Development of an Interactive Mobile Application for Student Revision: Critique and Future Research Proposals

CM20216 - Designing Interactive Systems

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Categories and Subject Descriptors

Human Centred Computing [**Human Computer Interaction**]: Interaction Design

General Terms

Design, Experimentation, Human Factors

Keywords

Mobile Applications, Education, Interaction Design, Critique, User Testing, Evaluation, Research Proposals

ABSTRACT

This paper provides a critique of the process undertaken by my group to design an interactive revision application, identifying key strengths and weaknesses within the early design, prototyping and evaluation stages. Both positive and negative aspects of the process will be identified and discussed, along with potential areas for future research within the contexts of mobile application technology for education, and interaction design for teenage students.

1. INTRODUCTION

The interactive system my group elected to develop [1] was a mobile app designed to aid students with revision, focusing on self-testing, collaborative resource sharing and portability of what is usually a cumbersome process to perform on-the-go. We consider the mobile application paradigm an important one as it "offers a new approach to delivering learning objects into users' daily lives [17]." This work aims to provide a thoughtful critique of the design process we undertook and the prototypes we developed. In addition to this, various directions for potential research within the field of HCI will be suggested based on the research areas and educational context within which our design exists.

2. CRITIQUE OF GROUP REPORT

My group's initial decision to focus on revision as a process was part of the broader context of empathising with stressful situations. While I think that stress was a suitably specific emotion to empathise with, we made no effort in our initial questionnaire to define the term 'stressful,' or to offer alternative options so as to avoid acquiescence bias [21].

Although our identification of a clear target demographic (undergraduate students) was a strength, when designing our surveys we failed to account for the fact that typically, teenagers are predisposed to engage in risky behaviour, and that "some methods, especially those that have the opportunity to flirt with extreme responses and actions might not be well suited to teenage use. [19]" Little research has been conducted to investigate how best engage teenagers in the design process within UX [4][5], but our initial work would definitely have benefited from a more age-specific approach.

Our characterisation of the three distinct revision personae was strengthened by the level of detail with which we described each, but could have benefited from considering the composite personae resulting from the overlap between our three. It is, after all, perfectly possible for a student to be both a social learner and both lacking organisational skills. The personae could also have been improved by mapping of each persona to a specific type of learner profile [24], since these determine students' optimal learning styles.

Hierarchal task analysis, specifically the level of detail at which we should stop decomposing, was a source of great deliberation within the group. Ultimately, I think choosing a high-level of abstraction benefited us in the early stages of design because we didn't have to commit to any implementation specific ideas before evaluating our first prototypes.

A common feature which ran through our low-fidelity prototypes after we cemented our design vision was the idea of 'cards;' indistinguishable from their real-world counterparts. This was a logical decision which simplified our design's affordance [23], we had to take sufficient care not to produce skeumorphic designs sharing necessary physical similarities to real flashcards, as "visual skeuomorphs can also impede the usability of a new artifact [7]."

A weakness in our low fidelity prototypes that we discussed briefly during the evaluation was that we asked potential users to directly compare prototypes which, although

were both lo-fi, were not developed to equal levels. There was a strong preference for the two prototypes which were more contextually developed (both shared were based on Android's Material Design UI style[1]) rather than the sketch-style prototypes. This is unsurprising, since evidence suggests teenagers prefer designs from familiar brands which "utilise authentic technologies [18]". Retrospectively, evaluating our lowest fidelity prototypes may have lead to meaningless results, as very low-fidelity prototypes make it "harder to claim whether the evaluation findings are originated by the actual concept of the system or by the innate characteristics of the prototype [14]." Our prototyping and particularly evaluation of the prototypes would therefore have benefited from further iterations within each stage, and usability evaluations.

The most obvious weakness in our iteration and final high-fidelity prototype was the platform on which they were developed. Due to time constraints, we built the high-fi prototype in Delphi as a desktop mockup of a mobile application. Although it contained all the appropriate functionality and was born out of the individual strengths of the low-fi prototypes, the user experience was far distanced from what it would have been had we built a touch-screen app for Android devices. Our initial aim to introduce portability and collaboration to the revision process fell short of providing the "anywhere, anytime, on demand, learning experience [10]" which mobile learning apps uniquely offer. Even though there was little we could do about the time constraints, we could and should have considered the low-level physical interactions and gestures necessary to design for touch-screen devices [2]. In my opinion, our high-fidelity prototype should have been a mid-stage prototype, superseded by (or evolving into) an application which could be run on a portable device, supporting touch-screen interactions, as portability and the sharing facilitated by NFC was paramount in our initial design.

The main strength of our evaluation was our empirical evaluation and critical analysis. Although some researchers question the validity of quantitative and empirical evaluation [12] due to the impossibility of controlling external variables [13], the specificity of our demographic would have had a controlling effect on a number of variables outside our control, such as the level experience with mobile devices.

3. FUTURE RESEARCH PROPOSALS

Our report suggested future research could be undertaken into the cognitive and emotional usability of menu design. My proposals for research, in contrast, focus less on the design paradigm of the app itself and more on the educational and developmental aspects of using apps as revision aids.

In our early design, we chose to use green as the central colour for the application, as it generally has positive and relaxing associations. We didn't give any particular thought to typeface or any other stylistic choice. Since we have already considered the effect of colour on revision stress, I propose an investigation into the usability and affectiveness of the application for students with a condition affecting an estimated 15-20% of the population [3]; Dyslexia. Gregor and Newell [6] found a distinct preference among Dyslexic users of digital applications for low-contrast between text and background colours, as well as the Arial typeface. A within-subjects experimental design methodology would be the recommended approach, with a single group of dyslexic students having their performance (either time taken to complete typical tasks, or errors made during any given task) observed while using the default app, and again while using the app with more dyslexia-friendly typefaces and colour contrast. Rello et al. [20] used methods including eye-tracking and semi-structured interviews as part of their experimental methodology, which informed their recommendation of layout guidelines for webpages in order to aid readability for dyslexia sufferers.

An alternative area for exploration lies in the input methods used by the application. Jeong et al. [9] found the flexibility offered by a flashcard application which supported hand-written input was particularly useful to students "learning mathematics, where typing the material using a keyboard can be difficult." The application they designed was similar in terms of purpose and scope to my group's application, but it was a desktop program, designed to be used with a graphics tablet for input. Usability evaluation of a variation of the application using a tablet with a digital pen, by a group of students studying particularly diagrammatic courses could provide some insight into whether handwritten input is preferable to keyboard text entry.

A final and potentially broad possibility is that of extending our app's testing functionality into a more game-like and rewards-based system. Studies show " teenagers display a heightened sensitivity to reward [4]" in contrast to adults and younger children. McDaniel et al. [15] attempted to "apply a video-game-style achievement system to an online learning environment" for a group of university students and found that females in particular were motivated by the reward system.

Gamification of online education as a method to strengthen engagement among students was described as promising by Krause et al. [11], whose study saw a 23% increase in test scores after a course was 'gamified' (increasing to 40% when the game became more social) and could help alleviate problems of procrastination among students [8]. The strengths of collaborative learning are also discussed in [22], where Shen et al. found that learning can improve significantly by making the nature of the exam process more collaborative. Games are now also considered "pedagogically sound learning environments" for digitally literate students [16], so a hypothesis that exam performance improves to a certain degree of significance using rewards-based revision tools could be tested with long-term between groups experiment, based on students studying the same course with half using the existing app and half using a socially gamified alternative.

4. REFERENCES

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