Co-designing with members of a chef school to develop a data management system (CHEFREG)

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1. PROJECT DESCRIPTION

Infinity Culinary Training (ICT) is a non-profit organisation that equips young disadvantaged men and women with basic cooking skills to find employment. In addition to professional culinary skills, the organisation strives to foster life skills to encourage personal development and enable students to thrive in the catering industry [4]. A major challenge for ICT is finding a system or tool for data management. The organisation currently uses spreadsheets to keep track of student information however these are difficult to maintain with an increasing number of graduates. Thus, there is a need for a system that provides efficient data management.

This research project aims to employ co-design and examine how effective co-design methods are in designing a system with high usability. We will also investigate how a collaborative design approach between us, the researchers and designers, and the members of ICT will improve design outcomes and the quality of system requirements. The major focus of this paper is on the design process rather than the software to be developed because the latter is flexible and likely to change as the scope of the project evolves.

1.1 Project importance

A major challenge in software development is the gap between the requirements made by researchers and/or designers during the design phase and the realities of the people being designed for [2]. Literature shows that numerous projects have been successful at employing user-centred design and co-design methods as a means to reduce this gap. Results from these projects point to the benefits of user participation, which include a better fit between the system and users' needs, improved system quality, improved user satisfaction, and improved mutual understanding [3, 5, 7]. Successful co-design projects have collaborated with children, elderly people, and employees from various sectors, to name but a few [15]. While there are projects that have developed applications for chefs and chef students, it appears that none of these have made attempts to include the chefs and students in the design process [6, 14]. Thus, our research project sets out to collaborate with chef students and involve them in all significant stages of design to reap the aforementioned benefits of co-design. We believe our research will contribute novel scientific knowledge about co-designing with chefs and chef students.

2. PROBLEM STATEMENT

Unemployment is one of the biggest challenges faced by South Africans who come from a disadvantaged background. In most cases this issue can be partially attributed to a lack of education and life skills that are necessary to stay employed [1]. There are non-profit organisations (NPO) that aim to alleviate this unemployment by training people with the necessary skills to acquire and keep a job. One such NPO is Infinity Culinary Training, ICT, which equips disadvantaged people with culinary skills, at no cost, so they may work in the hospitality field [4]. A key objective of the organisation is to provide their students with the necessary business and life skills to successfully obtain employment.

One of the things that set ICT apart is their commitment to the personal development of students, even after they have graduated from the school. It is important for the organisation to remain in contact with their graduates to continue to support them on their professional journeys. Currently they make use of Excel spreadsheets to keep track of information about current and former students. These spreadsheets are well-organised and productive however as the number of graduates increases they become increasingly difficult to use and manage; it becomes strenuous to keep track of graduates and their employment details. Therefore, it is necessary to provide ICT with a more efficient solution for keeping track of their students and graduates so they can continue to fulfill their goal of providing consistent support to them.

This project aims to actively involve members of ICT in a joint design venture to develop a system that successfully meets their requirements. As such, members of ICT will be crucial to this project because they will be at the centre of development. Table 1 illustrates how different individuals from the organisation will contribute to the project, which is likely to change as their roles and needs become more explicit.

Table 1. Key stakeholders' contributions to project

Inform	Consult	Involve	Collaborate
Board of Directors	Chef students and graduates	Chefs and lecturers	Admin

2.1 Research Questions

Our research aims to provide answers to the following questions:

- How can the artefacts generated through the design process help with implementing a usable system for the school?
- What needs do former students identify in a platform that aims to encourage them to remain in contact with the school?
- How would admin staff want to use the system to more effectively manage their daily operations?
- What aspects of technology would chef students want to use to encourage them to further engage with their learning?
- How do lecturers and students interact with technology to improve communication in the mentoring system?
- How would a former student want to keep track of his work profile to make it easy to apply for jobs and update the school about changes to employment details?

3. PROCEDURES AND METHODS

In this section, we will examine the procedures and methods that we plan to use in the design process to ensure that we achieve the research questions outlined above. We will explain the proposed approach and justify why that approach has been chosen. We will also look at any problems that may occur with the given approach and how we plan to solve those problems. Finally, we discuss evaluation methods.

3.1 Methodology

In this project, we will use a co-design approach to design a system that addresses the needs of ICT. This approach places users at the core of development and provides methods that enable them to express their requirements [16]. In a co-design approach users, who are viewed as "experts of their experiences" [17], are involved in a joint creation with designers to develop solutions to their problems. In this methodology users are not viewed as merely targeted end-users but they become co-designers and contribute actively in key design decisions [16]. A co-design approach is suitable for our research project because the success of the project will be determined by whether the needs of ICT have been catered for. In other words, user involvement is crucial to the project. Our initial meeting with members of ICT revealed that they have a strong understanding of their needs and what they expect from a new system that will address those needs, thus the decision to lean towards a co-design approach.

Methods

In co-design, it is important to select appropriate methods to use when engaging with users. This project will use various methods, such as contextual enquiry; co-design workshops; focus groups; one-on-one meetings and interviews; and questionnaires, to engage with users and elicit project requirements to determine the scope. We have identified several stakeholders whose contributions will be key, as illustrated in Table 1. These stakeholders have different needs and so the methods applied to engage stakeholder groups will vary depending on their contributions and interests. In Table 2, we illustrate which interaction methods we will use for the different levels of co-design.

Table 2. Interaction methods and levels of co-design

Inform	Consult	Involve	Collaborate
Email	Questionnaires; interviews	Focus groups; One-on-one meetings and interviews; Observations; Questionnaires	
			Co-design workshops; Brainstorming

The methods will be applied as follows: brainstorming sessions for ideation; observation of users in their natural context to discover unexpressed requirements; co-design workshops to model designs; questionnaires for evaluations; and focus groups, meetings and interviews to understand users and their needs.

We will be using an iterative design process because it will enable us to respond to changing user requirements and develop a system that meets users' needs, since there is a high degree of collaboration with stakeholders and design problems will be identified early [18]. Section 6 provides more detail on the design process.

Prototypes

We will be developing prototypes as part of the design process to model variations of the final system. Each iteration of design will produce either a paper or software prototype which will be tested to evaluate whether they reflect user requirements. Methods for evaluating these prototypes are outlined later in this section. The paper prototype sketches will be designed using paper and other low-cost materials which will be sourced from the team, while software prototypes will be designed with free online wireframing and prototyping tools such as Moqups [9].

Design Challenges

One of the challenges of co-design is finding appropriate methods of engaging with users. The success of our co-design approach will rely on the relationship we have developed with members of ICT and whether they trust us enough to be comfortable with sharing their experiences with us and letting us into their space. The challenge for us will be to develop our communication skills and step out of our comfort zones to minimise the communication gap between us and co-designers and create an inclusive environment for co-designers. While co-design methods are effective at facilitating the process, their efforts will be futile if not applied appropriately.

Another challenge will be finding appropriate times to hold co-design workshops with users while minimising disruptions to their work procedures and our academic obligations. To overcome this, it will be important for us to manage our time and schedule interactions with co-designers in advance.

3.2 Evaluation Methods

Four types of methods will be used to evaluate prototypes and the final system, namely usability testing, functional testing, heuristic evaluation and acceptance testing. Usability tests will evaluate the user interface's ease-of-use [24]; functional tests will evaluate functionality of the system [25]; heuristic evaluations will assess the user interface to identify design issues [19]; and acceptance tests will assess whether user requirements have been met [26].

All four methods will be necessary because they will ensure that design artefacts are extensively evaluated throughout the design process.

Usability Testing

Usability tests of prototypes will be done to determine how users interact with the interfaces. The process will involve creating use cases to specify which tasks will be carried out by users, doing a cognitive walkthrough of the prototype, then conducting a post-test interview in which we will establish the following:

- Was easy is it to complete tasks on first interaction with the design?
- How many errors did users make and was it easy to recover from them?
- Was it pleasant to use the design?
- How fast can users complete tasks once they are familiar with the design?
- How intuitive and useful the design is.
- Feedback for improvements.

Heuristic Evaluation

We will perform a heuristic evaluation of the final prototype and the final system to identify usability issues. Unlike the usability test, this will involve selecting evaluators to assess the interface against a set of heuristic guidelines [20, 21, 22, 23]. Evaluators will be selected from the University of Cape Town computer science honours students with domain knowledge about design principles and HCI.

Functional Testing

A functional test will be done once the final system has been developed to evaluate if it does what it is intended to do. We plan to do unit testing of the user interfaces to assess whether all individual components of the system are correct.

Acceptance Testing

An acceptance test of the final system will be done to evaluate whether users' needs have been addressed. We will define and execute test cases then evaluate test results. This will be the final test done to determine if users accept the system design, therefore this test is crucial to the success of the project.

4. ETHICAL, PROFESSIONAL & LEGAL ISSUES

4.1 Ethical Issues

Our research project will largely involve the participation of members from ICT, therefore it is necessary to obtain ethics clearance before any humans can participate in the project. Ethics approval warrants our commitment to the principles of confidentiality and anonymity, personal dignity and consent. We have also ensured that our project poses no threats or risks to participants.

4.2 Professional & Legal Issues

No personal data will be collected in this project. Any data collected will be used upon receiving consent from Infinity Culinary Training and removed from our personal computers once the project is complete. Any sensitive hardcopy documents received from ICT will also be destroyed appropriately.

The systems developed in this project will be the intellectual property of Amy Brodie, Nosipho Khumalo, Ednecia Matlapeng and the University of Cape Town. In addition, authorship credit of the results will be allocated to the co-authors and each author's contributions will be indicated in any publications, following recommendations from the Authorship Practices Policy of the University of Cape Town [8].

5. RELATED WORK

Human-centred design (HCD) is a design process wherein there is a focus on the requirements and needs of the end-user [13]. The end-users help in the design of a solution and aren't just providing the researchers/designers with information, this implies that there is active involvement of end-users in the HCD process [12]. In this approach the expertise of the researchers/designers is combined with the expertise of the end-users to help improve the end-user's current situation [10]. It allows for an early focus on the end-user which is beneficial for understanding the end-users needs and wants early in the project [7]. Sawhney, et al. argues that collaboration between end-users and researchers/designers is an important aspect in creating solutions or products for the end-users [11]. There are many different methodologies that are categorised as HCD methodologies which includes empathic design, ethnographic fieldwork, contextual design, participatory design and co-design [12].

Of the above mentioned methodologies, contextual design, co-design and empathic design will be highlighted. In contextual design the researcher/designer will observe end-users performing tasks or even act as an apprentice to the end-user to gain insight into the end-user's operations. Empathic design aims to get the researchers/designers to observe and get close to the end-users in their daily life and at work to try to empathise with the end-user's experiences and emotions. While co-design focuses on the collaboration of researchers/designers and the end-users in all phases of the design and implementation of a project [12].

For this project a co-design methodology will be adopted. This methodology entails a close working relationship with the staff and students of ICT who will be involved in all phases of the project. In addition, a variety of methods will be employed throughout the phases of the project to assist in interacting with ICT and collaboratively designing a solution with them. These methods will include contextual inquiry, interviews and workshops. The contextual inquiry will be used mostly in the research and design phases of the project to help understand the current situation at ICT. Whereas the interviews and workshops will be employed throughout the project for various purposes.

6. ANTICIPATED OUTCOMES

In this section, we detail the design process and the expected outcomes of each phase in the design cycle, namely design, prototyping and evaluation. We then outline the expected impact of our project and measures by which we will evaluate the success of the project.

6.1 Design Process

Our design process will be influenced by co-design, which is an iterative methodology that actively involves the users in all design decisions. We plan to have three iterations of designing, prototyping and testing, with each iteration producing a viable and fully tested artefact.

Design

In this phase, we will generate and select ideas in collaboration with the users, then design sketches and/or wireframes in co-design workshops to illustrate selected ideas. Prior to designing we will conduct a task analysis of the admin staff and lecturers through observations to understand their current work procedures. Information collected from this process will then be used to identify possible use cases.

Prototype

In this phase, we will use results from the design phase to create prototype artefacts. We will be creating a paper prototype for the first iteration and software prototypes for the later iterations. The prototypes will be fed back into the design process for evaluation.

Evaluate

This is where we will conduct a usability test to evaluate the prototypes through a cognitive walkthrough. The aim of the usability test will be to assess ease-of-use, efficiency and user satisfaction. We will then analyse findings of the usability test to identify common problems and modify design in the next iteration. In addition to a cognitive walkthrough, we will also distribute questionnaires to gather feedback about the prototypes.

6.2 Expected Impact

We expect that the joint design efforts of this project will result in the development of a highly usable system with a positive user experience. We also hope to educate members of ICT about design and equip them with skills which they can apply in their work procedures to identify problems and find solutions in the future. Finally, we expect that our project will improve how members of ICT use and interact with technology in their professions and daily lives.

6.3 Key Success Factors

The success of this project will be determined by user satisfaction and the continued use and maintenance of the software developed even after the duration of the project. Finally, because this is a research project, we will also evaluate the project by its ability to contribute new scientific knowledge.

7. PROJECT PLAN

7.1 Risk Management

A comprehensive risk management matrix in Appendix B details all the potential risks identified and their management strategies.

7.2 Timeline

The project starts on 05 April 2017 and ends on 23 October 2017. A timeline of the project is shown in Appendix A, which marks important project milestones.

7.3 Resources

The primary resource required for this project is people. A major component of the project will involve collaboration with members of Infinity Culinary Training, who will be critical to requirements gathering, development and evaluation of prototypes, and providing feedback for improvement. This project has a strong focus on human computer interaction so human participation' will be crucial to the project. Equipment required will be computers and Android cellphones, both of which will be provided by the team. All software used will be open source. Datasets for testing will be generated by the team.

7.4 Deliverables

The main project deliverables will be a complete and tested web-based and mobile application. Other tangible deliverables include a proposal, prototypes, a website, test plans, test results, a poster, research paper and reflection paper. Soft deliverables of the project will be improved data management procedures and users with knowledge and experience in software development.

7.5 Milestones

Major project milestones, which have been extracted from the timeline, are shown in Table 3.

Table 3. Project milestones

Task	Date
Literature Review	09-05-2017
Project Proposal	02-06-2017
Prototype iteration 1	14-07-2017
Initial Software Feasibility Demonstration	14-08-2017
Prototype iteration 2	18-08-2017
Prototype iteration 3	11-09-2017
Project Paper	22-09-2017
Project Demonstration	09-10-2017
Project Code	02-10-2017
Project Poster	09-10-2017
Project Website	12-10-2017
Reflection Paper	23-10-2017

7.6 Work Allocation

At this point there is still uncertainty about the exact software we will be developing however, from the problems identified in the initial meeting with ICT, we expect that the work will be distributed as follows: Amy will focus on developing a system to keep track of students; Nosipho will design an application that compiles student information to automatically generate a CV; Ednecia will be responsible for developing a mobile application for students; all team members will be involved in the database design. These roles are likely to change as the project scope becomes clearer, however we expect that each team member will be responsible for a self-contained component of the project.

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9. APPENDIX A. GANTT CHART

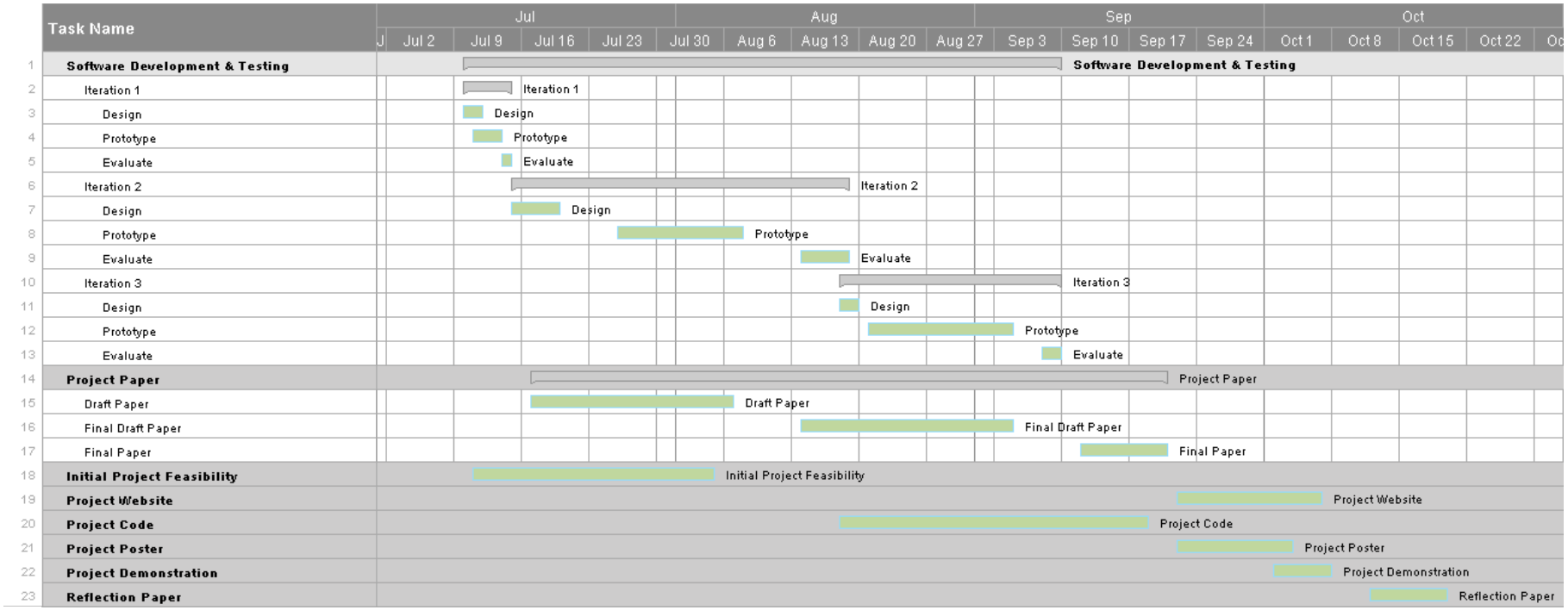

Figure 1. Gantt Chart

10. APPENDIX B. RISK ANALYSIS MATRIX

Table 1. Risk analysis matrix ordered by impact, from highest to lowest

Risk	Consequence	Mitigation	Monitoring	Management
Co-designers not available to participate in design activities	Failure to meet user requirements; untested design artefacts.	Schedule meetings ahead of time.	Send reminders to ensure co-designers can still attend.	Update co-designers who were absent so they may participate in the current activities.
Co-designers have conflicting views	Failure to progress with design activities	Keep all co-designers up to date on the project	Keep track of each co-designer's view to determine if there are conflicts	Assess each co-designer's influence and impact in the project to decide which views to considers
Loss of team member	Loss of project components; failure to complete milestones on time if notice is received late.	Add buffer to allocated time; distribute work appropriately to minimise task dependencies.	Weekly updates.	Reallocate work to remaining team members.
Last minute scope creep	Not enough time to implement changes.	Conduct regular meetings with stakeholders.	Monitor project scope.	Decide which changes are worth implementing without affecting deadlines.
Poor or lack of project management	Poor time management; failure to produce deliverables on time; delay in project.	Design project plan with clearly defined deadlines.	Schedule regular meetings and monitor timeline.	Reschedule internal deadlines or seek extensions to deadlines.
Co-designers lose interest in project.	Loss of commitment to design activities; Change of design methodology.	Keep all co-designers up to date on the project and ensure design activities involve everyone in the process.	Frequent communication with stakeholders.	Have a meeting with co-designers to find out why there was a loss of interest in the project.
Poor performance and lack of commitment from team members	Poor attitude, substandard work; team members not pulling their load.	Require each member of the team to sign a pledge that warrants full commitment to the project.	Conduct regular peer review.	Pull the underperforming team member's load; reassure team members of the project's significance.

Project deliverables deadlines conflict with other projects	Failure to meet milestones; production of substandard work.	Add 5% buffer to initial allocated time; mark deadlines on shared group calendar.	Assess progress weekly and adjust work schedule as needed.	Try to complete deliverable before deadline if possible otherwise try to complete it soon after.
Lack of leadership and inappropriate allocation of responsibility in team	Conflict in team, failure to meet project objectives; lack of accountability.	Appoint a team leader and define a clear allocation of responsibility.	Weekly team meeting to assess progress and potential problems.	Reappoint a team leader, seek mediation if conflict arises.
Poor or lack of communication between team members	Conflict; failure to meet project objectives.	Agree on preferred means of communication and keep team members updated on progress.	Weekly meetings.	Appoint a meeting leader and have mandatory meetings where team members provide progress reports.
Supervisor unavailable	Delay in tasks that require the supervisor’s input.	Schedule meetings ahead of time and agree on preferred means of communication.	Communicate with supervisor once in every two weeks.	Proceed without supervisor signing off.