it. (for detailed analysis see Hietajärvi et al.~~Authors~~, submitted).

Table 1. Information criteria values of LPA for different solutions of socio-digital participation profiles.

Number of groups	Log-likelihood (df) scaling correction	BIC	Adjusted BIC	VLMR	~~Class counts~~Number of participants in each group
2	2382 (22) 1.56	4885	4816	0.00	209, 44
3	2321 (30) 1.48	48087	4713	0.05	61, 161, 31
4	2269 (38) 1.67	4747	4627	0.52	152, 58, 18, 25

Muotoiltu: Fontti:

5	2234 (46) 1.72	4722	4576	0.41	146, 53, 24, 19, 11
6	2209 (54) 1.50	4718	4546	0.16	140, 52, 24, 8, 12, 17

The three distinguishable profiles were *basic participators*, *gaming-oriented participators* and *creative participators*, as illustrated in Table 2 and Figure 2. The *basic participators* (*n*=161, 63.6%) had below average values in all activities: social media presence, media composing, constructing personal knowledge, social learning and recreational gaming, especially in action gaming and social gaming. They were only engaged in friendship-driven hanging out and, together with gaming-oriented participators, were much less intensively present in social media than creative participators. The *gaming-oriented participators* (*n*=61, 24.1%) had below average values in social media presence, media composing, constructing personal knowledge, social learning and recreational gaming. What characterized them was higher than average values in action gaming and social gaming. Nevertheless, the *creative participators* (*n*=31, 12.3%) were well above average on all the activities: social media presence, media composing, constructing personal knowledge, social learning, recreational gaming, action gaming, and social gaming (see Figure 2 and Table 2).

Table 2. Descriptive results of clustering variables (*z* scores) used to extract the three profiles of socio-digital participation.

After a model of socio-digital participation profiles was produced, we examined the differences in group membership according to gender by applying cross tabulation. There was a significant association between gender and gaming-oriented participators χ^2 (2) = 63.86, p<0.00. The gaming-oriented participators were 82% male, whereas only 24% of the basic participators and 52% of the creative participators were male. Because of the biased gender distribution of the profiles, we examined gender and related interaction effects in the following ANOVA analyses.

Figure 2 insert here

Figure 2. Three profiles of socio-digital participation: mean values of standardized sum variables.

Socio-digital competence and networking patterns across SDP profiles

Two-way ANOVA was performed to examine whether the standardized level of advanced socio-digital competencies differed according to SDP profiles (basic participators, gaming-oriented participators, creative participators) and gender (males, female). The results (see Table 3) revealed a significant main effect for SDP profile (F (2,252)=20.77, p<0.001) and gender (F (1,252)=9.43, p<0.01), but not a significant interaction effect (see Table 3). Accordingly, SDP profile was closely associated with self-reported advanced socio-digital competencies: creative participators had a significantly higher level of advanced socio-digital competences than basic users or gaming-oriented participators. Both male and female creative participators reported a

substantially higher level of socio-digital competencies than basic users or gaming-oriented participators. Simultaneously, male students' level of self-reported socio-digital competencies was of a higher level than that of female students. A limitation of these findings is that socio-digital competencies were self-reported and thus some participants could have overestimated their level of competence. Social network analysis provided a kind of social validation for controlling such bias. The participants were asked to identify those students who were especially skillful in using socio-digital technologies (i.e. indegree of socio-digital expertise network). In accordance with expectations, the socio-digital competence of creative participators was recognized by a larger number of peers (M=4.42, mean number of indegree value in expertise network; *SD=2.94*) than that of gaming-oriented participators (M=3.38, SD=2.70) and basic participators (M=3.04, SD=2.62). Gender effect (F (5,247)=4.33, p<0.05, see Table 3) was found in terms of social recognition of participation (see Table 3). The differences were, however, less drastic than in the context of self-reported advanced competences.

Social networking measures were used to compare networking patterns across basic participators, gaming-oriented participators and creative participators. Since the adolescents' networks were different in respect of gender (e.g. Reich, Subrahmanyam, & Espinoza, 2012; ~~Thelwell~~Thalwall, 2008), the gender variable was also included in the analysis. The analysis indicated that the standardized reciprocal degree values of the hangout network and liking network were higher in the case of creative participators than those of basic participators or gaming-oriented participators (see Table 3). A significant gender effect was found in liking ties (F=11.89 (5, 247), p<0.001), meaning that gender is one of the main effects in networking practices of liking among the present sample of three SDP profiles, particularly in male (M=-0.43, SD=0.60) and female basic participators (M=0.28, SD=1.08, p<0.01). Gaming-oriented participators had the smallest number of reciprocal networking partners across the hangout and liking networking dimensions, indicating that they were less socially active than the other two groups. Further, media multiplexity was higher in the case of both male and female creative participators than in the cases of basic or gaming-oriented participators, indicating that creative participators had more redundant ties in their networks. Male and female gaming-oriented participators had radically lower numbers of networking partners than the basic and creative participators. This result may reflect gaming-oriented participators' tendency to hang around with a few like-minded peers. Obviously, due to the increasing use of digital technologies, the reportedly most advanced and active media users (i.e., creative participators) had larger social networks than the other two groups. Further, female creative participators (M=0.94, SD=1.12) had more ties in the liking network than male creative participators (M=-0.12, SD=0.91, p<0.05). Gaming-oriented participators had significant differences (see Table 3) across almost all networking measures with peers from the other two SDP profiles, indicating that gaming-oriented participators had different patterns of social networks than basic and creative participators. There was, however, no interaction effect between SDP profiles and gender.

Further, the Grade 7 hangout network was explored by Multidimensional Scaling (MDS) techniques to obtain the overall social connection picture (see Figure ~~2~~3) at that grade level. The stress value, the measure of the quality of the MDS map, was excellent (0.07) (Kruskal, 1964). In the MDS map, the intensity of communication is indicated as Euclidean distances (i.e. the more participants communicated with one another, the closer they were in the map). Three isolated participants were dropped from the analysis because they did not respond to the networking questionnaire and thus they did not have any reciprocal connections. The MDS map showed that female students were clustered to one side and male students to other side of the figure, indicating that students tended to hangout within their respective gender group. Further, the three SDP profiles (i.e. basic participators, gaming-oriented participators and creative participators) were somewhat clustered together, although interpretation of this result is hard because there are many basic participators but only some gaming-oriented participators and even less creative participators in the sample. Based on earlier research, we expected that gaming-oriented participators would be the most cohesive group. However, they did not originate from the same social networking environment and so our expectations did not come true. Presumably, some interests are closer to each other and it is not plausible to assume that all students who are interested in music, for example, would like a similar type of music. To conclude, there is only little (but some) evidence that socio-digital profiles influence who contacted with whom in the same grade. On the other hand, MDS graph indicated gender homophily meaning that participants tended to network with peers of the same gender (See Figure 3).

Table 3. ANOVA results of standardized variables of socio-digital competence and networking across the socio-digital participation (SDP) profiles integrated with gender.[a]

Figure 3 insert here

Figure 3. MDS graph of hangout whole network in Grade 7 without 3 isolated nodes. White=basic participators, Gray=gaming-oriented participators, Black=creative participators, Plus=not belong to any profile. Biggest white triangle=participant 8892 (basic participator); Biggest gray circle=participant 6521 (gaming-oriented participator); Biggest black circle=participant 8951 (creative participator); Circle=male, Triangle=female.

Personal social networks of students representing different profiles of socio-digital participation

In order to take a closer look at the participants' socio-digital profiles and their networking practices, we selected three cases representing, basic participators, gaming-oriented participators and creative participators respectively, for further examination. Irina (basic participator, 8892), Lars (gaming-oriented participator, 6521)

and Kim (creative participator 8951) are all located in the grade level MDS map (see Figure 3).

Irina is a 14-year-old girl who represents the basic participator profile. She reported starting to use computers at the age of seven and she has had her own laptop computer for six years or so. Her personal hangout network involved ties with 20 peers, most of them females; her network is smaller than that of the creative participator (8951) but larger than that of the gaming-oriented participator (6521). Her network members included all kinds of profiles: basic participators, gaming-oriented participators and creative participators (see Figure 4). She prefers to meet her friends face-to-face everyday rather than virtually. When asked what she does with friends, Irina stated that *"we are merely hanging out somewhere, nothing special,"* and they were *"just talking about all kinds of things."*Irina had two interests taking place mostly through face-to-face activities with coaches and peers. Acrobatic training took place at school, involving meeting with her school mates at acrobat lessons as well as after school. Singing, on the other hand, involved taking personal singing lessons together with a good friend: she [name of a friend] *"also participates in the hobbies, we go to the same one, then we sing together and sometimes meet after school."*

Figure 4 insert here

Figure 4. Irina's personal hangout network (participant 8892, basic participator) in Grade 7 (White=basic participators, Gray=gaming-oriented participators, Black=creative participators, Plus=not belong to any profile, Circle=male, Triangle=female). Irina herself is not presented in the figure.

When asked about the extent to which socio-digital devices were used to support keeping in contact with peers, she responded: *"Internet in the evenings or when you cannot meet, otherwise we try [to meet] face to face."* Irina reported calling her friends on the phone when she was *"with a mobile if I would like to meet or there is something urgent,"* otherwise she relied mainly on Facebook and Kik messenger. She had a couple of hundred Facebook friends, all of them known from offline contexts. When asked what kinds of things she does with a computer, Irina responded: *"I play, listen to music, watch (or see) the news or I do my homework through the net."* She used to play more but currently only played the Candy Crush game once in a while. She reported using Facebook mostly for watching the newsfeed and "liking" her friends, but hardly ever commenting on or sharing media. Irina is pretty strongly oriented toward school: *"We try to [meet friends] everyday but if there is a long school day, we are too busy to do so. Then we just see each other during hobbies."*She reported using Kik to share school work: *"with school mates after school if there is something to ask about homework or a need for assistance."* She reported at the end of the interview that she was planning to go to high school and, therefore, invested a great deal of effort in school learning: *"So my studies are going on well. If sometimes I get bad grades, later they rise back [to an acceptable level]."* Rather than having

parental support, Irina reported being taught at school using open office and facilities *"so that, if we need to do projects, then I master various applications and then search for information from the internet. Nothing much else."*

Lars (pseudonym for participant 6521, i.e. ~~bigger~~ biggest grey circle in Fig. 3) is a 13-year-old Finnish boy who was identified as a gaming-oriented participator; he stated that he had started to use the computer at the age of two. Lars' personal hangout network (Figure 5) consisted of one networking component of eleven network members including three gaming-oriented participators, seven basic participators and one peer who did not belong to any SDP profile. Lars was an avid ice-hockey player and he trained four times a week at a local junior ice hockey league, with many fellow players coming from outside of school. Lars' sport-related interests were complemented with socio-digital ones; he reported spending much time playing video games on the Play Station via the internet, approximately five and a half hours a day. He intensively played sports games, such as NHL 13, as well as WWE and Far Cry. Many of his ice hockey friends appeared to participate in playing games with him. Having a few close friends as well as a strong external network may be one reason for not having as many peer contacts as basic and creative participators from the same grade in school (see below). When asked how he kept in contact with his friends, Lars stated that he and his friends used "*text messages and all Facebook and stuff and I meet them truly often.*"He reported utilizing social media merely for keeping in contact with friends:"*I may examine their wall and perhaps put something somewhere, but mostly I am just chatting.*" He reported that ~~having searched~~searching for information regarding his hobbies, ice hockey and gaming, on the Internet had helped him to improve his skills.

Figure 5 insert here

Figure 5. Lars's personal hangout network (participant 6521, gaming-oriented participator) in Grade 7 (White=basic participators, Gray=gaming-oriented participators, Plus=not belong to any profile, Circle=male, Triangle=female). Lars himself is not present in the figure.

When asked about academic motivation, Lars stated that *"So usually you can tolerate it but once in a while it is very irritating,"* especially when having time consuming homework. He experienced being very busy and partially exhausted when trying, simultaneously, to cope with examinations, training, and gaming. Lars preferred asking the teacher rather than using socio-digital technologies for discussing school-related issues or sharing pieces of advice related to school work. He reported using smart phones when searching for information and making presentations a couple of times a month. Lars claimed that he had mastered information searches, computer gaming, and computer management; he had learned many skills from both the intensive useof a computer and some parental support.

Kim (pseudonym of 8951) is a 14-year-old boy who was identified as a creative

participator. He reported accessing the Internet at the age of six. He tended to spend much time participating in diverse socio-technical practices, such as chatting on Facebook, watching photos and YouTube videos, listening to music, using Wikipedia, and surfing the net. In this regard, his orientation was different from those of basic and gaming-oriented participators who only focused on a few socio-digital practices (i.e. Irina told us that she spent her time most frequently on interacting online while Lars reported spending most of his time on computer games). Kim's personal hangout network within school grade is larger than those of Irina and Lars (see Figure 6). The smaller component is composed of 10 network members, including basic, gaming-oriented and creative participators while the larger one is made up of 16 peers who are basic and gaming-oriented participators, including females. Kim reported sharing interests with friends in and out of school. "*Football is my hobby and I play it with my friends at school… Basketball is also my interest. I learn and play basketball with friends outside of school.*" His activities were interlinked in terms of learning many basketball skills by modeling techniques from Japanese Anime series: *"It is about basketball. We play in it."*Kim had been given social recognition regarding his competences by his friends. He also spent some time playing various computer games (e.g. Minecraft, World of Warcraft). Moreover, Kim utilized various socio-digital media to network with his peers. He reported having created novel networking relations through the internet.

For his academic activities, Kim relies on support from his teachers and friends as well as the Internet, going "*to the Internet to search and read the information*" if needed and sharing "*what I had done related to school with my friends,*" unlike Irina and Lars. He reported assessing the reliability of targeted information by checking the links at the bottom of web pages: *"First I read the material through and then I write it down in my own words, if I am able to."* Kim reported being willing to invest time and effort to learn digital competencies and claimed to be able to do *"all kinds of activities"* with socio-digital technologies so that he usually does not need help in troubleshooting. He claimed to have some experience of making animations, setting up operating systems and installing components (e.g. video card).

To sum up these three cases of personal social networks in different socio-digital participation profiles, the gaming-oriented participator tended to focus on networking with peers outside of the school context. In contrast, the basic participator relied more on peer connections from the same grade. The creative participator appeared to spend much time on various socio-digital networking practices. All of the three socio-digital participation profiles in the above cases appeared to network with peers of different profiles. All three participants took an active part in various structured activities related to their interests. Irina practiced acrobatics and singing in offline contexts whereas Lars and Kim participated in sports in conjunction with taking part in various online activities. It was rather typical to the above described cases to pursue sport-related interests in conjunction with participating in socio-digital activities (and we cannot determine to what extent it is a specific feature of the present three cases).

Figure 6 insert here

Figure 6. Kim's personal hangout network (participant 8951, creative participator) in Grade 7 (White=basic participators, Gray=gaming-oriented participators, Black=creative participators, Plus=not belong to any profile, Circle=male, Triangle=female). Kim himself is not present in the figure.

Discussion

We investigated how adolescents' social networks related to their patterns of socio-digital participation. Three qualitatively distinct profiles of socio-digital participation (i.e., basic participators, gaming-oriented participators and creative participators) were identified. The profiles were determined on the basis of the participants' responses to a self-report questionnaire tracing their skills and practices of using socio-digital technologies. The research relied on earlier studies (Hakkarainen et al.~~Authors~~, 2000; Barron et al., 2007) and it was also inspired by Ito and colleagues' (2009) ethnographic investigations. Basic participators were oriented toward hanging out via socio-digital technologies and gaming-oriented participators actively participated in playing videogames whereas creative participators indicated intensive involvement in all aspects of using socio-digital technologies. Labeling a participant as a gaming-oriented participator does not mean that he or she would in absolute terms play games intensively; the level of gaming participation was not very high overall in this sample of early adolescents (e.g. participants in grade 6). The same applies to creative participators who were distinguished because of exceptionally intensive participation in using diverse socio-digital technologies but not necessarily being the technologically virtuous freaks characterized in literature (e.g. Varma, 2007). The groups differed from one another in an expected way so that the creative and gaming-oriented participators both had higher-levels self-reported socio-digital competencies than basic participators as well as higher levels of socially recognized socio-technical expertise (i.e., socially validated competence). However, there was variance in the gender distribution of some SDP profiles across the present sample: there were substantially more female basic participators than males and more male than female gaming-oriented participators. Interestingly, within this sample there was equal number of male and female creative participators. Both male and female creative participators reported to have higher level of advanced competencies with socio-digital technologies than basic and gaming-oriented participators. As a whole, we found that male participants' self-reported socio-digital competences were higher than females across the three socio-digital participation profiles. Such result is in line with the findings of Hakkarainen and colleagues~~Author~~ (2000) among Finnish adolescents.

The results indicated that the nature of social networks varied across groups of participants representing the three profiles. The size of the hanging out and liking networks as well as the media multiplexity network (combined offline and online social network) were larger in the context of basic and creative participators than gaming-oriented participators. Gender effect (see Table 3) was found in all such

networks except in the reciprocal hangout network, suggesting that female adolescents' had relatively more networking ties than their male peers with regards to the liking network and media multiplexity, which is in line with previous studies (e.g. Reich ~~& Subrahmanyam~~et al., 2012; Thelwaell, 2008). Gaming-oriented participators seemed to have smaller networks, be less popular, and be less well-connected socially than basic and creative participators. In spite of relative differences regarding networks, the gaming-oriented participators did not appear to be isolated within their school network; instead, they had a few reciprocal partners. Gaming-oriented participators also reported having networking partners outside of school. Some earlier investigations indicated that gaming leads to diminished social relations (Huvila, Holmberg, Ek, & Widén-Wulff, 2010; Reinecke, 2009; Trepte & Reinecke, 2011; Williams et al., 2006). The results of our study partially support these findings. Having a few reciprocal networking relations may, however, provide sufficient support for an adolescent's wellbeing and development. Other investigations indicated that gaming has a positive impact on adolescents' social relations. For instance, Williams and colleagues (2006) have shown that gaming may extend players' pre-existing relationships. The players report that the social side of gaming is important to them and one of the strongest motivators to engage in gaming (Frostling-Henningsson, 2009; Jansz & Martens, 2005; Jansz & Tanis, 2007). A small but notable body of research on the transformation of social relations from a gaming to a real-world context (e.g. Trepte, Reinecke, & Juechems, 2012; Williams et al., 2006) or vice versa (Shen & Williams, 2011) suggests that this might help individuals to accumulate their social interactions. Because the participants' social competencies were not actually measured, the data provided only suggestive indications concerning reasons for the observed differences between the SDP groups' patterns of networking.

The use of digital games can provide additional options to expand the users' social networks in offline and online contexts (e.g. Cole & Griffiths, 2007; Trepte et al., 2012). According to Cole and Griffiths (2007) as well as Trepte and colleagues (2012), playing online in a team context strengthens existing ties and provides additional options for social relationships. Social online gamers play digital games in a social context via the Internet together with other co-players; many of them play regularly together in front of a computer or console. Such players could meet new friends in the game, get to know them beyond the game, or bring their offline friends into the game (Klimmt & Hartmann, 2008). However, it has been demonstrated that excessive and obsessive game playing may also increase the risk of isolation (Grüsser, Thalemann, & Griffiths, 2007) and lead to the erosion of offline friendships (Kraut et al., 1998a; Kraut et al., 1998b). Social isolation is often addressed as a possible consequence of hyper-intensive online gaming (Domahidi & Quandt, 2014; Griffiths & Hunt, 1998; Wan & Chiou, 2006). Further, other studies have expressed fears that gamers could neglect their real-life friendships, if they play too much (Griffiths & Hunt, 1998; Wan & Chiou, 2006). At this point, the findings of the present study correspond to those of previous studies to a certain extent. Future studies using multi-dimensional and longitudinal data are needed to provide deeper understanding concerning online and offline social behaviors among gamers. Although gender differences between male

and female gaming-oriented participators could not be found across networking measures from the present sample, future investigation with an equal sample size for both genders is needed.

Participants who intensively used all aspects of socio-digital technologies were considered as creative participators in the present study. They were rather ordinary students whose involvement was simply more intensive and extensive than their peers. Through intensive effort and determination, they appeared to master various socio-digital competencies (McArthur, 2009) better than their peers without necessarily having exceptional digital competence. Sugarbaker (1998) made the claim that "perhaps one of the identifying traits of creative media use participator culture is the fact that its participants are active rather than passive." Students categorized as creative participators in the present sample tended to have rather large personal social networks with peers representing various profiles of using socio-digital technologies. However, some earlier studies indicated that some adolescents intensively "geeking out" are "socially awkward" (Baron-Cohen, 2008) and socially inept in spite of being regarded as smart. The present participants seemed, however, to be oriented more toward "messing around" rather than actual geeking out with socio-digital technologies (Ito et al., 2009). Since socio-digital participation is rather pervasive within the lives of adolescents participating in the present study, it appears natural for students to network with peers outside of the creative participators' own community. The present creative participators actively used social media. They were often involved in social-creative activities with other peers. Being active users of socio-digital technologies in support of their academic studies also integrated their activities with those of other students. Further, female creative participators had more reciprocal ties in the liking network than male creative participators. This finding supported the assertions of previous studies (e.g. Bukowski, Hoza, & Boivin, 1994; Desjarlais & Willoughby, 2010; Leino, 2006; McPherson et al., 2001) that female adolescents tended to be more socially active than male peers, although we had a smaller sample of both male and female creative participators.

Further, network research indicates that people have a strong tendency to prefer interaction with those who share same characteristics (McPherson et al., 2001). Participants in present sample appeared to network with peers of same gender in lines with previous studies (e.g. Shrum, Cheek, & Hunter, 1988; Smith-Lovin & McPherson, 1993; Maccoby, 1998; Pearson, Steglich, & Snijders, 2006). Networking participants who spend time in the network where they are surrounded by others similar to them have less experience engaging people who do not share their behaviors (Burt, 2012). The results of the MDS map indicated, however, that homophily did not clearly characterize basic, gaming-oriented and creative participators. Adolescents presenting different patterns of socio-digital participation appeared to engage in networking interactions with one another. It is in accordance with our expectations that adolescents studying in the same class and school have relatively intensive networking interaction with one another, in spite of diverging patterns of socio-digital participation. Yet, it is plausible to assume that the SDP profile to some extent affects the nature of network members – especially those with

whom there is a strong reciprocal networking relation. To take gaming-oriented participators as an example, friendship between gaming-oriented participators occurs if they met in the game on a more or less regular basis. Domahidi and colleagues (2014) found that hyper-intensive inner-group communication has the largest potential to link gamers together and to ''facilitate a transformation of online relationships into offline relationships'' (Klimmt & Hartmann, 2008, p. 325). Many studies dealing with the transformation of in-game relationships assumed the positive impact of gaming on users' offline social lives. ~~They~~ Some of these research further emphasized that online gaming can lead to ties and contact with partners who serve as possible sources of rewarding interactions such as social support (e.g., Cole & Griffiths, 2007).

The present investigation produces adequately functioning instruments for tracing adolescents' patterns of socio-digital participation in terms of identifying various SDP profiles and comparing associated social networking relations. The present results should, however, be taken as only tentative because of several limitations. Although the measures functioned adequately psychometrically, the instruments involved numerous novel exploratory measures beyond those of earlier studies. The variables used to identify the three profiles were based on latent factors extracted from items that participants responded. Most of the items relied on an intensity scale (i.e. the frequency of participants' engagements in targeted socio-digital practices) that did not, necessarily, give sufficiently information regarding complexity of the actual enacted socio-digital activities. When interpreting the results, it should be taken into consideration that the self-report instruments included more specific gaming-related items than those included concerning other aspects of socio-digital participation. Because socio-digital profiles were determined according to composite variables with gaming orientation distinguishing clusters of participants from one another, this way may not have significantly biased the results. Nevertheless, when further developed instruments for assessing socio-digital participation, it is essential to work out more balanced instruments with detailed questions regarding diverse socio-digital practices. Further, the three profiles of socio-digital participation emerged from the present relatively small sample and it is also possible that, due to using socio-digital technologies for several hours per day, the participants were not able to provide reliable retrospective assessments of their usage patterns. Consequently, the results cannot be generalized, as such, across all adolescents regarding their patterns of socio-digital participation. Because the sample was from a multicultural school in Finland, the results of this paper might be generalized to other students of cultural diverse schools across Scandinavian countries. When having more extensive data, a larger number of identifiable socio-digital profiles are likely to emerge enabling more nuanced understanding of adolescents' socio-digital practices (compare Hietajärvi et al.~~Authors~~, submitted). Including high school or university students could have led to the identification of different profiles of socio-digital participation. Additionally, some interview responses were not very concise and did not provide detailed information about the targeted issues. The three interview cases presented in the present study were only selected because they had the

largest personal network in their respective SDP profile interviewee groups. Therefore, their SDP participation might not typically represent the exact characteristics of the SDP profiles that our SRQ measurements revealed. More detail qualitative studies concerning socio-digital practices of various clusters of adolescents will be needed in future. Adolescents' patterns of socio-digital participation are, however, rapidly transforming so that there are likely to be strong between cohort differences. Consequently, we are trying to shoot at a moving target. The participants' patterns of using socio-digital technologies relied on self-reporting as well as their self-assessed socio-digital competences; it is possible that some of the participants over-emphasized the intensity of using socio-digital technologies and the complexity of their competences. Because the frequency of daily contacts is increasing so strongly, retrospective self-reports of using socio-digital technologies are likely to become less and less reliable; thus survey methods have to complemented with detailed time diary methods or repeated-experience sampling methods (Experience Sampling Studies, Inkinen et al.~~Authors~~, 2013). On the other hand, longitudinal data concerning adolescents' personal social network ~~is~~ are needed to investigate the developmental trajectories of adolescents' socio-digital participation. Toward that end, the present investigators are engaged in collecting repeated measures data from the target school (and elsewhere) by extending the study from early to middle and late adolescence so as to validate the profiles distinguished.

References

~~Barker, L. J. & Aspray, W. (2006). The state of research on girls and IT. In J. M. Cohoon & W. Aspray (Eds.), *Women and information technology: Research on underrepresentation* (pp. 3-54). Cambridge: MIT Press.~~

Barron, B. (2004). Learning ecologies for technological fluency: Gender and experience differences. *Journal of Education Computing Research, 31*(1), 1-36.

Barron, B., Martin, K. C., & 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*, 75-105.

Baron, N. S. (2008). *Always on: Language in an online and mobile world*. Oxford, UK: Oxford University Press.

Baron-Cohen, S. (2008). Autism, hyper systemizing, and truth. *The Quarterly Journal of Experimental Psychology, 61*(1), 64-75.

Baym, N. K. & boyd, d. (2012). Socially mediated publicness: An introduction. *Journal of Broadcasting & Electronic Media, 56*(3), 320-329.

Blais, J., Craig, W. M., Pepler, D., & Connolly, J. (2008). Adolescents online: The importance of Internet activity choices on salient relationships. *Journal of Youth and Adolescence, 37*, 522-536.

Borgatti, S.P., Everett, M.G., & Freeman, L.C. (2002). Ucinet 6 for Windows: Software for Social Network Analysis. Harvard, MA: Analytic Technologies.

Borgatti, S. P., Everett, M. G., & Johnson, J. C. (2013). *Analyzing social networks*. Thousand Oaks, CA: Sage.

Bukowski, W. M., Hoza, B., & Boivin, M. (1994). Measuring friendship quality

Muotoiltu: Fontti: (Oletus) Times New Roman, 12 pt, englanti (Yhdysvallat)

Muotoiltu: Fontti: (Oletus) Times New Roman, 12 pt, englanti (Yhdysvallat)

Muotoiltu: Vasen, Sisennys:Vasen: 0 cm, Riippuva: 2 mrk, Älä säädä tilaa aasialaisen ja latinalaisen tekstin välissä, Älä säädä tilaa aasialaisen tekstin ja numeroiden välissä

Muotoiltu: Fontti: (Oletus) Times New Roman, 12 pt, englanti (Yhdysvallat)

Muotoiltu: Fontti: (Oletus) Times New Roman, 12 pt, englanti (Yhdysvallat)

during pre- and early adolescence: The development and psychometric properties of the friendship qualities scale. *Journal of Social and Personal Relationships, 11*(3), 471-484

Burt, R. S. (2012). Network-related personality and the agency question: Multirole evidence from a virtual world. *American Journal of Sociology*, *118*(3), 543-591.

Cole, H. & Griffiths, M. D. (2007). Social interactions in massively multiplayer online role-playing games. *Cyberpsychology and Behavior, 10*(4), 575-583.

Correa, T., Hinsley, A. W., & De Zuniga, H. G. (2010). Who interacts on the Web? The intersection of users' personality and social media use. *Computers in Human Behavior*, *26*(2), 247-253.

Creswell, J. W. (2003). *Research design: Qualitative, quantitative, and mixed methods approaches (2nd ed.)*. Thousand Oaks, CA: Sage.

Creswell, J. W., Plano Clark, V. L., Gutmann, M., & Hanson, W. (2003). Advanced mixed methods research designs. In A. Tashakkori & C. Teddlie (Eds.), *Handbook of mixed methods in social & behavioral research (pp. 209–240)*. Thousand Oaks, CA: Sage.

~~Davies, B. (1984). *Life in the classroom and playground*. London: Routledge & Kegan Paul.~~

Demir, M. & Urberg, K. A. (2004). Friendship and adjustment among adolescents. *Journal of Experimental Child Psychology, 88*, 68-82.

Desjarlais, M. & Willoughby, T. (2010). A longitudinal study of the relation between adolescent boys' and girls' computer use with friends and friendship quality: Support for the social compensation or the rich-get-richer hypothesis? *Computers in Human Behavior*, *26*, 896-905.

Domahidi E., Festl, R., & Quandt, T. (2014). To dwell among gamers: Investigating the relationship between social online game use and gaming-related friendships. *Computers in Human Behavior*, *35*, 107–115.

Domahidi, E. & Quandt, T. (2014, February 4). ''And all of a sudden my life was gone...'' A biographical analysis of highly engaged adult gamers. *New Media & Society*~~, *February*, 1-16~~, doi: 10.1177/1461444814521791

Eynon, E. & Malmberg, L. (2011). A typology of young people's internet use: Implications for education. *Computers & Education*, *56*(3), 585-595.

Frostling-Henningsson, M. (2009). First-person shooter games as a way of connecting to people: ''Brothers in blood''. *CyberPsychology & Behavior, 12*(5), 557-562.

Gee, J. P. & Hayes, E. R. (2011). *Language and learning in the digital age*. Abingdon, OX: Routledge.

Griffiths, M. D. & Hunt, N. (1998). Dependence on computer games by adolescents. *Psychological Reports*, *82*(2), 475-480.

Grüsser, S. M., Thalemann, R., & Griffiths, M. D. (2007). Excessive computer game playing: Evidence for addiction and aggression? *CyberPsychology & Behavior, 10*, 290-292.

Hakkarainen, K., Ilomäki, L., Lipponen, L., Muukkonen, H., Rahikainen, M., Tuominen, T., … Lehtinen, E. (2000). Students' skills and practices of using ICT: Results of a national assessment in Finland. *Computers & Education*, *34*(2), 103-117. doi:10.1016/S0360-1315(00)00007-5

Haythornthwaite, C. (2005). Social networks and Internet connectivity effects. *Information, Communication and Society*, *8*(2), 125-147.

Hietajärvi, L., Seppä, J., & Hakkarainen, K. (submitted). Analyzing adolescent

Muotoiltu: suomi

sociodigital participation – dimensions, patterns, and heterogeneity.

Hsu, S., Wen, M., & Wu, M. (2009). Exploring user experiences as predictors of MMORPG addiction. *Computers and Education*, *53*(3), 990-999.

Hussain, Z. & Griffiths, M. (2009a). The attitudes, feelings, and experiences of online gamers: A qualitative analysis. *Cyberpsychology and Behavior*, *12*(6), 747-753.

Huvila, I., Holmberg, K., Ek, S., & Widén-Wulff, W. (2010). Social capital in second life. *Online Information Review*, *34*, 295-316.

Iacono, C. S. & Weisband, S. (1997, January). *Developing trust in virtual teams*. Presented at the Hawaii International Conference on System Sciences, Hawaii, U.S.

Inkinen, M., Lonka, K., Hakkarainen, K., Muukkonen, H., Litmanen, T. & Salmela-Aro, K. (2013). The interface between core affects and the challenge-skill relationship. *Journal of Happiness Studies*, *15*(4), 891-913.

Ito, M., Baumer, S., Bittanti, M., boyd, d., Cody, R., Stephenson, B. H., Hosrt, H. A., Lange, P. G., Mahendran, D., Martinez, K.Z., Pascoe, C.J., Perkel, D. Robinson, L. Sims, C., & Tripp, L. (2009). *Hanging out, messing around, and geeking out: Kids living and learning with new media*. Cambridge, MA: MIT Press.

Jansz, J. & Martens, L. (2005). Gaming at a LAN event: The social context of playing video games. *New Media & Society*, *7*, 333–355.

Jansz, J. & Tanis, M. (2007). Appeal of playing online first person shooter games. *CyberPsychology & Behavior*, *10*, 133-136.

Jenkins, H., Camper, B., Chisholm, A., Grigsby, N., Klopfer, E., Osterweil, S., Perry, J., Tan, P., Weise, M., & Guan, T.C. (2009). From serious games to serious gaming. In U. Ritterfeld, M. Cody, & P. Vorderer (Eds.) *Serious games: Mechanisms and effects* (pp. 448-468), New York, NY: Routledge.

~~Kelly, K. (1998). The third culture. *Science*, 279, 992-993.~~

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.

Kim, E., Namkoong, K., Ku, T., & Kim, S. (2008). The relationship between online game addiction and aggression, self-control, and narcissistic personality traits. *European Psychiatry*, *23*(3), 212-218.

Klimmt, C. & Hartmann, T. (2008). Mediated interpersonal communication in multiplayer video games: Implications for entertainment and relationship management. In E. A. Konjin, S. Utz, M. Tanis, & S. B. Barnes (Eds.), *Mediated interpersonal communication* (pp. 309–330). Thousand Oaks, CA: Sage.

Kraut, R., Patterson, M., Lundmark, V., Kiesler, S., Mukopadhyay, T., & Scherlis, W. (1998a). Internet paradox. A social technology that reduces social involvement and psychological well-being? *American Psychologist*, *53*, 1017-1031.

Kraut, R. E., Rice, R. E., Cool, C., & Fish, R. S. (1998b). Varieties of social influence: The role of utility and norms in the success of a new communication medium. *Organization Science*, *9*, 437-453.

Krippendorff, K. (2004). *Content analysis: An introduction to its methodology (2nd. Ed.)*. Thousand Oaks, CA: SAGE.

Kruskal, J. B. (1964). Multi-dimensional Scaling by optimizing goodness-of-fit to a non-metric hypothesis. *Psychometrika*, *29*, 1-27.

Leino, K. (2006). Reading the Web-Students' Perceptions about the Internet.

Scandinavian journal of educational research, *50*(5), 541-557.

Lenhart, A., Kahne, J., Middaugh, E., Margill, A. R., Evans, C., & Vitak, J. (2008, September 16). Teens, video games, and civics: Teens' gaming experiences are diverse and include significant social interaction and civic engagement. *ERIC Collection*. Retrieved from http://eric.ed.gov/?id=ED525058

Lo, Y., Mendell, N. R., & Rubin, D. B. (2001). Testing the number of components in a normal mixture. *Biometrika*, *88*(3), 767-778.

Lo, S., Wang, C., & Fang, W. (2005). Physical interpersonal relationships and social anxiety among online game players. *Cyberpsychology and Behavior*, *8*(1), 15-20.

Maccoby, E. (1998). *The two sexes: growing up apart, coming together.* Cambridge, MA: Belknap/Harvard University Press.

Madden, M., Lenhart, A., Duggan, M., Cortesi, S., & Gasser, U. (2013, March 13). Teens and technology 2013. *Pew Internet & American Life Project*. Retrived from: http://www.pewinternet.org/files/old-media/Files/Reports/2013/PIP_TeensandTechnology2013.pdf

McArthur, J. A. (2009). Digital subculture: A geek meaning of style, *Journal of Communication Inquiry*, *33*(1), 58-70.

McPherson, M., Smith-Lovin, L., & Cook, J. (2001). Birds of a feather: Homophily in social networks. *Annual Review of Sociology*, *27*, 415-444.

Pastor, D. A., Barron, K. E., Miller, B. J., & Davis, S. L. (2007). A latent profile analysis of college students' achievement goal orientation. *Contemporary Educational Psychology*, *32*, 8-47.

Pearson, M., Steglich, C., & Snijders, T. (2006). Homophily and assimilation among sport-active adolescent substance users. *Connections*, *27*(1), 47-63.

Peugh, J. & Fan, X. (2013). Modeling unobserved heterogeneity using latent profile analysis: A Monte Carlo simulation. *Structural Equation Modeling*, *20*(4), 616-639.

Rainie, L. & Wellman, B. (2012). *Networked: The new social operating system.* Cambridge: MIT Press

Reich, S.M., Subrahmanyam, K., & Espinoza, G. (2012). Friending, IMing, and hanging out face-to-face: Overlap in adolescents' online and offline social networks. *Developmental Psychology*, *48*(2), 356-368.

Reinecke, L. (2009). Games and recovery: The use of video and computer games to recuperate from stress and strain. *Journal of Media Psychology*, *21*, 126-142.

Rheingold, H. (2012). *Net smart: How to thrive online.* Cambridge: MIT Press.

Salmela-Aro, K., Muotka, J., Hakkarainen, K., Alho, K., & Lonka, K. (in press). School burnout and engagement profiles among digital natives in Finland: A person-oriented approach. *European Journal of Developmental psychology.*

Scott, J. (2000). *Social network analysis: A handbook 2nd Ed.* London: Sage.

Shen, C. & Williams, D. (2011). Unpacking time online: Connecting Internet and massively multiplayer online game use with psychosocial well-being. *Communication Research*, *38*(1), 123-149.

Shirky, C. (2010). *Cognitive surplus: Creativity and generosity in a connected age.* London: Penguin.

Shrum, W., Cheek, N. H., & Hunter, S. M. (1988). Friendship in school - gender and

Muotoiltu: Fontti: Ei Kursivoitu

Muotoiltu: suomi

racial homophily. *Sociology of Education*, *61*(4), 227–239.

Smith-Lovin, L. & McPherson, J. M. (1993). You are who you know: a network perspective on gender. In P. England (Ed.) *Theory on gender, feminism on theory* (pp. 223-251). New York: Aldine.

Sugarbaker, M. (1998). What is a geek? Retrieved from http://www.gibberish.com/gazebo/articles/geek3.html

~~Thelwell~~Thelwall, M. (2008). Social networks, gender and friendship: an analysis of MySpace member profiles. *Journal of the American Society for Information Science and Technology*, *59*, 1321-1330. doi: 10.1300/J017v21n04_05

Thelwall, M. (2009). Homophily in MySpace. *Journal of the American Society for Information Science and Technology*, *60*(2), 219-231

Trepte, S. & Reinecke, L. (2011). The pleasures of success: Game-related efficacy experiences as a mediator between player performance and game enjoyment. *Cyberpsychology, Behavior, and Social Networking*, *14*, 555-557.

Trepte, S., Reinecke, L. & Juechems, K. (2012). The social side of gaming: How playing online computer games creates online & offline social support, *Computers in Human Behavior*, *28*, 832-839

van den Beemt, A., Akkerman, S., & Simons, R. (2011). Considering young people's motives for interactive media use. *Educational Research Review*, *6*(1), 55-66.

Varma, R. (2007). Women in computing: The role of geek culture. *Science as Culture*, *16*(40), 359-376.

Vasbø, K. B., Silseth, K., & Erstad, O. (2014). Being a learner using social media in school: The case of Space2cre8. *Scandinavian Journal of Educational Research*, *58*(1), 110-126.

Wan, C. S. & Chiou, W. B. (2006). Why are adolescents addicted to online gaming? An interview study in Taiwan. *CyberPsychology and Behavior*, *9*(6), 762-766.

Wasserman, S. & Faust, K. (1994). *Social network analysis: Methods and applications*. Cambridge: Cambridge University Press.

Williams, D. (2006). Groups and goblins: The social and civic impact of online games. *Journal of Broadcasting and Electronic Media*, *50*, 651-681.

Williams, D., Ducheneaut, N., Xiong, L., Zhang, Y., Yee, N., & Nickell, E. (2006). From tree house to barracks: The social life of guilds in World of Warcraft. *Games and Culture*, *1*, 338-361.

Yee, N. (2002). Befriending Ogres and Wood-Elves: Understanding Relationship Formation in MMORPGs. Retrieved from http:// www.nickyee.com/hub/relationships/home.html

Appendix. Rotated Factor Matrix[b] regarding intensity of socio-digital participation.

Measures of the intensity of socio-digital participation	Factor					
	1	2	3	4	5	6
Go to see and follow profile pages, pictures, and activities of my friends	.84					
Update and go to see my own profile page (FB, Kaverit,net, IRC Galleria)	.83					
I go to community services (FB, IRC, Galleria, Kaverit.net)	.74					
Report my feelings and activities to my friends	.70					
I am chatting (MSN, Whatsup, ICT, KIK)	.49					
I listen to music in the internet	.44					
Surf the internet without specific aim and hope to find something interesting	.40					
How often do you play shooting games with ICTs		.82				
How often do you play adventure games		.72				
How often do you play driving games with ICTs		.67				
How often do you play role games with ICTs		.64				
How often do you play sport games with ICTs		.59				
How often do you play strategy and simulation games with ICT		.56				
Share material I myself have created related to my school work (homework,			.76			
Share material I myself have created related to my hobbies and interests			.73			
I share music I have created or remixed			.62			
I share videos I have taken or edited			.60			
Modify and remix material I find (texts, videos, photos, music)			.59			
I write and comment on discussion forums			.38			
I give help to my friends in school-work related issues				.85		
I ask my friends to help me in school work related issues				.79		
I discuss school-work related issues in the internet				.64		
How often do you play music, rhythm and dance games					.83	
How often do you play exercise (training) games					.66	
How often do you play party games with ICTs					.59	
I write microblogs (Twitter)						.82
I read and follow microblogs (Twitter)						.74
I keep my own blog or share my writings						.44
Number of items	7	6	6	3	3	3
Cronbach's Alpha	.83	.84	.79	.85	.79	.72

Note: Extraction Method: Maximum Likelihood. Rotation Method: Varimax with Kaiser Normalization.b. Rotation converged in 6 iterations.