A preliminary investigation into the use of multimedia to enhance dietetic management of overweight and obese children: multimedia design for child–dietitian consultations

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Summary

This research focuses on an ever-increasing problem within the UK – that of childhood overweight and obesity. Overweight primary school children, especially those in the 7–11 years age category, find it difficult to discuss issues that concern their weight. Interactive computer-based images, sound and text (or multimedia) may be an effective communication aid for this population group. It could also help the dietitian to explain beneficial changes to food choices and eating habits. Interest in educational software has led to a number of multimedia programs aimed at helping children with health problems. Research suggests that these computer programs can improve health but are not utilised in clinic settings. One explanation for this lack of use is that they have not been designed for this purpose. The aim of this study is to construct a technology framework for the development of interactive multimedia technology that can be used within dietetic consultations with children. A multimedia software prototype was developed using the framework. Children and dietitians tested the developed prototype and provided feedback, thereby evaluating the validity of the model. Further research is needed to determine whether software developed using this framework, or approach, does enhance dietary management of overweight children.

Keywords: children, communication, dietary treatment, multimedia, overweight

Study background and motivation

Data from several studies indicate that overweight and obesity among primary and pre-school children has doubled in the last decade (National Audit Office 2001; Summerbell *et al.* 2002). As a result, dietitians are now seeing more children referred for weight control advice.

Dietary treatment often involves one or more consultations with a dietitian.

There are certain limitations to these child–dietitian consultations. Firstly, the nutrition messages may be beyond the cognitive ability of the child (Hart *et al.* 2002). Secondly, visiting a clinician at a clinic or health centre can be daunting, for adults and children. General discomfort can make it more difficult to communicate effectively (Petrie 1989), hampering the usefulness of such a consultation and the dietary treatment discussed there. Away from these consultations in everyday life, pre-adolescent children are afforded greater responsibility over their own diets (Office for National Statistics 2000) but lack the ability to make healthy food choices (Hart *et al.* 2002). Improvements in the way messages are conveyed to children, particularly within the consultation environment, are needed.

Interactive multimedia, which involves conveying ideas using computer-based images, sound and text, can be an effective communication tool in certain environments. It could be used as a tool for communicating messages about healthy eating to children, assisting the dietitian in explaining dietary improvements and involving the child more in lifestyle changes. Engaging and involving children is crucial to successful dietary treatment (Kolasa & Miller 1996), and technology may facilitate this process.

Use of multimedia software to help children with health problems is not a new concept. Research suggests that such software can increase knowledge (Redsell *et al.* 1998) and may improve health (Lieberman 2001). However successful these applications are within the research environment, they are not used in child–dietitian consultations. One possible explanation is that available technology-based tools fail to address the communication needs of both child and dietitian.

Aim

This study aims to develop a guide to multimedia design with the potential to complement and enhance dietetic consultations with overweight and obese children. It is a preliminary investigation, limited to children referred to the Community Nutrition and Dietetic Service in South Staffordshire. The research focuses on producing multimedia that encourages child–dietitian interaction but does not address the content of what is communicated.

Ethical approval was obtained from the Shropshire and Staffordshire Strategic Health Authority and the study was conducted between June and September 2003.

Subjects

Children and dietitians, were involved in this research.

Children

Subjects were selected from the paediatric patient caseloads between 2001 and 2003 of two community dietitians. Children aged 7–11 years, at the time of their dietetic treatment and the research, were considered. Of these, children referred for simple overweight or obesity were invited to participate. Information letters and a reply slip were sent to their parents. Four girls and two boys were recruited to the first, or analysis, stage of the study in this way. A profile of the study sample is shown in Table 1. Individual differences illustrate treatment diversity between dietetic cases. Children involved in stage 1 and who were willing and available at the time of the design testing stage became subjects for the second phase of the research. There were two such children (Table 2).

Table I Dietetic treatment details of the user group

Gender	Age	Number of dietetic visits	Number of dietitians* involved	Previous consultation	Patient status
Boy	8 years 11 months	10	2 (9 + 1)†	<1 month	Ongoing‡
Boy	9 years	2	1	<1 month	Ongoing
Girl	6 years 10 months	1	1	3 months	Discharged§
Girl	8 years 7 months	1	1	3 months	Discharged
Girl	7 years 3 months	1	1	1 year 6 months	Ongoing
Girl	8 years 3 months	1	1	1 year 2 months	Discharged

*Dietitians who have treated the child. †This child has seen the same dietitian nine times and another dietitian once. ‡Ongoing here means that s/he is still being treated and a further appointment is planned. §A discharged patient has no further dietetic treatment or follow-up.

Table 2 Child-user profiles for usability testing

Categories	User 1	User 2
Gender	Girl	Boy
Age*	8 years 4 months	9 years
Home computer available	yes	yes
Frequency of computer gaming	Once per month	Once per week
No. of dietitians involved	1	2 (10 visits with one dietitian)
No. of dietetic visits	1	11
Time since last consultation*	1 year 4 months	1 month
Patient status	Discharged	Ongoing

*Age and time was calculated at each interview and rounded down to the nearest whole month.

Dietitians

The two paediatric dietitians who regularly treat the recruited child-subjects tested the software design.

Method

This descriptive study was divided into three stages. Below is a brief overview of the methods and techniques used at each stage.

Analysis of opportunities for using multimedia to enhance child–dietitian consultations

Parents (and children) were given the choice of meeting the researcher-dietitian at their local community health centre or in their own home. All but one opted to meet at home. Semistructured interviews with children investigated how multimedia could support face-to-face communication. More specifically, the sessions captured the child's perspective on their meeting(s) with the dietitian and how they felt communication could be improved. It has already been stated that children can find the expression of ideas and opinions difficult. The first part of the interview therefore consisted of questions requiring 'yes/no' responses. Parents provided further insight into answers as required.

On completion of the interview questions, a laptop computer with a sound card and external mouse was placed in front of the child. Multimedia software (South-western Staffordshire PCT & Showme Multimedia 2003), which aims to promote healthier lifestyles amongst 7–11 years olds, was viewed. The researcher cultivated conversation typical of a dietetic consultation, guiding the child's navigation through the various sections of the software. Verbal and non-verbal signs of communication were noted, according to categories outlined by Davies (no date) – these categories are selected for their contribution to determining the strengths, weaknesses, opportunities and barriers to interaction provided by the multimedia.

Multimedia design to enhance child–dietitian communication

The design was developed iteratively with a prototyping technique. In other words, it started out as a paper-based diagram showing the sequence of all the screens and navigation between them. A general outline of each screen was planned on a storyboard. The design took shape when detail was added through individual screen sketches.

A dietitian tested the suitability of the design at each of these so-called low-fidelity stages. Testing highlighted problems with screen layout, navigation and general usability. Comments and suggestions were used to redesign the prototype, improving it iteratively before the paper version was translated into software.

The high-fidelity prototype or multimedia version was refined in much the same way as the paper-based prototype, until it was deemed ready for testing with children.

Design testing with child- and dietitian-users

Shorter, semistructured interviews with two children and two dietitians were used to test the design. Children and parents again chose to meet in their own homes. Dietitians were interviewed in an office environment. Characteristics of these sessions are contrasted with initial interviews in Table 3.

The results outline the outcomes of these three stages (already described).

Results

Analysis of opportunities for using multimedia to enhance child–dietitian consultations

Interviews with children using an existing piece of software demonstrated the need for design to follow the general format of a consultation, thereby giving the dietitian control over the conversation and the child's navigation through the software. There were times when conversation moved into a subject area not supported by the program. This is a consequence of the original software used not having been designed for face-to-face child–dietitian communication. It therefore failed to

Table 3 Comparison of the characteristics of the semistructured sessions involving child-users

Category	User-involvement during initial analysis	User-involvement during design testing
Software used	Professionally developed multimedia	Researcher-developed multimedia
Aims	1. To understand potential problems child-patients have when communicating with a dietitian 2. To identify the potential of multimedia to support child–dietitian communication 3. To highlight any particular design requirements for this purpose	1. To measure the potential of the multimedia prototype to support child–dietitian communication 2. To measure the suitability of the design for this purpose 3. To measure the degree to which the design meets design specification, and usability goals in particular
Structure	Questions followed by observation	Observation followed by questions
Observations	The same observation categories were used for both sessions. In addition: • Attention paid to design usability, media success and failure	• Focus on ease of use, navigability, error prevention and error handling
Questions	• IT facilities available at home • Familiarity with computers and multimedia software • Attitude toward educational, as opposed to entertainment, multimedia games • Ability to communicate with a dietitian and level of engagement within a consultation	• User satisfaction – like, dislike, enjoyment, frustration and understanding of the prototype • Time taken to complete the task
Time taken	30–45 min	15 min

meet the communication needs of either the child or the dietitian or both.

Text-based instructions and screen feedback distracted from face-to-face communication and posed a reading challenge for some children. Voice-overs also hampered dialogue. If multimedia is to provide an opportunity to enhance consultations with children, it needs to encourage conversation rather than stifle it.

Multimedia design to enhance child–dietitian communication

The design took the form of a multimedia food diary. Food diaries are usually completed on paper by parents on behalf of the child. Records of what children eat can also be made within a consultation. The software design supported communication in the following way:

• The dietitian helped the child navigate through the screens and uncover relevant and accurate information about dietary intake.
• Images normally associated with each meal were shown. This involved the young person more in their treatment because they:
  – reminded the child of foods that may be eaten with each meal; and
  – provided a concrete basis for the conversation. The dietitian could base questions on images in order to find out more about the type of food the child normally chooses.

Design testing with child- and dietitian-users

Whilst the final design was by no means perfect, the children's ability to communicate appeared to improve. They initiated a significant amount of dialogue and were able to answer specific questions about food choices, quantities of foods and frequency of foods consumed (an improvement on the level of interaction during stage 1, using the developed software). Other specific screen design and navigation features were tested, the results of which are beyond the scope of this paper.

The dietitians also found the layout logical and easy to use. Both dietitians took less than 4 min to learn the design of the multimedia tool – implying that the design simulated, to some degree, their thought processes. They also thought it would prove useful in a consultation setting. Again, the specifics of these results are beyond the scope of this paper.

Lessons learned from these stages were structured into a framework that can be used when developing future multimedia aids to enhance child–dietitian communication.

Framework overview

The framework consists of three key stages, illustrated in Figures 1 and 2: design specification, development and testing. There is no definitive end point to each phase and one stage of design development is not necessarily completed before moving on to the next. The guide also emphasises iteration, returning to and
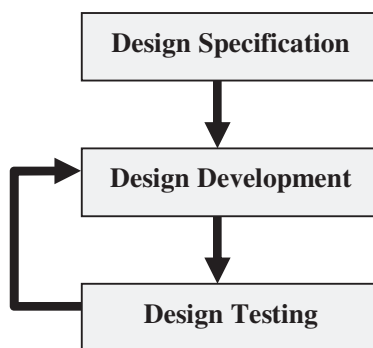
Figure 1 Framework overview.

enhancing previous design elements as required. Each of the three stages has been expanded upon below.

Overview of design specification

The design specification outlines the design scope and finds answers to the questions:

- What should the software do? – Task requirements
- Who will use it? – User/s profile
- Where will it be used? – Context of use
- Which media will it use? – Media selection
- How will it be used? – User goals

The next phase deals with implementation of the design specification in developing the design itself.

Overview of design development

Knowing the design requirements is the starting point for design development. The design usually begins with low-fidelity prototyping, followed by evaluation and prototype improvement. The design should be translated into high-fidelity technology when the low-fidelity techniques (like paper) are no longer useful. Even though more technically advanced, the prototype continues to develop iteratively – evaluation followed by improvement. A point is eventually reached when the prototype is ready for testing with end-users (children and dietitians).

Overview of design testing

Experts and representative users should test the design. Experts can be 'expert testers' who are external to the project, however, 'experts' usually know the software well. They can identify a number of problems before users, in this case children and dietitians, are involved, which saves time.
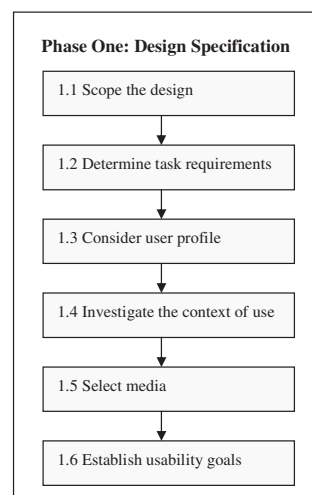

Figure 2 Overview of the framework phases.

Experts may identify a number of design flaws but users are essential if the software is to be tested properly. Design testing with users determines the degree to which the design specification is met, and invariably leads to further design improvements.

Discussion

There were a number of limitations to this preliminary investigation, and the first was the interview settings. There is some value in a child being interviewed in a familiar home setting, but more clinical settings may have highlighted different issues.

Secondly, the presence of another researcher to observe interaction with multimedia, or using recording devices (video or audio) may have yielded greater insight into children's responses. In addition, feedback from

more children and dietitians on the design itself would have produced more comprehensive results.

Every effort was made to remain objective. However, subjectivity may have crept in due to the all-encompassing role of the researcher. The researcher was the investigator, observer, designer and developer.

Further research should evaluate whether developing multimedia using this framework does indeed enhance dietetic management of overweight and obese children. This would provide a definitive answer as to the efficacy of the framework itself.

Conclusion

One of the most important skills of any human being is the ability to communicate. If dietetic treatment of young overweight children is to improve (and confirmed in these children gaining control over their weight), communication between child-patients and dietitians needs to be addressed. This research confirms that involving children and dietitians in multimedia development produces multimedia with the potential to enhance dietetic treatment.

Robinson *et al*. (1998) raised the point that 'inaccurate or inappropriate health information and/or poorly designed applications can result in harmful outcomes, such as inappropriate treatment . . .' (1998, p. 1265). The framework provides user-centred guidance to multimedia resources designed for child–dietitian communication. Usable applications, which meet the needs of children and dietitians, are more likely to be incorporated into the clinical setting and used in consultations.

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