Activities with Parents on the Computer: An Ecological Framework

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ABSTRACT

This paper proposes an ecological framework "Activities with Parents on the Computer" (APC) to bridge home and school contexts by involving parents and students in digital media based assignments. An exploratory case-study was conducted based on ten parent-child dyads that engaged in an APC at home. Attitudes were assessed through a self-evaluation questionnaire. Four parent-child dyads, that showed different patterns of attitudes, were studied in depth through semi-structured interviews. The findings revealed that parents and children have mixed attitudes towards APC. The performance in the activity varied according to the kind of parental involvement in homework and individuals' relationship with digital media. Relevant insights helped to reframe the model in order to evaluate the relations with other living elements (e.g., friends) brought by technology into the ecological microsystems (e.g., home, school). Future research should focus on the development of more accurate instruments of evaluation, the role of teachers and other community members.

Keywords

Digital media, Homework, Computer-based tasks, Education ecology, Activities with parents on the computer

Introduction

Young people spend most of their time either at home or at school. These contexts are often strange to one another and do not communicate effectively. Given that knowledge can be distributed anywhere through Internet, it is possible to develop new socio-pedagogical, technology-based strategies to bridge school and home contexts.

Technology can connect school and home contexts and help parents to follow – and get involved in – their children academic development (Lewin & Luckin, 2010). But parents often need to be instructed on how to do it (Yu, Yuen, & Park, 2012); and, despite common beliefs, students need to be taught digital skills (Ng, 2012). Digital literacy – as the very contemporary nature of literacy - is deictic (Leu, Kinzer, Coiro, Castek, & Henry, 2013), and it "refers to the multiplicity of literacies associated with the use of digital technologies" (Ng, 2012, p. 1066). As if it was not enough, many students lack scientific literacy – defined as "as the ability of people to understand and critically evaluate scientific content in order to achieve their goals" (Britt, Richter, & Rouet, 2014, p. 105). Whereas society became more digital, science and technology became more transparent and unperceived (Jenkins, Purushotma, Weigel, Clinton, & Robison, 2009). Without scientific and digital literacy one can hardly be aware of the mechanisms that elude social unbalances and, most likely, will feel helpless to act upon them.

All considered, interconnecting school and home contexts through technology is not as simple as it could seem at the beginning. Since literature on bridging school and home contexts is very associated with homework, we started by reviewing the literature on it. Then, we exposed the theoretical tenets, structure and processes involved in the framework. In the following section, methods and materials were identified and described. Finally, results were showed and discussed, conclusions were summarized and future work outlined.

Lessons from research on homework

Homework assignments can be used to create productive bonds between different settings providing students and parents with structured opportunities to collaborate (Dettmers, Trautwein, Lüdtke, Kunter, & Baumert, 2010), although they have been used by educators for different purposes, e.g, personal development, punishment, etc. (Epstein & Van Voorhis, 2001). Quality homework not only helps school to be more effective, enhancing students' achievement, but it can also help to connect schools and homes, involving parents in their children's academic life.

Parental involvement has been the main focus of Teachers Involve Parents in Schoolwork (TIPS), activities designed by teachers with the purpose of establishing a teacher-parent partnership through which they can help the families to be up-to-date with their children's learning activities at home while becoming involved in the process (Epstein et al., 2002). When parents get involved, children do better in school, but most families need information and guidance on how to do it in a successful way (e.g., Epstein, Van Voorhis, & Batza, 2001). Figure 1 summarizes the fundamental motives (why), behaviors (what), processes (how) and outcomes (which) that underlie parental involvement in homework (Hoover-Dempsey et al., 2001).

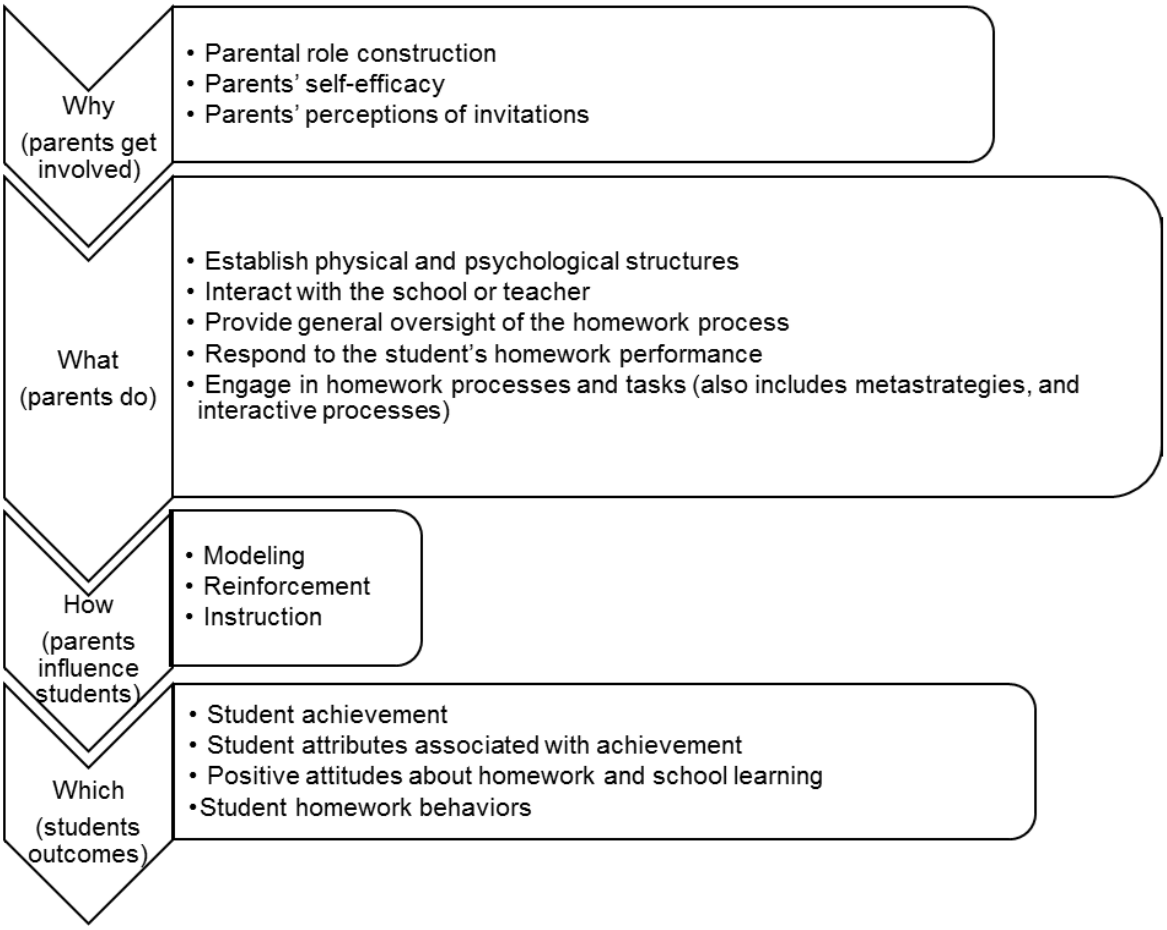


Figure 1. Motives "Why, What, How, Which" that underlie parental involvement in homework (based on Hoover-Dempsey et al., 2001)

Parents get involved in homework because they think that they should (role construction); they perceive themselves as capable of helping their child succeed in school (self-efficacy, see Bandura, 1994); and they perceive that they are invited to participate (perceptions of invitations). What does it mean to get involved in homework? Activities range from creating physical and psychological conditions for children success, to engage in homework processes and tasks or in meta-strategies in order to adjust the task demands and the child's skills. Parents influence children through modeling, reinforcement and instruction. Modeling means that children "acquire knowledge of skills, processes, concepts and personal capabilities through observation" (Hoover-Dempsey et al., 2001, p. 203). Through reinforcement children learn by associating behaviors with desired consequences while through parental instruction they learn attitudes, skills and knowledge that are directly taught by their parents (Hoover-Dempsey et al., 2001).

Regrettably, research has only focused on what parents do and on what students gain. Moroni, Dumont, Trautwein, Niggli and Baeriswyl (2015) concluded that the quantity of parental support in homework was negatively associated with students' achievement, while the quality of homework support was found to be a good predictor of achievement. This and other examples (Karbach, Gottschling, Spengler, Hegewald, & Spinath, 2013; Jeynes, 2012; You & Nguyen, 2011) tell us much about the motives underlying parental support and their effects on children and adolescents but tell us little about how parents are affected by engaging in homework-like tasks. Little attention has been given on how programs can promote changes that may influence not only students but parents and teachers themselves. Research on parental involvement in technology-based tasks with children

followed a similar path. Cho and Cheon (2005) investigated the relation between family context factors and children Internet usage. Findings reveal that children were more exposed to negative Internet content than their parents thought and that engaging in shared activities reduced the exposure to negative Internet content. More recently, Nikken and Haan (2015) found out that parental mediation was enhanced by positive views of digital media, presence of elder siblings, children engagement in educational games and media skill level. On the contrary, parents feel less confident if their children use social media. Also Lee and Chae (2007) were primarily concerned with parental involvement and how it affects children. From an ecological point of view, it is fundamental to investigate bidirectional effects in dyadic interactions within microsystems (Bronfenbrenner, 1979).

Thus it seems important to develop a heuristic and ecological framework in order to help teachers to take advantage of Internet affordances to accomplish disciplinary goals (Wallace, 2004) and at the same time include parents in the dynamics of their children academic development. In the next section we will propose a framework based upon a constructivist (Piaget & Inhelder, 1969), developmental (Vygotsky, 1978) and ecological (Bronfenbrenner, 1979) approach. Piagetian and Vygotskian perspectives, although different, are far from being incompatible and exploiting their commonalities can bring new insights to research (Piaget, 1962; Nicolopoulou, 1993).

Activities with parents on the computer – An ecological framework

By APC we understand pedagogical tasks – based on socially relevant disciplinary contents– adopted or designed, assigned and evaluated by teachers, aiming to promote home and school connection, parents and students collaboration, digital and domain-specific literacy skills.

Hopefully, APC will act upon teachers, students and parents leading to changes in their usual social position, since their roles and contexts are challenged, occurring what Bronfenbrenner (1979) called "ecological transition." An ecological transition would have happened when a student, at home, for example, explains his parents a Chemistry content as if as he was playing a teacher's role.

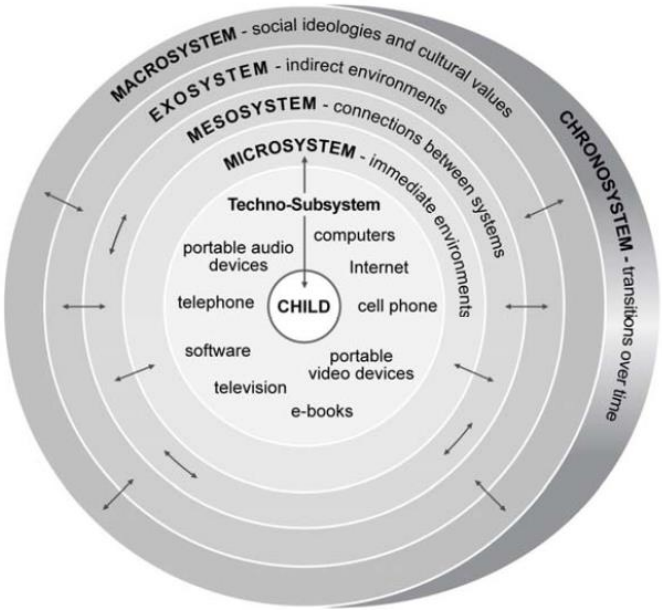


Figure 2. A techno-subsystem (reproduced with permission from Johnson & Puplampu, 2008)

Johnson and Puplampu (2008) added to the original ecological model a techno sub-system. The techno sub-system is included in the micro-system and it should account for "continuously increasing complexity and availability of childhood technology" (Johnson & Puplampu, 2008, para. 11). As one can see in Figure 2, it "includes child interaction with both living (e.g., peers) and nonliving (e.g., hardware) elements of communication, information, and recreation technologies in immediate or direct environments. From an ecological perspective, the techno-subsystem mediates bidirectional interaction between the child and the microsystem" (Johnson & Puplampu, 2008, para. 11).

A closer look at Figure 2 helps us to identify and conceptualize the challenges that literacy raises to the techno-subsystem. Nowadays, being connected means that one can skip the microsystem mediation and enter in new kinds of mediation and (re)mediation (Grussin, 2004). Johnson (2010a; 2010b) gathered empirical support to validate the techno-microsystem construct but the main focus of the researches was child development and scarce attention was given to parents. This is a gap that the current study tried to tackle.

As one can observe in Figure 3, we propose a knowledge-centered approach mediated by attitudes considered as "a psychological tendency, that is expressed by evaluating a particular entity with some degree of favor or disfavor" (Eagly & Chaiken, 1998, p. 269).

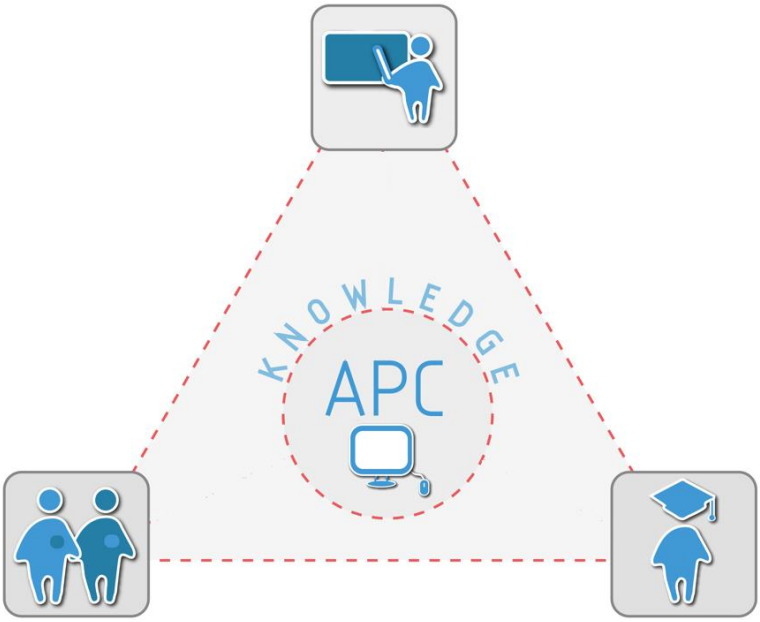


Figure 3. APC networking frame

Teacher is represented at the upper vertex of the triangle while students and parents are represented at the lower vertexes. It should be noted that the right side represents the relationship between teacher and students (school context); the bottom side of the triangle represents the relationship between students and parents (home context); and the left side represents the relationship between educators, i.e., teacher and parents (institutional relations).

Translating the framework into Bronfenbrenner's (1979) terminology, one can say that students and teachers share the same microsystem (i.e., school); students and parents share another microsystem (i.e., home). Students move from one context to another often in a daily basis performing very different roles, while parents and teachers meet not so often and they are strictly focused on students, which act as a carrier of messages and meanings from school to home and vice-versa. APC acts as a mesosystem, engaging school and home microsystems in dialogue.

APC are built upon the notion of "zone of proximal development," i.e., "the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). After Bronfenbrenner (1979, p. 9), we define development as "the person's evolving conception of the ecological environment, and his relation to it, as well as the person's growing capacity to discover, sustain, or alter its properties." As such, the concept is applicable not only to students but also to parents and teachers.

Ultimately, as mentioned by Cicconi (2014), in Web 2.0, Vygotsky's traditional proposal of the more knowledgeable other (MKO) − someone with more knowledge or a higher understanding of a particular situation/task/problem than the learner − has been transformed. The fact is that the MKO varies depending on the subject and the context. Parents are naturally expected to be more knowledgeable than their children, but one may find situations, especially among families coming from deprived social milieus, where children are the one who bring new knowledge into home. This reconceptualization provides teachers with a wide range of opportunities to promote social change.

Structure and design of an APC

Similarities can be found between APC and WebQuests. Knowing how difficult it is for young students to select and organize the enormous amount of information that is nowadays available, Dodge (1997) proposes learning activities, which guide the students while browsing the Internet. Thus, a "WebQuest is an inquiry-oriented activity in which some or all of the information that learners interact with comes from resources on the internet" (Dodge, 1997).

Exploration guides are aimed at helping learners to use specific computational simulations, through a sequence of instructions, enriched with questions and challenges in order to bridge the computer program with specific pedagogical purposes (Paiva & Costa, 2010). When a more complex computer program is expected to be used in APC, such exploration guides may be included.

APC is divided in six parts to be completed either by the student alone or by the students and their parents together, as signalized by small icons at the beginning of each part (see the bottom icons of the triangle in Figure 3). Figure 4 aims at showing a schematic view of the steps involved in APC and its relation with Bronfenbrenner's (1979) ecological model and Johnson and Puplampu's (2008) techno-subsystem.

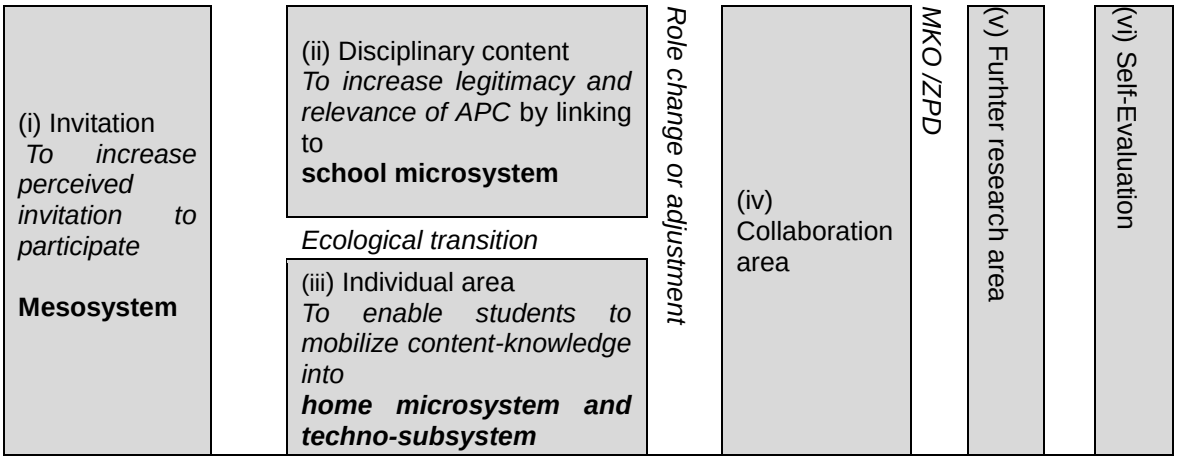


Figure 4. Structure and processes involved in APC

The six mentioned parts are explained bellow:

- Invitation: students and parents are explicitly invited to participate, and goals and the process are explained, assuming that parents are more prompt to participate if they "perceive that their involvement is wanted and expected" (Hoover-Dempsey et al., 2001, p. 206). It acts as a mesosystem, where all participants take part. It leads to the disciplinary context.

- Disciplinary context: a brief description of the activity's disciplinary context, according to science, technology, society and environment (STSE) education (e.g., Zoller, 2012), is defined by teachers (school microsystem) and it aims at increasing APC perceived legitimacy and relevance, since computers and digital technologies are often associated with less demanding activities (Kolikant, 2012). An ecological transition is expected to occur when students try to carry the disciplinary content into their home.

- Individual area: tasks usually computer-based (techno-subsystem) are assigned only to students. Our claim is that parental support should not replace individual work but enhance it. Autonomy is tested in ecological transitions to new settings and parents should learn how to better support their children as they grow up. After this step, parents will be called to collaborate with students.

- Collaboration area: parents and students are expected to work together. At least one computer-based task is included in this area. Tasks are defined in order to foster desired changes and behaviors.

- Further research area: this area is aimed at allowing participants to extend their research (follow-up activities). It can help teachers to identify and assess each family's resources in order to establish challenges located in the zone of proximal development (Vygotsky, 1978).

- Self-evaluation area: parents and students are asked to assess the quality of the work they have developed through a questionnaire (see next section). Self-evaluation is an important means to trigger and organize meta-reflection processes on parents and children relationship and behavior, to promote development and to help teachers to adjust and optimize further APC proposals.

Materials and methods

In the following section we described the materials and methods used in the research.

Research question

What are the attitudes of the families towards APC and what inputs do they give us about the structure and processes that APC aimed at activating?

Materials

Bearing in mind the STSE education perspective, the APC focused on a socio-scientific chemistry topic: climate changes. In the individual area, students were asked to search the web and learn about phenomena such as greenhouse gas and acids rains, after which they should explore a computational simulation to observe how the temperature varies as a consequence of greenhouse gas concentration.

In the collaboration area, the objective was to raise the awareness about the relationship among fossil fuels, the increment of greenhouse gas effect and acidity in rain. The participants should discuss the family electricity receipt, explore a new simulation to challenge their knowledge about acid, basic and neutral solutions and finally they should explore together, through a new perspective, the simulation on greenhouse effect.

In the further research area, the family was asked to expose doubts and to identify new practices that may integrate the life of each family member, in order to help ensure the sustainability of life on Earth.

The self-evaluation questionnaire included: (i) six items (six-point Likert-type scale) to evaluate attitudes towards APC (see Table 1), that aimed primarily at promoting reflection inside each dyad; (ii) open-ended questions on the advantages and disadvantages of APC, and (iii) socio-demographic questions (e.g., occupation and age) and technology use and competence perception.

Table 1. Questionnaire items

Item #	Full questions	Short designation
1	I liked to participate in this activity.	Interest
2	My parent/guardian engaged in this activity.	Hetero-engagement
3	It was important to cooperate with my parent/guardian in this activity.	Collaboration
4	I engaged in this activity.	Self-engagement
5	During the activity, there were unpleasant moments.	Unpleasant
6	I would be available to participate in other activities like this one in the future.	Future participation

After Johnson and Puplampu (2008) presented the theoretical proposal about the techno-microsystem, empirical studies by Johnson (2010a) assessed children's use of the Internet by parent-report. Different methods of data gathering and different samples are necessary to support or challenge the proposal. In our study we designed a semi-structured interview to collect data from each parents-child dyad together. This approach it is an important methodological contribution to study digital ecologies.

Participants

The study involved approximately twenty participants: ten 8th grade students and ten parents (i.e., ten parent-child dyads) from which eight individuals (i.e., four dyads) were interviewed in depth (see Table 2). Qualitative studies, with relatively small samples, have given relevant contributions, for instance, to the understanding of

out-of-school digital media contexts (Burnett & Wilkinson, 2005) or digital fluency (Wang, Wiesemes, & Gibbons, 2012).

Table 2. Dyads characteristics

Dyad	Parents			Students	
	Occupation	Age	Role	Role	Chemistry grade*
A	Finance manager	46	Mother	Daughter	4
B	Factory worker	53	Father	Daughter	2
C	Surveillance	44	Father	Daughter	3
D	Gardener	39	Mother	Son	3

Note. *Minimum 1, maximum 5.

Data gathering procedure and analysis

Students were given an envelope containing the APC and the informed consent letter. Approximately a week later, the teachers collected the envelopes and reported to the researchers who selected, based on distinctive patterns of attitudes showed in the questionnaires, and contacted the parents to be interviewed together with their children.

Four dyads were interviewed in depth by one of the authors (a psychologist) at the school facilities in different moments. The interviews, which lasted between 26 to 40 minutes, were recorded and fully transcribed.

Quantitative data was inserted in a SPSS database and descriptive statistics were obtained. The transcriptions of the interviews were inserted in NVivo and a thematic data analysis was conducted according to the questions asked and the categories extracted from the literature on homework (see Figure 1 above), ecological development (see above the definition of "change in position") and socio-cultural theory (e.g., "more knowledgeable other").

Results and discussion

Overall the dyads reported to have spent between half an hour and one hour in the activity. The outcome was analyzed by one of the authors (a chemistry). Students showed different performances in the individual area. Five students answered correctly to all or almost all chemistry questions. Two students answered correctly to all or almost all questions except those questions that required accessing the computational simulation. Only two students had a clearly poor performance in the individual area.

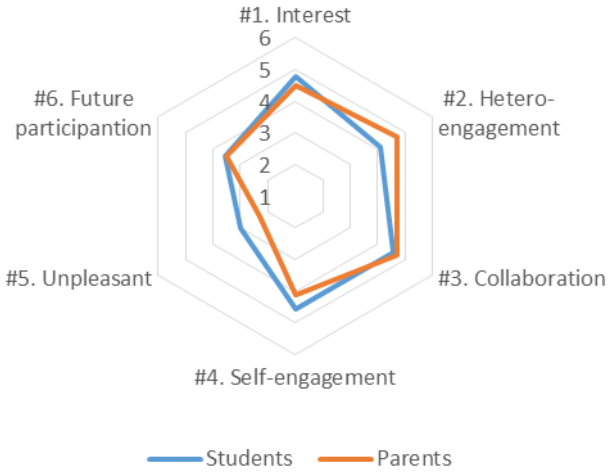
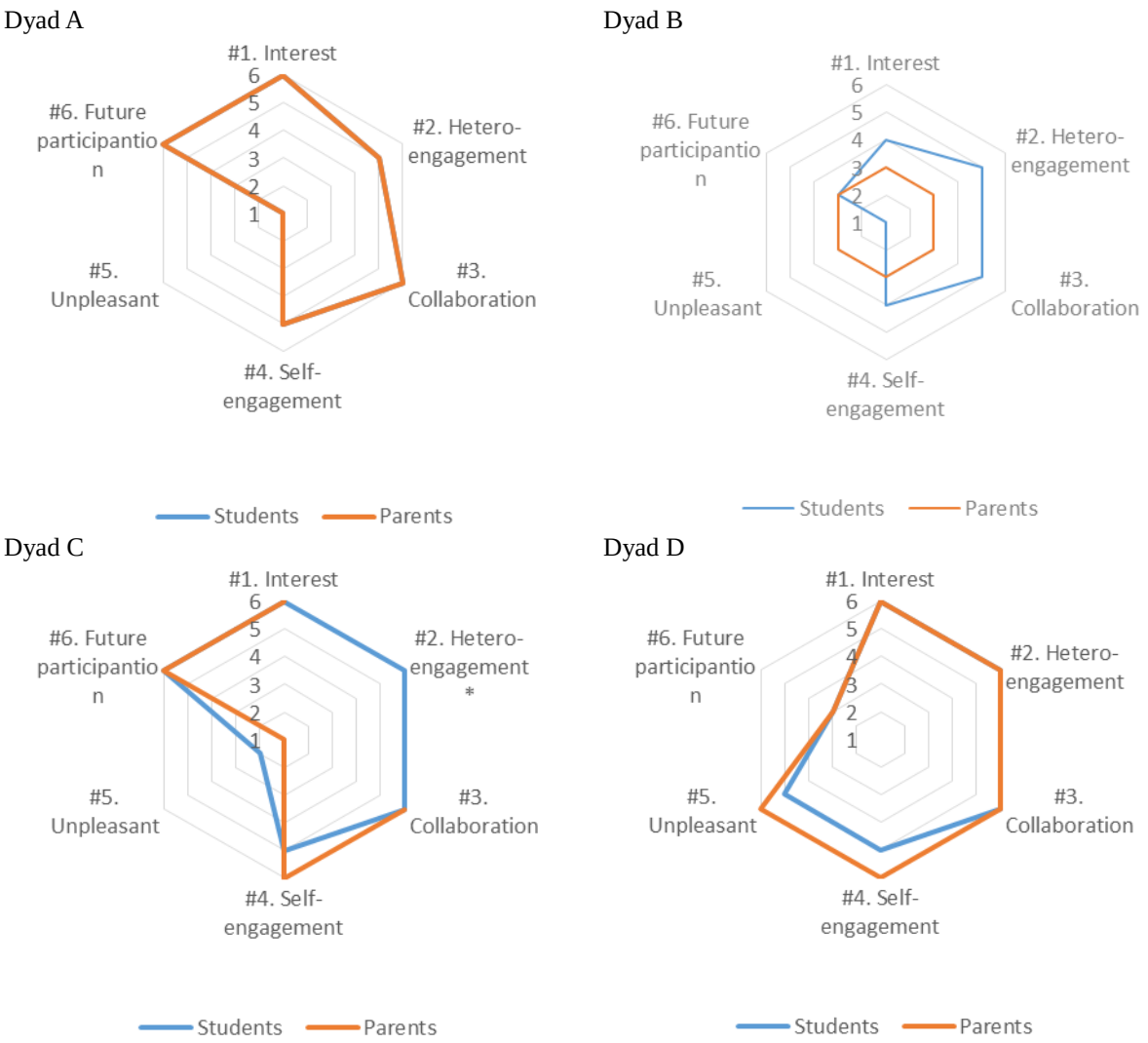


Figure 5. Questionnaire results

In the collaboration area, three dyads showed good levels of collaboration and research; one answered correctly but without showing indicators of joint reflection and research. Only two dyads' performance was clearly weak. The other five dyads only answered to part of the questions. It is important to note that besides the online simulation there was also an activity that required participants to check the electricity receipt; this activity, although in line with the STSE goals, did not required digital literacy.

In further research area, participants' answers ranged from concrete, specific suggestions (six dyads) to absent or very elusive answers (four dyads). One should mention that it is not possible to predict the quality of the cooperation among children and parents based on the individual performance. For instance, one student that performed quite well in the individual area did not show signs of cooperation with his parents. On the other hand, we also noticed that some students who showed strong signs of cooperation with their parents did not perform as well in the individual area.



Note. *Missing answer from father C.

Figure 6. Questionnaire results by dyads

The answers to the open-ended questions were submitted to a content analysis. Parents and students considered that APC promoted learning, collaboration, and knowledge about themselves, the other and their emotional relationship. Few disadvantages have been reported when compared with advantages: lack of time; technical constraints in accessing the links; and cognitive obstacles (e.g., not knowing the answer).
The overall evaluation about APC is positive as one can see in Figure 5.

The APC was perceived as pleasant (item #1: M = 4.7; SD = 1.17) and collaboration between parents and children as important (item #3: M = 4.7; SD = 1.53). Perceived hetero-commitment (item #2: M = 4.42; SD = 1.43) and self-commitment (item #4: M = 4.4; SD = 0.94) scored high, while unpleasant moments scored very low (item #5: M = 2.55; SD = 1.76). Nonetheless, the participants were only moderately available to participate in an APC in the future (M = 3.65; SD = 2.03).

Figure 6 shows the scores on the questionnaire within each dyad. In dyads A, C and D, parents and children have similar attitudes towards APC. However, in Dyad D, the participants report that they faced unpleasant moments during the activity. In Dyad B, the differences between father and daughter are more explicit. The results of each dyad are analyzed and discussed above.

Dyad A

Dyad A was formed by a middle-age, highly-educated mother, who worked as finance manager at university, and a daughter with good academic achievement. The relation between mother and daughter was positive and digital technologies were not perceived as problematic. The mother was strongly dependent on technologies in her professional daily-life but she did not use social networks. On the other hand, the daughter used Facebook with a high perception of control over her own behavior (perception that was shared with her mother).

The mother responded to her daughter homework, trying to give the structures for her daughter to develop herself, advising and instructing her. She felt more confident when homework was about mathematics (her academic expertize area), but she acknowledged that sometimes her explanations about the subject could be too elaborate for her daughter to understand.

The dyad answered to all the questions of the APC acknowledging that the activity made them reflect upon new themes (STSE) and lead them to collaborate more than they usually did in homework.

"It is good to step out of our subject area and get in touch with other subjects especially with this one which is so important related with the environment." [Mother A]

Mother and daughter showed a positive and identical evaluation on APC (Figure 6). From a qualitative perspective, APC increased the perceived relevance of parental involvement in homework:

"If I got more involved in [her] activities she could have had more fives [equivalent to the highest grade]. This year I think that I ought to have stayed a little more with her to understand where she had more difficulties." [Mother A]

In line with You and Nguyen (2011, p. 556) it is evident that "having a close bond and showing personal interest and care for the child does, in fact, have far-reaching consequences in the lives of children."

Dyad B

Dyad B was formed by a 53 years-old father, who worked at a factory, and a daughter with poor academic achievement. He did not use the computer and had a low perception of competence on digital technologies. Daughter and father perceived her relation with Internet as problematic:

"She isolates herself. She spends hours and hours alone with the computer… doesn't even eat and sometimes we don't even notice her, she is there, alone." [Father B]

"I see that I isolate myself, but I could be in another part of the house with the rest of the people, but being on the computer I would not be truly there…" [Daughter B]

According to literature, total time using Internet affects perceived family time but not family communication (Lee & Chae, 2007). In this case time and communication were affected. Typically, father B did not get involved in his daughter homework tasks, justifying that she arrived late at home and that she was given explanations on a daily basis elsewhere. In fact, it was the first time that they worked and studied together and both acknowledged that it was not easy to collaborate.

"She does not accept that much my opinion... she has difficulties in accepting..." [Father B]

"I think we both have different opinions, but then it was only a matter of putting all in one." [Daughter B]

Based on the quantitative results, one could say that father and daughter developed different attitudes towards APC (Figure 6). The daughter evaluated APC more favorably than her father, although less favorably than her schoolmates. She did not report any unpleasant moment during the activity. Although the father has scored three in all questions, his attitudes and the meaning of the experience became more visible during the interview. STSE subject was highly valued by the father who examined the electricity receipt with his daughter easily and with confidence. The digital activity was led by the daughter, who introduced her father to Internet and computers, despite the fact that she was not able to access one of the computational simulation available online.

I think that it is positive. It brings people together. We had an opportunity to make more use of the computer. I, for instance, have a computer at home, but I do not use it. [Father B]

Dyad C

Dyad C was formed by a middle-aged father, who worked as vigilant and perceived himself as relatively competent using the computer, and a daughter with medium academic achievement who also reported being competent on digital technologies. Now and then, the mother also participated in the activity. The father usually engaged in his daughter homework, instructing her through an almost strictly cognitive approach:

"I study with her. She studies first and then she comes to me to check if it is correct. I also ask her questions, how much she has studied, if she has learnt anything or not…" [Father C]

Both of them acknowledged being easy to find information on Internet but also that it was necessary to understand it and to reproduce it with new words (avoiding copy and paste processes).

Father and daughter evaluated highly their experience with the APC (Figure 6). The daughter considered that the APC was important because parents could monitor what children learn at school. As Jeynes (2012) suggested, the efficacy of parental involvement programs depend on the quality of the parent-children interaction, monitoring included.

Father and daughter considered that APC helped to show the relevance of understanding different points of view and was efficient in bridging people's opinions. They acknowledged that APC involved some stress (which can be taken as a sign of having experimented cognitive dissonance).

Dyad D

Dyad D was formed by a middle-aged mother (a gardener), and a son, with medium-low academic achievement who has experienced a problematic relationship with digital technologies in the recent past. His mother had to limit the use of the computer because he was spending too much time playing games. His father was working abroad and engaged in the APC through *Skype*, an unexpected answer to a contingency (geographic dispersion) that nowadays affects innumerous families.

Considering Figure 6, the evaluation is ambivalent. Although the unpleasant moments' item scored high and the willingness to participate again scored low, one should note that the interview did not support these values.

Mother D overtly acknowledged that she was no longer capable of helping her son on a disciplinary content basis. To overcome the handicap, they had developed a strategy that was very tuned with the expected collaboration to perform APC.

"Honestly, I cannot follow the subjects anymore. Sometimes, I will check if the homework is done, but he got used to do it on his own early on." [Mother D]

"(…) from early on I developed a tactic to make him studied: it was to pretend that I did not understand the subject – this was not the case, because I did not understand – which made him read and study, and let us say that he was delighted, because he thought he was explaining that subject. [Mother D]
I felt like if I was a teacher explaining. [Son D]

They did not answer to all the questions of APC, but their cooperation was visible and positive. Nonetheless, the intensity of the relationship was somewhat excessive, and the son seemed still dependent on his mother to control his relation with digital games (e.g., the computer was in mother's room, so that he could not use it during the night).

Wrapping up and reframing APC

The digital media may become a source of tension within the family, requiring dialogic skills from parents and students (dyads B and D). Mother D limited the use of computer in time and space: if she helped her son coping

with the immediate problem or dependence, she did not provide her son with means to emancipate his relationship with digital media or to build his autonomy: "simply prohibiting or restricting seems ineffective for guiding children's Internet use" (Lee & Chae, 2007, p. 644). Furthermore, parents' confidence depends on how active on social media children are (Nikken & Haan, 2015) and "when parents' control or guidance over the computer use turned out to be ineffective and their children refused to communicate with them about these issues, they became 'worried outsiders'" (Yu, Yuen, & Park, 2012, p. 19). It is not irrelevant that family B and D had a low socio-economic status, a factor highlighted by the literature on digital divide (e.g., Ritzhaupt, Liu, Dawson, & Barron, 2013). Both home microsystems include technology but dialogue, especially in Dyad B, about technology is rather poor if not incipient.

The inability to access the web resources confirmed the need to promote digital literacy, among youth and adults (Ng, 2012). When neither parents nor students possess adequate levels of digital literacy to address specific challenges, it is up to the teacher to take advantage of how students change position within the home microsystem (Bronfenbrenner, 1979).

Personal or digital mediated communication from teachers to parents can be a good strategy to increase the visibility of the invitations. While almost all students successfully completed individual area, collaboration area was not and adjustments are necessary. Further research area helped families to bridge theory and practice, turning knowledge in behaviors that can organize family daily-life on sustainability, but did not gave us enough indicators about the families' resources. As such, it is necessary to rewrite this section in order to map the ZPD, according to Vygotsky (1978).

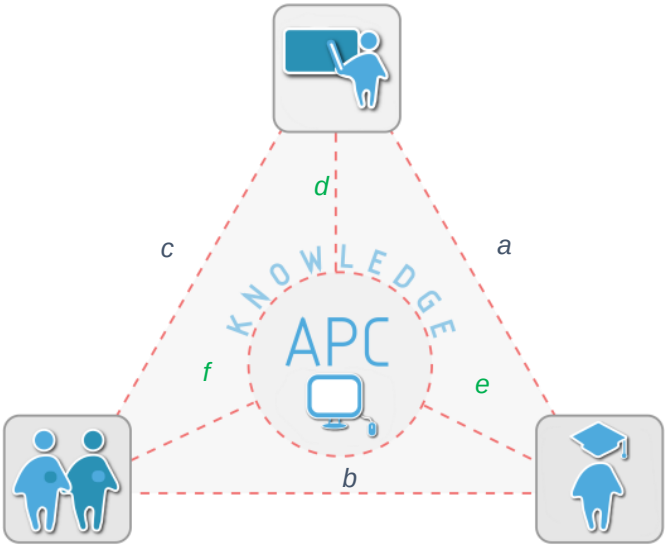


Figure 7. Remodeled APC framework

It is not clear if changes in the process of role construction only became meaningful or not during the interview. The fact is that (i) parents' insights (A and C) on their usual approaches to homework opened the possibility of adopting behaviors that do not require academic expertize (Simpkins, Price, & Garcia, 2015) and (ii) students assumed the MKO role in relation with digital technologies (daughter B) and in relation with disciplinary content (son D).

Children establish emotional and "academic" bonds with their parents and teachers. At the school microsystem they primarily play the role of students, interacting with their teachers while developing attitudes towards them and school. At the home microsystem, they are primarily children, interacting with their parents and relatives: school is brought into their homes through homework assignments or grades. Within a specific setting each person is also connected with other living objects of evaluation (e.g., friends) that can be activated through digital media. APC overlap schoolwork and digital media while overtly involve parents, thus creating new triadic relations inside the triangle formed by students, parents and teachers. The smaller triangles can intensify, change or disrupt previous attitudes as predicted by Heider's (1946) balance theory, through psychological processes, e.g., cognitive dissonance (Festinger, 1957). In dyads B and C, conflict was not merely cognitive, but was also emotional, since it equalized the value of parents and students' opinions. These insights lead us to reframe our model, in order to account for micro-relationships (see Figure 7, d, e, f). The APC framework should be Internet-

based and compatible with multiple devices, from computers to smartphones, in order to help teachers to implement participatory and geo-localized activities that increase the visibility of its socio-scientific meaning.

Conclusion

In this paper we have presented APC as a means to interconnect school and home and to promote literacy. The scope of this research has been mainly circumscribed to the participants' attitudes towards APC inside each parent-child dyad.

Although the result's generalizability is limited, small-scale studies provide powerful theoretical and practical insights. Bearing in mind an ecological framework, we observed that APC challenges parents and children to play alternative roles. Since digital media usage affect family time as well as communication, to restructure the way children and parents approach technology can increase the quality of family relationships.

Literature is mainly focused on the effects of parental involvement in homework or digital-based tasks in children academic achievement or development. Our research uncovered the possibility of parents - and not only children - be affected by shared technology-mediated interactions. Whether or not these changes only affect parental involvement models or are also manifested in other dimensions of parents' life, there is no doubt that this topic deserves to be investigated.

Johnson (2010b) hypothesized that mesosystem lost relevance in contemporary society. On the contrary, the current findings reinforced mesosystem as a theoretical tenet with practical significance. The alternative hypothesis is that digital media are more than a nonliving object in the techno-microsystem. They are a means through which different systems communicate, one that encompasses mesosystem in a highly sophisticated society. As highlighted by one of the reviewers, school teachers, educators and principals can apply APC to foster school-parents relationships.

Future work should try to gather more qualitative data from other settings in order to suppress time and sampling limitations that affected this research. It is our choice to conduct ecologically-grounded research instead of quantitative approaches, including direct observation in order to track how many time parents and children spend on each area and assess their interactions. Nonetheless, it would be important to use more reliable quantitative assessment of some of the tenets of the framework, including data gather instruments, e.g., questionnaires on homework and on the relationship with teachers. A second line of research consists in investigating teacher's role during the process of creating, implementing and evaluating an APC. What variables are at stake when APC is discussed inside classroom with students and in the regular meetings with parents? Future work should also discuss if APC is to be strictly aimed at parents or if it can also be aimed at other relatives or other members of the community.

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