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Digital Mental Health Resources for Children and Youth - Evaluation of Strengths in User Interface Design

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Abstract: The aim of this research is to explore the positive user interface (UI) design of digital mental health resources for children and youth. For this purpose, a heuristic model is introduced and heuristic evaluation is used as a method to systematically assess 49 digital mental health resources. In the assessment, the resources are evaluated by observing the prevalence of UI design strengths defined in the heuristic model. The results of the study indicate that the resources analyzed have strengths especially in the dimensions of visual design, content, reliability, engagement and functional design. Furthermore, all of the resources have at least four design strengths, creating a good basis for increasing positive design. However, further research is needed to establish how to incorporate positive design into digital mental health resources designed for children and youth.

Introduction

In today's world, children and youth spend an increasing amount of time in digital environments. Digital environments provide a channel through which children and youth are likely to be reached, since different obstacles such as acceptance of technology do not restrict this age group in a similar manner to other generations (Baños, Etchemendy, Mira, Riva, Gaggioli & Botella, 2017). In fact, with easy access to information technology (IT) and an environment that supports IT use, youth growing up with these technologies have a chance to benefit from the technological development in the best way possible (Shneiderman & Plaisant, 2005). In terms of health behavior, it has been established that models formed in youth may have a noteworthy effect on the formation of lifelong wellbeing (McDaid, 2016). Since children and youth can be reached through digital environments and childhood is crucial for future wellbeing, close attention should be paid towards inspecting the connections between IT use and health promotion.

There is recent research evidence supporting the notion that digital interventions promoting mental health can be effective among children and youth (e.g. Huen et al., 2016; Li, Chau, Wong, Lai & Yip, 2013). However, health research has traditionally focused on the prevention and intervention of problems instead of wellbeing promotion (Huebner, Gilman & Furlong, 2009). In the area of mental wellbeing, controlled studies with long-term follow-ups are still lacking (Baños et al., 2017). Additionally, despite the fact that studies exist on the effectiveness

of digital mental health resources, clinically trialed and validated interventions are not the only resources that are available through the Internet. A recent study indicates that there is a lack of research evidence to support the effectiveness of applications intended to instil the education of mental health for children and youth (Grist, Porter & Stallard, 2017). Thus, it is important for children and young people to build their competence in different domains such as critical literacy (e.g. Shor, 1999) to be better able to differentiate between trustworthy and questionable sources of information. At the same time, it should be made sure that valid resources are easily approachable by the intended target groups (see e.g. Edgerton et al., 2016).

Towards Positive UI Design Framework

When digital mental health resources are designed, one of the key aspects for success is the careful execution of the UI design. The central idea behind this thinking has been aptly summarized by Baumel and Muench (2016):

“-- a product can be usable without exhibiting any therapeutic potential, but it cannot have therapeutic potential without being usable.” (p. 3)

The researchers created heuristics for electronic health interventions relating to the therapeutic process perspective. The different domains identified in the study include usability, aesthetics, safety, content, engagement, persuasive design, research evidence and the application owner’s credibility. Of particular interest is to design electronic health interventions in a way that serves the needs of the target group but does not compromise user privacy or the desired outcome of the intervention (Baumel & Muench, 2016). Similarly, the properties of digital resources designed for children and youth have been studied in the past (see e.g. Hourcade, 2008; Livingstone, 2007; Martens, 2012; Masood & Thigambaram, 2015; Naidu, 2008; Shneiderman & Plaisant, 2005). For example, Masood and Thigambaram (2015) have identified four components and relating guidelines for child UI design. The identified components include navigation, presentation, content and interaction. One key observation made by the researchers is that mobile applications tend to follow adult mental models. However, child mental models should be followed when designing resources for children (Masood & Thigambaram, 2015).

In the past, research targeting children and youth has concentrated on their competences in using digital devices (see e.g. Chang, Tsai, Chang & Chang, 2014; Shneiderman & Plaisant, 2005), as well as the effectiveness of digital mental health resources and interventions (see e.g. Baños et al., 2017; Manicavasagar et al., 2014). However, little attention has been placed on the design qualities of these resources. It is well known that children and youth are heavy users of digital resources featured on websites (Duggan & Brenner, 2013) and mobile games (Kinnunen, Linja & Mäyrä, 2018). However, it has been noticed that existing digital mental health resources might not meet the expectations of youth (Wetterlin, Neilson, Werker & Krausz, 2014). Thus, there might be a gap between what children and youth are used to and expect from digital resources and how the educational resources are currently being designed. This creates a need to re-evaluate the design process itself.

Traditionally, the design of information and organizations has been problem-centric (Avital, Boland & Lyytinen, 2009), which is common for technical domains (Carroll, Rosson, Farooq & Xiao, 2009). In the field of information systems (IS), for example, there seems to be a tendency to highlight issues and failures (Grover, Straub & Galluch, 2009). Following this tradition, the evaluation of UIs has long concentrated on finding the flaws in design (see e.g. Madan & Dubey, 2012; Nielsen, 1994). However, this seems to be a prominent way of approaching design. One could ask, do design processes have to focus on problems to function?

Once the focus of UI design starts to shift from problems to opportunities, we begin to approach the field of positive design. According to Desmet and Pohlmeier (2013), positive design refers to a design process that aims to increase the subjective wellbeing of humans. In this sense, positive design is intertwined with positive psychology, which can be defined as the study of human flourishing or optimal functioning (Seligman & Csikszentmihalyi, 2000). Thus, positive design is not only a design method, but a different way of observing the design process itself.

One example of positive design thinking, appreciative inquiry, aims to change and develop organizations by replacing the traditional problem-solving mindset with finding the positives of a system (Asif & Klein, 2009). Appreciative inquiry can be seen as a part of positive scholarship, which is a term used to characterize research focusing on positive states, outcomes and generative mechanisms (Roberts, 2006). Accordingly, design principle research is closely linked to positive scholarship since it targets the same goals (Zhang, 2007). However, since design principle research has traditionally been problem-centric, the connection to positive scholarship is not entirely visible. Thus, employing similar positive design thinking that is present in appreciative inquiry to design principle research could potentially strengthen the link to positive scholarship and help shift the research focus from problems to opportunities.

A Framework for Designing Digital Mental Health Websites and Applications for Children and Youth

In order to outline the design of digital mental health resources for children and youth from UI design point of view, A Framework for Designing Digital Mental Health Websites and Applications for Children and Youth (Mehtälä, 2018) was created. The framework is based on digital mental health and UI design literature, and it comprises eight heuristic dimensions with relating heuristics for children and youth. The primary purpose of the framework is to combine the basic dimensions of UI design, such as visual and functional design, with dimensions that are especially relevant for children and youth in the context of mental health. By doing this, it is possible to consider the topic more comprehensively. The heuristic dimensions of the design framework, as well as the underlying literature, are presented in Table 1.

Heuristic Dimension	Objective	References
Visual Design	Ensure that the visual design of the resource is appropriate for its purpose	Baumel & Muench, 2016; Masood & Thigambaram, 2015; Shneiderman & Plaisant, 2005; Livingstone, 2007; Martens, 2012; Hourcade, 2008; Naidu, 2005; Chang et al., 2014; Baños et al., 2017
Content	Ensure that the content of the resource is appropriate for its purpose	Baños et al., 2017; Rasmussen-Pennington et al., 2013; Baumel & Muench, 2016; Shneiderman & Plaisant, 2005; Martens, 2012; Masood & Thigambaram, 2015
Functional Design	Ensure that the functionality of the resource is appropriate for its purpose	Kenny et al., 2016; Baumel & Muench, 2016; Shneiderman & Plaisant, 2005; Masood & Thigambaram, 2015; Hansen et al., 2003
Social Interaction	Acknowledge the role of social support and social networks	Mäntymäki et al., 2014; Kenny et al., 2016; Drost et al., 2017; Wetterlin et al., 2014; Rasmussen-Pennington et al., 2013; Fok & Wong, 2002
Engagement	Ensure that the design of the resource promotes engagement	Dondlinger, 2007; Amory et al., 1999; Naidu, 2005; Masood & Thigambaram, 2015; Hourcade, 2008; Huen et al., 2016; Kenny et al., 2016; Rasmussen-Pennington et al., 2013; Baumel & Muench, 2016
Co-Design	Ensure that co-design is utilized in the resource development process	Kenny et al., 2016; Kayser et al., 2015; King et al., 2015
Reliability	Verify the reliability of the resource and its contents	Grist et al., 2017; Baumel & Muench, 2016; Manicavasagar et al., 2014; Burckhardt et al., 2015
Information Privacy	Ensure that the system data is secured	Kenny et al., 2016; Wetterlin et al., 2014; Baumel & Muench, 2016

Table 1: A Framework for Designing Mental Health Websites and Applications for Children and Youth (adapted from Mehtälä, 2018)

In the study by Mehtälä (2018), the framework presented above was used to create design heuristics for evaluating digital mental health resources in terms of UI design. As a result, the essential components of the framework were carefully analyzed and divided into observable variables. However, in its current form, the heuristic model does not consider the area of positive design. In this study, the aim is to explore the positive UI design that is present in digital mental health resources designed for children and youth.

Research Design

The aim of the study was to evaluate the UI design quality of digital mental health resources from the view of designing for children and youth. The more specific research question was: *What strengths do resources for child and youth digital mental health education have in regards to positive design?*

Method: Heuristic Evaluation

This study attempts to characterize digital mental health resources for children and youth from the UI design perspective. Since the aim of the study relates to achieving a deeper understanding of the design strengths of existing digital mental health resources for children and youth, heuristic evaluation was chosen as a method for the evaluation process. In heuristic evaluation, an evaluator reviews the design of an interface by contrasting it to an existing set of design criteria (Shneiderman & Plaisant, 2005). This, in turn, increases the reliability of the study by diminishing the possibility for results that are evaluator dependent (see e.g. Carmines & Zeller, 1979). Motives for choosing heuristic evaluation as a method for the study include the fact that the method was not restricted by the design phase of the resources analyzed (Shneiderman & Plaisant, 2005). That being said, heuristic evaluation is appropriate for evaluations on design strengths, especially when the strength view is incorporated into the heuristics model used. Additionally, the high amount of resources analyzed (n=49) and the use of established heuristics in the evaluation process made heuristic evaluation seem like the most suitable option.

Design Heuristics

For the purposes of this study, the design heuristics proposed by Mehtälä (2018) were adjusted to create a heuristic model for evaluating design strengths of digital mental health resources for children and youth. Following the principles of positive design, the design heuristics were reformed to better reflect the strengths and possibilities that are present in the resources, disregarding the focus on flaws and limitations. For example, the original model included design heuristics focusing on the deficiencies on design consistency and problems with navigation, while the new model focuses on presence of consistent design and effortlessness of navigation. This, in turn, allows the focus to shift from design flaws and problems to design strengths, affecting the way in which the assessment process is seen. The adjusted model is presented in Table 2.

Heuristic Dimension	Design Heuristic(s)
Visual Design	Visual design is consistent Colorful pictures and animations are used
Content	Target group age range is defined and narrow enough Provided content is light
Functional Design	Navigation is effortless
Social Interaction	Ways for social interaction are provided Ways for social interaction experience are provided (e.g. interaction with content produced by other users)
Engagement	Narrative elements are used Gamification / game elements are used Interactivity between user and UI promotes engagement
Co-Design	Target group has participated in design processes
Reliability	The owner is trustworthy Sources are presented for the content provided
Information Privacy	Privacy policies are thorough

Table 2: A Heuristic Model for Evaluating the UI Design Strengths of Digital Mental Health Resources for Children and Youth (adapted from Mehtälä, 2018)

Since users, tasks and use context are essential components of ICT design (Te'eni, Carey & Zhang, 2007), the framework presented above provides a substantial basis for assessing digital mental health resources for children and youth. Additionally, the framework attempts to observe the resources from the perspective of UI design, adding another outline to the assessment process.

Data

The set of resources analyzed in the study was received from a systematic review conducted in an earlier phase of the project (see e.g. Hankala, Kankaanranta, Kepler-Uotinen, Rousi & Mehtälä, 2017). The review comprised 181 mental health resources that were systematically searched and screened out using the results provided by the Google search engine. The set of resources was reviewed to confirm the suitability of the resources for the analysis, which resulted in the exclusion of 132 resources. Thus, altogether 49 resources were deemed to be suitable for the purposes of this study. The suitability of the design heuristics proposed by the heuristic model, in turn, was confirmed by carrying out an initial test with only two of the resources. This step was critical in light of the validity of the results, since it allowed the contemplation of the relationship between the results of the analysis and the phenomenon studied (see e.g. Carmines & Zeller, 1979). The results of the initial test indicated that the design heuristics were suitable for the current study and the data collection could be carried out by contrasting the resources with the established design heuristics.

Data Analysis

Based on the information collected from the 49 resources, it can be concluded that the sample is international, and the primary languages used in the collected resources are English (63%) and Finnish (37%). The resources are either targeted towards children (12%) or youth (74%), or they have content relevant to both age groups (14%). The mental health emphasis of the resources is on mental health problems (53%) or mental wellbeing (12%), or both mental health problems and mental wellbeing (35%). More than three-quarters of the resources analyzed come from Finland, Canada or Australia. Other countries of origin include the United Kingdom, New Zealand, Ireland and the United States of America. Based on the information, it can be noticed that the amount of Finnish resources is quite high in the set. This is due to the fact that Finnish and English search words were used in parallel when conducting the searches. Additionally, a large portion of the resources focus on mental health problems and are targeted towards youth. Yet, this is likely due to the fact that digital mental health resources tend to focus on mental health problems, and more digital resources generally exist for youth than for children.

Results

The prevalence of design strengths reflects the quality of a digital resource in regards to child and youth mental health resource design. In this heuristic model, there is a total number of 14 design strengths. To understand the design strengths of individual websites and applications, the resources were observed one by one and individual profiles were formed based on the ability of each resource to meet the design heuristics. Based on this set of profiles, five noteworthy strength categories could be distinguished. The strength categories and relating statistics are presented in Table 3.

Strength Category	Amount of Resources	Percentage (%)
Category 1: 0-3 strengths per resource	0	0%
Category 2: 4-6 strengths per resource	19	39%
Category 3: 7-9 strengths per resource	18	37%
Category 4: 10-12 strengths per resource	12	24%
Category 5: 13-14 strengths per resource	0	0%
Total	49	100%

Table 3: Design Strengths of Digital Mental Health Resources for Children and Youth

Based on the statistics, it can be stated that each resource has at least four design strengths, but none of the resources include all of the design strengths. Almost an equal amount of resources, a little over third, fall into the categories of 4-6 strengths and 7-9 strengths. That being said, it is noteworthy that the amount of resources in the higher strength category does not noticeably decrease as the amount of strengths increases. Finally, nearly a quarter of the resources analyzed have up to 10-12 strengths in their design. Even though this categorization provides information about the strengths of individual resources, it tells little about the ability of the resources to meet the

heuristic dimensions and individual design heuristics. Thus, a more detailed analysis is required to conclude how the resources analyzed compare to the different areas of the heuristic model used in this study.

Heuristic Dimensions

The heuristic dimensions reflect the main areas of UI design of digital mental health resources for children and youth. To gain a better view on the ability of the resources to meet the heuristic dimensions, the data collected from the design heuristics were used to calculate mean percentages for each heuristic dimension. The statistics relating to different heuristic dimensions are presented below (Tab. 4).

Heuristic Dimension	Mean Percentage	Percentage of Resources Meeting the Design Heuristics
Visual Design	78%	Visual design is consistent (90%) Colorful pictures and animations are used (65%)
Functional Design	73%	Navigation is effortless (73%)
Engagement	56%	Narrative elements are used (76%) Gamification / game elements are used (33%) Interactivity between user and UI promotes engagement (61%)
Content	56%	Target group age range is defined and narrow enough (22%) Provided content is light (90%)
Reliability	56%	The owner is trustworthy (90%) Sources are presented for the content provided (22%)
Co-Design	41%	There are mentions of target group inclusion (41%)
Information Privacy	33%	Privacy policies are thorough (33%)
Social Interaction	28%	Ways for social interaction are provided (35%) Ways for social interaction experience are provided (20%)

Table 4: Design Strengths Categorized by Heuristic Dimensions

Based on the mean percentages, it can be concluded that the dimensions of visual and functional design are most often met by the resources. This means that on average, over three-fourths of the resources meet the visual design dimension and nearly three-fourths the functional design dimension, indicating that the foundational dimensions of UI design are well acknowledged in the resource design. On average, over half of the resources analyzed meet the dimensions of engagement, content and reliability. However, the design heuristics within the dimensions of co-design and information privacy are met by less than half of the resources, with this number being merely a third in the case of information privacy. Finally, less than a third of the resources are able to meet the design heuristics within the social interaction dimension, which might imply that the resource design focuses on individual use, disregarding the wider context of collaborative learning.

Conclusions

In light of the results, it can be established that digital mental health resources for children and youth have strengths in their design, and some of the resources meet nearly all of the design heuristics set in this research. Additionally, all of the resources analyzed include positive design in more than four areas of observation. Based on the closer analysis of the heuristic dimensions, it can be concluded that the resources include strengths especially in the dimensions of visual and functional design. This is very important for child and youth UI design since functional UIs have the chance to not only provide better user experience, but also enable children to perform tasks that are interesting to them. In turn, the possibility to, e.g., produce and share content can promote the personal and social development of children (Shneiderman & Plaisant, 2005).

On the basis of this study, recommendations can be made to parties developing digital resources for children and youth to pay more attention to information privacy, co-design and social interaction. While these dimensions are less often met by the resources, they are important aspects of digital mental health resource design (Kenny et al., 2016; Wetterlin et al., 2014). Positive design can be increased within these dimensions by providing thorough privacy policies, by increasing the use of co-design with clear descriptions the processes used, and by

increasing means for social interaction or social interaction experience (e.g. ways to interact with content created by other users). However, any adjustments regarding the social interaction dimension should be undertaken with care, since different studies concerning the use of social networking sites as channels for mental health information provide rather mixed results (see e.g. Li et al., 2013; Rasmussen-Pennington et al., 2013; Wetterlin et al., 2014).

The current study focuses on the development of UI design heuristics, as well as, the assessment of existing digital mental health resources for children and youth. Future research should focus on how to include the UI design heuristics into the processes of creating new resources and further developing existing ones. Additionally, this study focuses on the UI design side of human-technology interaction (HTI). In regard to the positive aspects of IT users, there might be a need to pay more attention to children and youth as users with different strengths in the domain of digital mental health resource use. This, together with the strength view on digital mental health resource design, could allow a more holistic approach to positive HTI.

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