Children are joining the ranks of telecom researchers

Veerle Van Rompaey, Sofie Vandoninck, Bart Van Der Meerssche, Anneleen Vandenbempt & Hans De Mondt

Abstract

Complementing last year's contribution to the FICTE conference in Vienna, this paper discusses new methodological aspects and research findings within EnComPAs (Enabling Community Communications – Platforms and applications). This European project is Celtic-labeled, involving research divisions of major telecom companies and universities in Belgium, Finland, Spain, and France.

EnComPAs started off with an investigation of twelve Flemish families who got the assignment to invent and create new technologies. From April until July 2005, a multidisciplinary research team guided the families through the whole process of brainstorming, ideation, and creating paper prototypes.

Instead of families, the research methodology is now applied to the context of children suffering from a long-term illness. These children have specific communication needs because of the frequent hospitalizations they have to undergo. As a result, they lose contact with their social environment and often feel isolated from it requiring an innovative e-inclusion application that facilitates the children's contact with their family, friends and classmates. Since this technology should meet the needs of the children in the best possible way, they are actively involved in the entire development cycle. In order to accurately assess the impact of this application on their lives, the children themselves assume the role of researchers.

I. INTRODUCTION

In the scope of the EnComPAs project the co-design methodology is investigated in different contexts. After working together with twelve Flemish families, the team is now working on a co-design project with children. The aim of this project is to address the specific needs of long-term ill children. These children often get isolated from their normal social environment because of frequent hospitalizations or because they have to stay at home for a longer period. Alcatel is developing an innovative e-inclusion application which allows long-term ill children to stay in touch with their classmates and teacher. This new technology should facilitate the children's communication with others, which prevents them from becoming isolated. During the whole project, the children play an active role. Within a storytelling frame, the children are approached as if they are part of a real research team. This makes the project more appealing and attractive to them.

The paper first gives a literature review of the typical problems sick children encounter. Next, we present an outline of the methodology we used. The study is split into four research phases: the contextual investigation, technology probe: exploration, technology probe: hardware co-design, technology probe: software co-design. Each of them will be explained further in this paper. Throughout the whole research cycle, evaluations and feedback are considered to be important and take place on a regular basis.

II. LITERATURE

How children cope with long-term illness

The experience of being seriously ill and being hospitalized certainly has an overwhelming impact on the life of a child. It causes instability and stress in the daily routine, which enhances the risk for negative emotional feelings and psychosocial problems [1, 2]. Children use their 'coping resources' to handle this unusual and rather unpleasant situation of being ill. Yet, not every child can cope as easily with the negative aspects of its disease. It depends on the presence or absence of a number of risk factors whether the child can or can not cope successfully with the illness [3, 4, 5]. It is clear that a high level of social support has a mediating effect on upcoming negative emotional feelings. Children with a good parental relationship and an elaborate network of relatives and friends that take good care of them, are generally able to cope better with negative and stressful experiences such as being long-term ill [6, 7, 8]. Another important factor that can give an indication of the ability to cope successfully with difficult situations is the child's age. In general, children from elementary school aged 7 to 12, dispose of the best coping capabilities. These children have a certain degree of independence from their parents and generally they are very flexible. Also, the duration of the stay at the hospital and the number of previous hospitalizations has an impact on the coping capacities of the children. Generally, the longer the stay and the more hospitalizations the child has to go through, the more the child alienates from his social environment. One last very important coping-factor is the behavior of the child preceding the hospitalization. Children with prior behavioral problems have more difficulties in accepting their illness and coping with it.

'Normal environments': the family, friends and school

Generally, school-aged children have a strong desire to be 'normal', to be just like everyone else. The three most important settings where 'normal' life takes place are: the family, the social network of friends and the school. For school-aged children, the friends and the school often overlay. These settings are most stimulating for the child's mental, emotional and social development. Thus, every child, even when it suffers from a serious disease, should spend as much time as possible in these 'normal' environments [9]. Sick children consider maintaining social contact during the period of illness as very important. They appreciate it enormously to be in touch with their friends. This is why every long-term ill child should have the opportunity to keep in touch with their social network, also with people outside the family. This prevents the child from feelings of alienation and it promotes a smoother reintegration in the social network when the child is back in healthy condition.

The social benefits of attending a 'normal' school on a regular basis should not be underestimated. For this reason, one-to-one education services in the hospital, at home or at school should not be encouraged, since this form of education enhances social isolation. [10, 11, 12, 13]. It is better to offer education in a group setting. As soon as the health condition is favorable enough, the child should get the opportunity to return to its own school, part-time or full-time. Thus, schools should provide facilities in order to supply education to their pupils that suffer from a long-term disease. These measures have to prevent feelings of isolation and alienation and should facilitate the return to the classroom.

The advantages of ICT for ill children

ICT can offer these long-term ill children a lot of benefits concerning school-issues and social contacts. First of all, ICT is a perfect tool for homework-assistance. One advantage is the possibility to work for school at any moment, when their medical condition is at best. Using different ICT-applications such as email, websites or video-conferencing, the continuity from the school curriculum gets minimally disturbed. It is clear that ICT has a positive impact on the child's participation and involvement in the school environment, which makes the reintegration easier. In the second place, ICT can deliver an enormous range of opportunities concerning social contacts with the family and friends. Transferring text, sound and images with ICT, the children can inform their social network about their progress at the hospital meanwhile staying involved in the daily lives of their family and friends. Even if the child suffers badly from the disease and can not leave the bed or if contagion risk is too high, it is still possible to keep in touch with the social network. Using ICT reduces the risk of isolation and alienation from the social environment profoundly. Thus, further exploration of the use and impact of ICT on the lives of long-term ill children is useful, certainly in the context of enhancing social contact with friends and classmates [14, 15, 16, 17].

III. METHODOLOGY

The research methodology developed during prior EnComPAs activities is now applied to the context of children suffering from a long-term illness for which a new communication application is to be designed. This innovative device is designed by children, aged seven till eleven, together with a multidisciplinary team applying a qualitative methodology. Communication sociologists, product designers and engineers enter the natural environment in order to research the social relationships and processes. The natural setting exists of two primary school classes, located in a small Flemish village.

As noted in the literature review, long-term ill children encounter different problems concerning social contact; an important is a reduced contact with their friends at school. This discomfort combined with falling behind on their schoolwork, inspired the research team to design a mockup that enables long-term ill children to make contact with their friends and teacher in the classroom while themselves are in hospital or at home.

We contacted a Flemish hospital in order to find long-term ill children that were willing to participate in this research. From the first contact it became clear that this would be a complicated and long-term mission. Nowadays, hospitals pursue the policy to keep long-term ill children only in the hospital when strictly necessary; reducing the days they are away from home to the minimum. Children who nevertheless have to stay longer in hospital suffer mostly from a severe disease like cancer which makes them less accessible to participate in a study. For the moment, contacts with the hospital are still ongoing.

Since the prototype is designed initially in order for long-term ill children to have contact with their classmates and be able to follow the lessons from a distance, we decided to introduce this prototype in the classroom of a primary school. A second grade and a fifth grade class participated in this research. The age of the children ranged from seven till eleven.

The research questions related to this research are:

- How can ICT help long-term ill children to stay in touch with their social environment, more specific their school activities?

- How can a creative co-design methodology facilitate the introduction and adaptation-process of a new ICT application into this specific user group?

In order to find an answer to these research questions a research design consisting of four phases was developed. Every phase of the research design is executed by both classes, independent from each other. During the spring of 2006 these classes were submitted to four research phases (Figure 1):

- Phase 1: Contextual investigation
- Phase 2: Technology probe: exploration
- Phase 3: Technology probe: hardware co-design
- Phase 4: Technology probe: software co-design

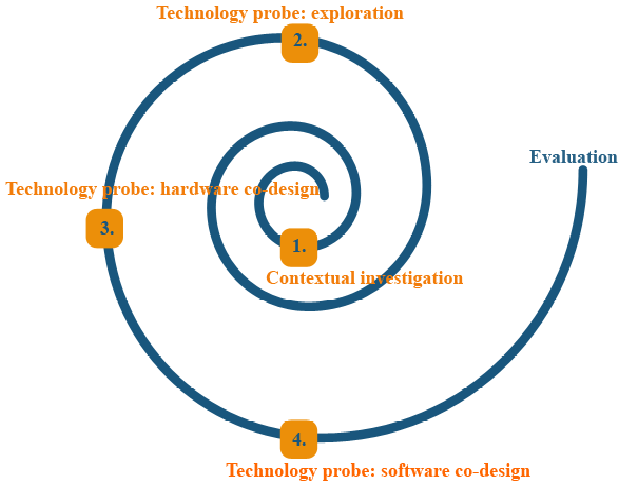

Figure 1: Co-design methodology

PHASE I CONTEXTUAL INVESTIGATION

In order to understand the impact of a new ICT application introduced into an existing environment with its own rules and common social processes, you have to understand the context in which the user lives before this new device enters his life [18]. With regards to this study, we wanted to get an insight in the everyday life of the children, how their social environment is constructed and how they communicate with their family, friends and schoolmates. This information, obtained by a contextual investigation, provides valuable resources throughout the whole research design (Figure 2).

To obtain useful information about the ideas, desires and problems of children, it is found that creative methodologies are most suitable. Children have a whole range of well-defined emotional feelings, but they are not always capable to describe them verbally. On the other hand, most children are able to express their emotional state in a different, more creative way. Drawing a picture or scheme and story-telling techniques with additional in-depth interviews already showed to deliver good results in obtaining an impression of the daily lives, problems, worries and feelings of children between 7 and 12 years [19].

Figure 2: Contextual investigation

One of the creative techniques we used throughout all the phases is storytelling. Instead of introducing ourselves to the children as researchers of a university and telecom company, we entered the classrooms as *messengers of Steward*. Together with a bunch of friends Steward has the most exciting adventures, solves problems all around the world and helps people in distress. One of his friends is professor Theodosius, the smartest human of the world who invents new vehicles, devices and robots but who is always absent-minded and therefore lots of his inventions fail or blow-up. For his latest invention, professor Theodosius asked Steward to find children who would like to assist the professor in (re-)designing the invention in the hope this time the invention can be completed successfully. The children of both classes were very eager to become the assistants of Steward and professor Theodosius.

Before the children could help the professor with his invention, he needed to know who the children are, what they like and what they do at school. Communication sociologists introduced a cultural probe box in the class that contained different assignments and various materials. Making photographs of their daily school life was one of the main assignments. Each class received two digital photo cameras and also two tape recorders. With these recorders children could interview each other in the classroom or at the playground. The children got a class book in which they could all individually write and draw something about themselves, using the stationery and emoticon stickers provided in the box. The fourth assignment

was gathering evidence of their daily school life through evidence containers.

After two weeks we collected the class books, pictures, cassettes and evidence containers, analyzed them and listed questions about the material. A feedback interview in the class followed two weeks later. Product designers and engineers of the research team came along to observe the children in order to get to know them before starting the technology probe phases in which they played a key role. The interview was captured on video so that the researchers could access this feedback anytime during the research process.

PHASE II TECHNOLOGY PROBE: EXPLORATION

At this stage of the study, the children got their first introduction to the prototype that functioned as a technology probe. The prototype consists of two devices: a device that is put in the classroom (Figure 3) and a device that the 'sick' children can use to have contact with the classroom (Figure 4). Both are linked to each other via an Ethernet cable. During the lunch break, the classroom device (a moveable screen with a webcam, placed on a wooden box) was put in the classroom and the device for the 'sick' children (a laptop with a headset and an x-box controller) was put in a separate room.

Figure 3: Classroom device

Figure 4: 'Sick' children´s device

Again, this research phase is framed within the storytelling frame of professor Theodosius and Steward. The researchers installed the device in the classroom before the children arrived. As the children entered the classroom, the researchers continued the story about Steward. They told the children that Steward became very ill and cannot go to school anymore for a long time because he has to stay in bed to get better. Steward is very sad that he cannot go to school, because he likes playing with his classmates, he misses his friends at school, he wants to see the teacher and he likes learning new things in class. The story continues as professor Theodosius comes up with a solution to Steward's problem. The professor created an 'invention' which allows Steward to stay in touch with his classmates and teacher. But, before professor Theodosius could hand over his 'invention' to Steward, he wants to make sure the 'invention' works perfect. Therefore, the professor needs a helping hand from his 'assistant help team' in order to perform a try-out session to test the 'invention'.

Up to this point, the device in the classroom was covered by a blanket but as the children agreed to help professor Theodosius, they were allowed to remove it so they all could take a look at the 'invention'. As soon as the blanket was removed, the children spontaneously gathered around the device. They were all very curious to take a closer look at it. They touched it, waved at themselves and made funny faces before the camera. For a few minutes the researchers just let the children explore the device and observed what they did with it and how they reacted to it. Thereafter, the researchers explained to the children how they were going to test the 'invention'. We told the children that five of them were going to be selected. These children got the assignment to pretend being ill, just like Steward, and thus not being able to sit in the classroom. They were told to sit in another room, were they could use the 'invention' to attend the lesson. They had to imagine they were sick at home and the only way to stay in touch with the class would be by using the 'invention'. The five children were selected randomly and each of them

could sit in the other room for about 10-15 minutes to try out the device for the 'sick' children. During this research stage, the researchers divided different observation tasks among each other. Some stayed in the classroom to observe the group of children or the teacher. Others observed the 'sick' children. Before the 'sick' child actually started using the device, he or she received some brief instructions from the researchers. The researcher showed the child how the headset worked and on which buttons of the x-box controller the child had to push in order to move the camera and to raise the 'hand' (a wooden stick on the front of the classroom device). After these instructions, the child was asked to try out the buttons for a moment and to make contact with the class. From that point on, the researchers mainly observed the child and only intervened if necessary.

After the exploration phase, that lasted for about an hour, all the children got the assignment to fill in a short survey about how they experienced the exploration session. The children had to rate eleven statements about the 'invention' on a 7-point likert scale. Instead of using numbers, this likert scale used different kinds of smileys in order to make the survey more appropriate for the children. Within the storytelling frame, the children were told this survey was a 'research report' which would help professor Theodosius to discover the shortcomings of his 'invention' and eventually to improve it so he could make a newer, better version. After filling in this one-page-survey, the children had an evaluative group discussion were they could give their opinion about the invention and make suggestions for further improvement of the prototype. The five children who tried out the device for the 'sick' children had a seperate group discussion about their experiences. They were encouraged to give their personal opinion about it, what they liked about it and what they would like to change. The surveys and especially the group discussions are very important in the continuous evaluation cycle.

PHASE III TECHNOLOGY PROBE: HARDWARE CO-DESIGN

In this stage of technology probing, the focus is on hardware co-design of the classroom device. The children had the opportunity to create a new design, a new 'look' for the prototype. This creative co-design session took place in their classroom and this time as well, the whole session was framed within the story of Steward and professor Theodosius. The researchers started the session by telling the children they received a special message from professor Theodosius. The message was recorded on cassette beforehand. On the tape, professor Theodosius praised the children for their great ideas for improvement and the suggestions they made during the previous session. Next, he announced to the children he needed their help once again, because he could not manage to create a nice design for the 'invention'. Since professor Theodosius was convinced that the children were far more creative than him, he asked his 'help team' if they could create a new and nicer design for the 'invention'. After the message from professor Theodosius, the researchers explained the assignment for this session a bit more in detail and they started to hand over all the material the children could use to create their new design. The children worked in groups of four or five and each group had to create one new 'invention'. Every group received different shapes of polystyrene foam and colored paper. The children could use their own material as well, such as paint, pencils, adhesive tape and scissors. The children could choose what kind of shape and which color their 'invention' should have. The basic function of the 'invention' had to remain the same: the new prototype still had to serve for communication between a sick child and his or her classroom. For about an hour, the children worked in small groups of four to five children. During the co-design session, the researchers gave assistance where needed. In most cases, the assistance was limited to cutting the polystyrene foam and attaching the different parts of the 'invention' to each other. Every group came up with ideas for a new design and managed to work independently for most of the time. They worked for an hour on their design.

After a break, the children were asked to present their new design to the other groups and to the camera. The children explained how every part of their new prototype works, how they named the prototype, what is special or typical about their design and why they choose to build it that way. Afterwards, the other children got the opportunity to ask questions to the presenting group about their 'invention'.

PHASE IV TECHNOLOGY PROBE: SOFTWARE CO-DESIGN

The aim of the software co-design phase is to discover the preferences of the children concerning software issues such as the interface and the different functions the prototype should have. In a creative co-design session, the children will have the opportunity to develop their own ideas about software related topics. The starting point of this session will be a set of basic icons that can perform some simple tasks when clicked on. These icons serve as a source of inspiration for the children. The children will be stimulated to visualize their ideas for the software design by making a drawing or creating a 3D paper prototype. This phase has not started yet. The timing for it is still to be decided.

IV. RESULTS AND FINDINGS

The children took their assignment of being part of professor Theodosius' assistant help team very serious. They were very motivated and did their best to stay in touch with the class and to attend the course using the prototype. Results and findings from the different research phases are situated in two areas: usability and methodology. The first area is that of findings related to the actual improvement of the design and the usability of the prototype. Observing the children during the technology exploration phase was very helpful for the researchers to have an idea of which features of the prototype worked well and which acted as bottlenecks. In addition to this, the survey and the evaluative group discussion provided detailed information about how the children experienced the try-out and what they would like to change and improve to the prototype. During the creative co-design session, the children could create their own 3D paper prototype that incorporated all the ideas and suggestions they had to improve the hardware and its overall design.

The following is an outline of the children's most important remarks and suggestions. First of all, most children wanted the prototype to be more colorful (bright and basic colors, such as red and blue, were preferred) and more decorated so it would look less 'boring'. Secondly, a lot of remarks were made about the wooden stick that represented the 'hand' of the sick child. The children noticed very well that during the lesson, the teacher often did not see the wooden stick being raised. Their solution was to make the stick larger, more colorful and with an image of a 'real' hand attached to it. Some children even suggested that something should light up or make a sound as the sick child raises his 'hand'. Another point often mentioned was the visibility of the images on the screen, or rather, the lack of it. Especially the children that sat somewhat further away from the prototype, complained about the fact they could not see their 'sick' classmate clearly enough. They suggested using a larger screen. The children who posed as 'sick' classmates had some additional complaints about the visibility: they could not see what was written on the blackboard. Also the sound could be improved according to the children who sat on the other side of the classroom. They mentioned having difficulties in being able to hear their 'sick' classmate. These children proposed to use better (and bigger) speakers and, if possible, to hang up more speakers all over the classroom, so the sound would come from every corner in the room. Some of the children who had to pretend being ill reported they could not always hear everything the teacher said. This was a problem, since, in some instances, they could only rely on what they heard in order to attend the lesson because they could not see what the teacher wrote on the blackboard. Another feature that a lot of children suggested to add was the possibility to unplug the device, to make it wireless. This would allow the children to take the device with them to the playground. As a result, the sick child could not only attend lessons in class, but could also 'go outside' to the playground with his classmates. Furthermore, a more original feature to send fill-in papers and task assignments was suggested. During the hardware co-design session, the different groups incorporated most of these ideas and suggestions into their designs. In addition, some less common additional suggestions were made. A few examples are: a camera that could zoom in and out and move up and down (Figure 5), another headset in the classroom that would allow 'two-by-two' work with the 'sick' child, making the device moveable by adding wheels underneath (Figure 6), a second screen in the classroom, a device that would open and close itself as the lessons start and end (Figure 7).

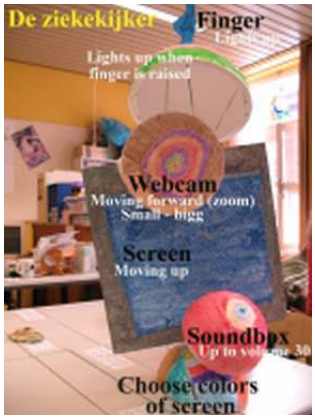

Figure 5: De ziekekijker

Figure 6: De ziektenoplosser

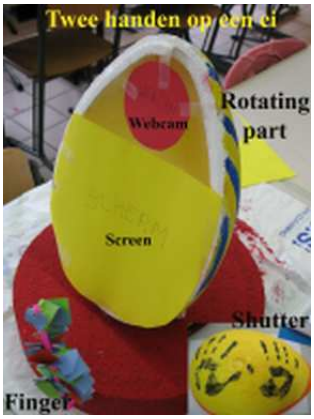

Figure 7: Twee handen op een ei

The feedback the children gave us (survey and class discussions), was very useful to evaluate how the children experienced the research phases. We can conclude that the children enjoyed participating in the exploration phase and that they were very enthusiastic to design their own version of the prototype. Moreover, almost every child indicated they would like to have this prototype themselves if they were ill and most of the children are convinced the prototype could be a very useful and helpful instrument for sick children in general. But, although being very enthusiastic, a number of children admitted they were sometimes distracted from the lesson because of the device standing in their classroom. They indicated that it was sometimes quite confusing to have a classmate that actually did not sit in the classroom. Because of this rather confusing situation and being distracted more often, these children experienced more difficulties in following the lesson in a proper way and in keeping their attention to the subject of the course. Nevertheless, the children's overall opinion about this whole experience was very positive.

The second area of findings is of a methodological nature. This project was not only very interesting to find out what kind of application could help sick children to keep in touch with their class, but it was very useful to learn more about the co-design methodology as well. We observed that the storytelling framework works very well, both in de second grade as well as in the fifth grade. Because everything was framed within the story, the aim of the different sessions was immediately clear to the children. The children were really involved in the story of professor Theodosius and Steward, and some of the 8-year olds even believed these characters really existed. The children were proud to be part of the professor's help team and this motivated them to become a part of the research team. Concerning the cultural probe box, we noticed that adding some popular 'childish' material such as glitter pencils, funny stickers and colorful post-it notes, enhanced the enthusiasm of the children. They all wanted to use the material in the box as soon as possible, which probably had a positive influence on the children's motivation to do their best to complete the tasks attached to the cultural probe box. With regard to the digital photo camera and the tape recorder, we can conclude that both class groups were positive about working with these tools. Nevertheless, we must conclude that the 11-year olds took much more pictures and taped more audio conversations. These fifth grade children were allowed to use the photo camera and tape recorder themselves, without supervision of the teacher, whereas the second grade children only used these materials under supervision. This could indicate that 8-year olds, contrary to the 11-year olds, are not ready yet to work independently with a cultural probe box. It can be useful to bear this in mind for future co-design projects with children. The technology exploration phase turned out to be really helpful for the engineers to find out what technical improvements could be made. Afterwards in the group discussions, the children who stayed in the classroom made a lot of remarks and suggestions without much encouragement from the researchers. Their ideas for improvement kept on coming and the enthusiasm was high. On the other hand, the discussion in the other room with the smaller group of children who had to pretend to be sick was somewhat less spontaneous. The children seemed to be shier when sitting in a smaller group and the researchers really had to encourage them to come up with ideas and suggestions for improvements. During the hardware co-design session, no difficulties appeared. The children liked working with the polystyrene foam (for them a rather unusual and new material to work with) and most of them got started immediately and with great enthusiasm. Only one group of the fifth grade seemed to have a bit difficulties in coming up with a good idea for a new design and this group needed some help from one of the researchers in order to get started. In general, we must say that the children, even the 8-year olds, were able to work quite independent. Probably because they are used to work with paint, paper and scissors during their weekly 'creative afternoon'. They only needed some assistance to assemble the different parts of their design.

Thus, we can conclude that applying the co-design methodology to primary school children turned out to be a positive experience. No major problems occurred, the sociologists learned a lot about the children's daily class activities, the engineers and designers learned a lot about what could be improved on the first prototype and the children enjoyed the sessions and learned about 'how to be a researcher'.

ACKNOWLEDGMENT

We like to thank Daniel Mcbrearty and Stijn Van Rompaey, the two Alcatel Research & Innovation engineers who worked very hard on the prototype in the scope of the IBBT ASCIT project. Furthermore, we would like to thank Linda, Ann and the principal from the primary school in Heffen for lending us their class and a special thanks goes to all the children of the second and fifth grade of this primary school that participated in this research.

REFERENCES

[1] Vanni, J.M., & Katz, E.R. (1997). Stress, social support and negative affectivity in children with newly diagnosed cancer: a prospective transactional analysis. *Psycho-oncology, 6*, p. 273.

[2] Bessell, A.G. (2001). Children surviving cancer: psychological adjustment, quality of life and school experiences. *Exceptional Children, 67* (3), p. 355.

[3] Hägglöf, B. (1999). Psychological reaction by children of various ages to hospital care and invasive procedures. *Acta Paediatr Supll, 431*, p.74.

[4] Vanni, J.M., & Katz, E.R. (1997). Stress, social support and negative affectivity in children with newly diagnosed cancer: a prospective transactional analysis. *Psycho-oncology, 6*, p. 272.

[5] Sartain, S.A., Clarcke, C.L., & Heyman, R. (2000). Hearing the voices of children with chronic illness. *Journal of Advanced Nursing, 32* (4), p. 914.

[6] Midence, K. (1994). The effects of chronic illness on children and their families: an overview. *Genetic, social & general psychology monographs, 120* (3), pp. 311-312.

[7] Samuelsson, M., Thernlund, G., & Ringström, J. (1996). Using the five field map to describe the social network of children: a methodological study. *International Journal of behavioral development, 19* (2), p. 328.

[8] Vanni, J.M., & Katz, E.R. (1997). Stress, social support and negative affectivity in children with newly diagnosed cancer: a prospective transactional analysis. *Psycho-oncology, 6*, pp. 268-275.

[9] Caldwell, T.H., & Sirvis, B. (1991). Students with special health conditions. *Preventing school failure, 35* (3), p. 15.

[10] Department for Education and Skills. (2001). *Access to education for children and young people with medical needs.* [brochure], p. 6.

[11] Fels, D., Shrimpton, B., & Robertson, M. (2004). Connecting schools with hospitalized children and youth. Journal of Research on Technology of Education, 37, p. 22.

[12] Committee on School Health. (2000). Home, hospital and other non-school-based instruction for children and adolescents who are medically unable to attend school. *Pediatrics, 106* (5), p. 1154.

[13] Bessell, A.G. (2001). Children surviving cancer: psychological adjustment, quality of life and school experiences. *Exceptional Children, 67* (3), p. 345.

[14] Fels, D., Shrimpton, B., & Robertson, M. (2003). *Kids in hospital, kids in school*. Paper presented on World Conference on Educational Multimedia, Hypermedia and Telecommunications. (EDMEDIA). Honolulu, Hawaï, USA.

[15] Hill, S., Hill, A., & Hampton, D. (2004). Videoconferencing in a hospital school: removing barriers. *Journal of Audiovisual Media in Medicine, 27* (2), p.60.

[16] Fels, D., Shrimpton, B., & Robertson, M. (2004). Connecting schools with hospitalized children and youth. Journal of Research on Technology of Education, 37, pp.1-26.

[17] Department for Education and Skills. (2001). *Access to education for children and young people with medical needs*. [brochure], pp. 21-39.

[18] Van Rompaey, V., Hemmeryckx-Deleersnijder, B., Van Der Meerssche, B., De Mondt, H. & Godon, M. (2005). Beyond Marketing. Applying qualitative user experience research techniques on social media applications. The Journal of The Communications Network, 4 (3): 26-30.

[19] Samuelsson, M., Thernlund, G., & Ringström, J. (1996). Using the five field map to describe the social network of children: a methodological study. *International Journal of behavioral development, 19* (2), pp. 327-345.

[20] Sartain, S.A., Clarcke, C.L., & Heyman, R. (2000). Hearing the voices of children with chronic illness. *Journal of Advanced Nursing, 32* (4), pp. 913-921.

[21] Rae, W.A. (1991). Analyzing drawings of children who are physically ill and hospitalized using the ipsative method. *CHC, 20* (4), pp. 198-207.