

# Using educational technology to advance the practice of preparing children and families for hospitalisation

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## **Abstract**

*It is widely acknowledged that hospitalisation can be a stressful experience for children and their families. There is strong evidence in the literature that the utilisation of well-designed preparation programs can assist children to overcome their fear of hospitalisation and increase their ability to cope with medical procedures. A range of preparation programs have been described in the literature as have barriers to implementation including cost, access and flexibility. It is also important that the content presented is appropriate for the children undertaking the preparation in order to promote understanding. It is imperative that current and future research continues to focus on reducing children's fear of hospitalisation and draws upon previous knowledge to produce effective modes of preparation. The aim of this paper is to discuss how the use of multimedia technology can maintain the momentum in the development of effective preparation programs for children undergoing elective surgery. This paper will provide an overview of the instructional design process for a multimedia preparation program and present data to demonstrate that the program developed is a cognitively appropriate and an acceptable form of preparation for children aged 7–11 years who are scheduled for elective surgery.*

## **Keywords**

*multimedia, children, preparation for hospital*

## **Introduction**

An important component of practice for clinicians working with children and families is to reduce anxiety and stress associated with hospitalisation and medical procedures. It is well documented in the literature that children perceive hospitalisation to be stressful (Hart & Bossert, 1994; Kain, Mayes, & Caramico, 1996; King & Ziegler, 1981; Vernon, Foley, Sipowicz, & Schulman, 1965). A range of resources and preparation programs has been developed to reduce the stress of hospitalisation for children undergoing elective surgery (Edwinson, Arnbjornsson, & Ekman, 1988; Robinson & Kobayashi, 1991; Uzark, Klos, Davis, & Rosenthal, 1982).

Evaluation of these preparation programs has highlighted issues that restrict implementation and efficacy. It is of paramount importance that program style and content is suitable for the cognitive developmental level of the target audience and that programs are cost efficient to conduct to enable sustainability. Flexibility in delivery is another desirable characteristic to ensure programs are readily accessible for families. The aim of this paper is to demonstrate how emerging technology can maintain the momentum in the development of effective hospital preparation programs for children undergoing elective surgery and families.

## A review of the literature

Significant changes to the way children are cared for in hospital have occurred over the past 40 years. No longer are visiting hours restricted and children's wards stark, sterile environments where children are expected to conform to routines and not allowed to play (Shields & Nixon, 1998). Families, now, are actively encouraged to participate in their child's care and there is a greater emphasis on the emotional care of children (Mitchell, Johnston, & Keppell, 2004; Shields & Nixon, 1998).

A number of researchers have endeavoured to determine the stressful aspects of hospitalisation for children (Barnes, Kenny, Call, & Reinhart, 1972; Hart & Bossert, 1994; King & Ziegler, 1981; LaMontagne, Hepworth, Byington, & Chang, 1997; Timmerman, 1983; Visintainer & Wolfer, 1975). Vernon and colleagues (1965) conducted an extensive review of the literature and determined the most stressful aspects of hospitalisation for children to be: unfamiliarity of the hospital setting, separation, interpersonal relationships during hospitalisation, sensory-motor restrictions and children's conceptions of hospitalisation. Despite continuing advances in the provision of emotional care for children in hospital, a decade later, Visintainer and Wolfer (1975), identified similar threats as well as the additional themes of fear of bodily harm, loss of control, the uncertainty about expected acceptable behaviour and the fear of the unknown. These themes have been predominantly formulated as a result of adults' perceptions and observations of children in hospital. Studies in the 1980's and 90's, however, have directly asked children to describe their fears relating to hospitalisation. The major themes reported were fear of separation from family, pain, fear of intrusive events such as injections and finger pricks and confinement to bed while recovering (Hart & Bossert, 1994; LaMontagne et al., 1997; Timmerman, 1983). Additionally, Hart and Bossert (1994) identified the fear of the doctor or nurse telling the child that something was wrong with them, as a major stressor. It can be seen that despite radical changes to the emotional care provided to children in hospital since the 1960's, children continue to report the existence of the same anxiety producing threats up for four decades later. It appears therefore, that despite the integration of numerous child-friendly initiatives and the provision of formal preparation programs to prepare children and families for hospitalisation, further research and development in this area is still required.

A number of important lessons can be learned from the body of literature evaluating the effectiveness of various preparation programs. Firstly, programs must provide information that is suitable for the cognitive developmental level of the participants. One of the most important determinants of how a child will react to hospitalisation relates to their understanding of the situation. A child's understanding, cognitive appraisal skills and behavioural responses to stress will be dependent upon their intellectual development and previous life experiences (Bar-Mor, 1997; Bibace & Walsh, 1980; Brewster, 1982; Perrin & Gerrity, 1981). Piaget (1969) identified four major stages in the development of logical thinking: sensorimotor; preoperational; concrete operations and formal operations. Piaget theorised that it is not until children reach the concrete operations stage at approximately 7–11 years of age that they begin to think in a logical and coherent manner and develop problem solving skills. Children's level of cognitive development, therefore, will have implications for how they interpret threatening encounters. Their understanding of the situation will determine if they can identify and employ the most appropriate coping strategies to address the situation. Previous life experiences will also assist children to determine if they possess coping strategies that they can utilise to adapt to and master situations. It is important to consider all these factors when designing preparation programs. A number of researchers have implemented and evaluated various types of programs with participants of a wide age range (Faust & Melamed, 1984; Meng, 1980; Peterson, Ridley-Johnson, Tracy, & Mullins, 1984; Schmidt, 1990; Uzark et al., 1982). It is not possible to provide content suitable for children ranging in age from 2–16 years as was intention of many of the programs evaluated in these studies. It is important to acknowledge that the effectiveness of preparation may not only depend on the method used to deliver the information but also the appropriateness of the information presented. The most effective programs include those which are designed for children of a specific cognitive developmental stage (Mitchell et al., 2004).

A second important lesson learnt from previous research is that the form of preparation must be cost-effective to implement and conduct. Programs that are time- and resource-intensive may not be viable in the long term (Whelan & Kirkby, 1995). A variety of preparation programs have been evaluated in the literature including hospital tours, medical play sessions, information and coping skills training sessions, stress point preparation and systematic desensitisation (Meng, 1980; Peterson et al., 1984; Peterson & Shigetomi, 1981; Schmidt, 1990; Uzark et al., 1982; Wolfer & Visintainer, 1979). While demonstrating varying degrees of effectiveness, these programs require a variety of resources to conduct, including clinicians' time. Few researchers have considered the cost of implementation as a barrier to the provision of effective preparation; however, it appears that multicomponent programs that include both information and coping skills training are the most effective programs (Mitchell et al., 2004).

Peterson and colleagues (1984) examined the cost-effectiveness of a multicomponent program for children undergoing day surgery. It was concluded that a comprehensive hospital-based program that included coping skills training was not the most cost-effective program. The program was administered to children the night before surgery thus restricting time to practice the use of coping techniques and potentially influencing the results. Cost effectiveness was also considered by Robinson and Kobayashi (1991) who sought to determine the educational effectiveness of learning via film. They studied the effect of a multicomponent program that incorporated coping skills training and was designed for use at home. The program was considered cost-efficient; however, the study failed to demonstrate effectiveness in reducing anxiety. It is possible therefore, that film is not the most effective method to prepare children for hospitalisation and provide coping skills training due to the limited interactivity and fixed pace of information. It is possible that a multimedia program may be a more effective means of providing interactive learning in the home environment as the child can work through the activities and information at their own pace and revisit the reinforcement activities as often as required (Mitchell et al., 2004). This approach, while cost effective, would also provide families with greater flexibility, with regards to time and environment, in which to undertake the training.

The effectiveness of multimedia education in paediatric health care is an exciting new area of study. Multimedia education has been developed to address the issue of preparation for hospitalisation of primary-school aged children by one group of researchers (Nelson & Allen, 1999). However, it cannot be determined if these researchers utilised an evidence based design approach. An evidence based multimedia preparation program has been developed in Australia to prepare 7–11 year old children undergoing elective surgery, and their families, for hospitalisation (Mitchell, Keppell, & Johnston, 2003). The program has utilised the best available clinical evidence and educational theory to underpin the design process. A major feature of this program is that it provides information and activities that are designed specifically for the cognitive developmental level of 7–11 year old children.

## Method

The purpose of this study was to develop an interactive CD-ROM, based on the best available evidence, to provide cognitively appropriate information to 7–11 year old children and their families about hospitalisation and teach them strategies for coping with anxiety while in hospital. A development-based research approach was utilised in the design of the interactive learning system as this approach emphasizes evaluation and reflection to refine and redesign the learning system. The study utilised a four phase design process: analysis, design, production and evaluation as described by Reeves and Hedberg (2003).

### Analysis

The aim of the analysis phase was to determine the goal of instructional design and the essential content to be included in the CD-ROM. Three processes were utilised to gain data to inform the content of the CD-ROM: an extensive review of the literature; parent questionnaires and patient interviews.

Two hundred questionnaires were sent to parents of children who had recently undergone surgery to identify key areas of concern. In addition, interviews of six children in hospital and their parents to gain more in depth data about the key issues of concern were also conducted. The data generated from the questionnaires and the interviews was utilised, in conjunction with the evidence from the literature, to inform the content and design of the multimedia program.

### Design

The design phase involved utilising the data gained from the analysis phase to inform the content of the multimedia program. Specifically, the major themes from the literature review, the interview and questionnaire data were utilised to formulate the macro and micro design of the learning system. The content was reviewed by clinical experts at a specialist children's hospital to ensure clarity and completeness.

The learning system titled "*Going to hospital: What will it be like?*" utilised a game style approach and took the form of a virtual tour of the hospital (see Figure 1). The user observed a child of a similar age experience the hospitalisation process for an elective surgical procedure. A concept map outlined the sequence of the learning modules while the micro design involved dividing the content into separate storyboards to facilitate communication between the instructional designer, graphic designer and principal investigator. Individual screen design and interface requirements were detailed by the principal investigator and discussed with the design team to determine viability. Adjustments to the interface structure to improve usability were completed prior to creation of the software. Separate scenes, consisting of a group of storyboards addressing a distinct theme were reviewed prior to production. Issues and ideas arising from the review then informed the design of future scenes. Ongoing evaluation, therefore, was an integral component of the design process.



Figure 1: 'Going to hospital' CD-ROM title screen

### Production

The interactive learning system was produced by a team of graphic designers and utilised a constructivist approach to learning as the major educational theory underpinning the design. The major aim of the project was to provide the child with an authentic learning environment that simulated the hospitalisation experience. Authentic activity, according to Brown, Collins and Duguid (1989), allows the learner to act meaningfully while providing a learning experience that is similar to that of real life. It was anticipated that the process of providing meaningful learning through authentic activities would promote the transfer of knowledge to real life situations. The design of the learning system was based on the nine critical characteristics of situated learning for instructional design as outlined by Herrington and Oliver (1995).

The CD-ROM utilised a game style approach to provide information and coping skills training. The text described the experience of a child admitted to hospital for elective surgery. The module took the form of a virtual tour of a large specialist children's hospital and incorporated key components of effective preparation previously determined by the literature. The module provided information about stressful aspects of hospitalisation and explained the process in cognitively appropriate language. It has been asserted by a number of researchers that it is important that children have an understanding of situations that they may experience in hospital in order to promote coping (Ellerton, Ritchie, & Caty, 1994; LaMontagne, 2000; Peterson, 1989; Peterson & Toler, 1986). It is also vital that information is presented in a manner which suits the cognitive developmental level of the users (Mitchell et al., 2004). Specific techniques to promote coping were also taught within the game environment (see Figure 2). Peterson and Shigetomi (1981) and Campbell and colleagues (1995) have both provided strong evidence that the addition of coping skills training is an important component of an effective preparation program.



Figure 2: Screen depicting the calm breathing coping strategy

In addition to information, a range of activities was provided within the context of the game to reinforce and apply knowledge gained. In preparing the child for hospitalisation by reducing their anxiety and increasing their knowledge about the process, it is also vital to address the information needs of the parents. It has been demonstrated in the literature that reducing parental anxiety regarding the hospitalisation process has positive effects on reducing child anxiety (Jay & Elliott, 1990; Melnyk & Feinstein, 2001; Peterson & Shigetomi, 1981; Vulcan & Nikulich-Barrett, 1988). For this reason, information specifically for parents regarding the hospitalisation process was included in the program.

The visual interface utilised animated characters, colourful graphics and interesting type font and navigational buttons designed to appeal to users of the target age range. It was important that the schema and functionality appealed to the users. A monkey, named Zoobi, was utilised to act as the 'help' character as animals were considered to be appealing to both genders (Figure 3).

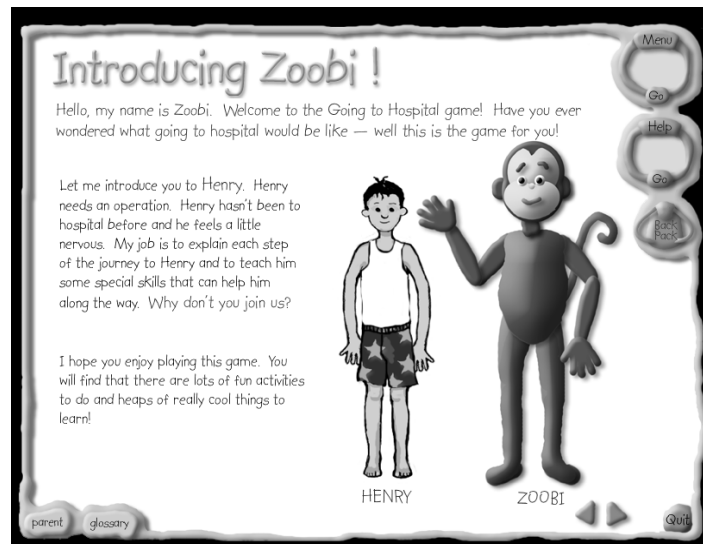


Figure 3: Screen depicting the 'help' character Zoobi

Audio sounds were utilised to provide verbalisation of key terms and deliver positive reinforcement upon completion of set tasks. An accompanying activity book was also produced to assist with reinforcement of information while in the hospital environment. Information in the CD-ROM and activity book was provided in short sentences to enhance readability. Rollovers and pop up boxes were design techniques incorporated to reduce the amount of visible text. The written content needed to be suitable for the range of literacy levels that could be anticipated in the target age group. The readability of the text was tested with the Flesch-Kincaid Grade Level Score, which produced a score based on the average number of syllables per word and words per sentence and rates text based on a US school grade system (Flesch, 1974). The text specific for children within the CD-ROM scored 4.8 and therefore was determined suitable for the age range of the user group. The text specific for parents was also analysed and was rated at a grade level of 8.4, which was also considered satisfactory for adults with a range of literacy levels. Doak et al. (1996) suggest that materials which have a readability score of seventh–ninth grade level should be readable by most adults.

### **Evaluation**

A formative evaluation was conducted to systematically determine the appropriateness of the content and design for the target audience and collect information about the usability of the product. The product was prospectively pilot tested with children aged 7–11 years who were undergoing elective surgery, and their families. Data about user friendliness, interactivity and the ability to engage in the process was evaluated via questionnaires and interviews. One hundred and fifty-eight CD-ROM packages and questionnaires were sent to parents of 158 children between the ages of 7–11 years who were scheduled for elective surgery. Five children, whose parents indicated on a detachable component of the questionnaire that their child would like to discuss their thoughts about the CD-ROM with a researcher, were interviewed while in hospital. The data generated from the evaluation process was utilised to inform modifications to the product to enhance usability and improve the design.

## Results

The results of the evaluation phase of this study will be presented in this paper. The questionnaire administered was designed to elicit feedback about the CD-ROM from parents and children. Most questions utilised a Likert scale with the rating scale 'not really,' 'sometimes,' and 'all of the time' utilised for the child's questions. Open-ended questions were also utilised to gain additional data about the users' feelings about the game. Of the 158 packages that were sent to children scheduled for surgery, 22 completed questionnaires were returned resulting in a response rate of 14%. Additional data was also gained from the interviews of 5 children and their parents currently in hospital.

The questionnaire was designed to evaluate the instructional and conceptual design for orienting of information, flow and sequence, interactivity, navigation and orientation, learning objectives and outcomes. However, the results of this phase of the study that pertain only to structure, content and interactivity will be presented in this paper.

Most children (91%) indicated, via the questionnaire, that it was generally clear what the game required the user to do. This finding was also supported by data generated from the child and parent interviews:

Interviewer Was the aim of the CD clear? Did you know why you were playing it?  
 Mohammed Yes, to make sure that you wouldn't get scared when you go to hospital.  
 Interviewer Could you understand the story?  
 Mohammed Yes, I could read it.

(Interview with Mohammed, aged 8 years, following general surgery)

Most children (81%) indicated that the information was clear 'all of the time,' and did not believe that there was too much information on screens (62%) or that more information was required (67%). The majority of the children (76%) felt that the story flowed well throughout the game and that overall, the information was well explained 'all of the time.' This data was also supported by data gained from the interviews:

Interviewer What about the amount of information in the CD, was it enough, too much or too little?  
 Mohammed It was middle. Just right.

(Interview with Mohammed, aged 8 years, and his parents, following general surgery)

The children were asked to evaluate the level of interactivity the game provided. The majority of children (91%) believed that the game provided good feedback about their performance 'most of the time.' The game's activities were liked 'all of the time' by 62% of children. Again, this finding was supported by interview data:

Interviewer What did you think of the activities?  
 Carina They were good  
 Interviewer Did the 'pack your bag' activity help you to know what to pack?  
 Carina Yes. I printed out the list of stuff to bring to hospital.  
 Father It certainly did because Carina had her bag well and truly packed, well before we came down.  
 Interviewer What was your favourite activity?  
 Carina Calm Breathing  
 Father Yeah, she played all the activities.

(Interview with Carina, aged 9 years, and her parents, following orthopaedic surgery)

The activities appeared well suited to the cognitive developmental level of the user group as only two children surveyed indicated that some of the activities were a challenge 'all of the time.' The participants interviewed generally stated that the level of information was appropriate:

Interviewer Were the activities challenging enough for you? Were they hard enough? Or too easy?  
 Jayne Some were hard and some were easy...a good mix.

(Interview with Jayne, aged 9 years, and her parents, following orthopaedic surgery)

A number of questions determined the utility of the navigation system. Most children surveyed (71%) found it easy to navigate their way around the game and the buttons were easy to use 'all of the time.' Children interviewed to determine their thoughts about the CD supported this finding:

Interviewer Did you use the site map at all to go back to places? Can you remember the site map – it was like a big obstacle course?  
 Carina Yes, it was good.  
 Father Yes, it was, cause if you wanted to go back to an activity that you wanted to go to and play, you go straight back and then pick out which one you want to go play on.

(Interview with Carina, aged 9 years, and her parents, following orthopaedic surgery)

Children were asked to provide their opinion about the on-screen graphics. Most children surveyed liked the colours used and the majority of children indicated that the drawings and photographs assisted their understanding of the information presented. The drawings and photographs were determined to be mostly clear by all children and interesting by 20 out of the 21 respondents. During interview, both genders stated that they liked the look of the game. The 'help' character, a monkey named Zoobi, also appeared to be well liked by the users as demonstrated by the interview data:

- Interviewer Did you like the look of the game?  
 Mohammed Yep, it was pretty cool.  
 (Interview with Mohammed, aged 8 years, and his parents, following general surgery)
- Interviewer What was the help character, Zoobi, like?  
 Su-Lin He is sort of happy in the game. He did some funny things...He taught me a lot of stuff...He's cute!  
 (Interview with Su-Lin, aged 8 years, and her parents, following plastic surgery)

Children were also asked to indicate their feelings about the game in general. All children surveyed found the game easy to use. All but one child like the game and found it to be interesting. Open-ended question data from the questionnaires support this finding:

"The best thing about the game was the information and pictures were interesting and helped me understand what hospital was about"

Most children surveyed (71%) found the game to be enjoyable 'all of the time' and all children indicated that the game helped them to understand what going to hospital would be like. This finding was also supported by the open-ended question data:

"I thought it was really fun, interesting and a good learning game. Good job!"  
 "It was a great idea and I really loved it. I've played it 15 times."

Data gained from the interviews also supported this finding:

- Interviewer What was the best thing about the game?  
 Jayne It didn't make me scared of hospital, so many things that I would have been scared of...especially blood tests.  
 (Interview with Jayne, aged 9 years, and her parents, following orthopaedic surgery)
- Interviewer What was the best thing about the game?  
 Su-Lin That it was easy to understand...It's a fun game to play.  
 (Interview with Su-Lin, aged 8 years, and her parents, following plastic surgery)

Parents surveyed also praised the concept and design and demonstrated their appreciation of the opportunity to utilise the CD package:

"Very user friendly and not time-consuming. It was a fun and enjoyable way for 'X' to learn constructively about hospital. It prepared 'X' for his hospital stay, that is, taught him relaxation skills and taught him about different types of people that he will come across."

Parents who participated in the interviews also supported these findings:

- Mother I thought it was good, very clear, very easy to use. I actually went though it beforehand just to make sure it was ok for Mohammed. I sat with him for a minute or two and then left him to it. His reading ability is very good so I knew that he'd understand most of it. Yes and that's the thing about multimedia, you can do it at your own pace.  
 (Interview with Mohammed, aged 8 years, and his parents, following general surgery)

## Conclusion

In conclusion, it is important to prepare children and their families for the hospitalisation experience. It is crucial in order to promote understanding and increase coping that the information is presented in a cognitively appropriate manner. Clinicians and researchers working with children and families in the health care setting need to utilise the knowledge gained from previous research to design effective hospital preparation programs. A number of essential components of highly effective programs have been identified in the literature. Barriers to the utilisation of effective programs have also been identified including cost, access and flexibility. It is acknowledged that hospital preparation programs are not well attended in Australia by children and their families. A multimedia form of preparation has the potential to be a highly utilised and effective form of preparation. An opportunity exists to use technology to advance the practice of preparing children and families for hospitalisation and maintain the momentum generated by previous research.

In light of this, researchers in Australia have taken up the challenge to produce an evidence-based multimedia hospital preparation program for 7–11 year old children and their families. The multimedia program “*Going to hospital: What will it be like?*” utilises best practice principles to assist children and families to cope with the stress of hospitalisation. It can be seen from the evaluation data presented in this paper that the multimedia program is a cognitively appropriate and enjoyable form of preparation for families. The Instructional Systems Design model described in this paper asserts that the process involves continuous evaluation to improve the product. As a result, the pilot program is currently undergoing review prior to further development. The next phase in the process will involve summative evaluation to determine effectiveness and impact.

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