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Finding a needle in a library stack: Improving wayfinding in an academic library

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**A thesis submitted in fulfilment of the requirements of the
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Arts (by Research)**

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I. Abstract

Students have difficulty locating items on the shelf in a library. This mixed-methods case study reviews the existing literature relating to this issue and investigates the nature of these problems. It tests an online wayfinding App which the researcher created which was installed at Goldsmiths University library. The aim was to ascertain whether this could improve the ability and perceived experience of students searching for items. A field exercise is incorporated into the research which investigates six participants' experiences of finding material both with and without the aid of the App, using the semi-structured interview technique.

The research also investigates whether there are variances in the nature of difficulties experienced at different study levels including both undergraduate and postgraduate students in its sample.

The results indicate that students find an online wayfinding App useful and feel that it reduces the anxiety which surrounds the retrieval of physical items in libraries. There is a demonstrated time saving in using the App, particularly in relation to finding the correct stack. Self-efficacy levels increased following the field exercise. It was also noted that the parallel use of signage in the App and in the library in order to indicate a stack number was a significant factor which improved the wayfinding experience.

A notable aspect of this research were unexpected results from two participants who declared that they had Specific Learning Disabilities. Their performance and insights indicated that steps could be taken to improve their student experience and that further research in this area would be beneficial. The key recommendation is to install an online wayfinding App with companion signage in order to improve the student experience.

II. Acknowledgements

I would like to thank Geoff Walton, my supervisor for his advice during this research. I would also like to thank the staff and students of Goldsmiths' university for their participation and for allowing me to trial the ShelfMap App in their library.

III. The researcher

Bernard Scaife is a Systems Librarian with 19 years' of experience, mainly within the academic library sector. He has worked with a variety of Library Management Systems and has provided technical solutions which further library strategy objectives. He is the creator of the ShelfMap App which is used during this research.

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1 Background to research and context

1.1 Introduction

Throughout his career as an Information Professional specialising in library systems in academic libraries, the researcher has observed and been responsible for providing answers to the following question. Why do students find it so difficult to find books on the shelf when armed with a classmark? Allied to this, the question of whether there was anything that could be done to improve the situation was also posed. This led the author to develop a prototype wayfinding App which was designed to reduce the barriers to access that students were experiencing by providing three-dimensional images of the location of stack in the space which contained the item which was being sought. Anecdotally, favourable feedback from students and library colleagues suggested that this had been achieved.

In a quest to demonstrate this in a more formal setting, this dissertation focusses on students' ability and perceived experiences in finding items on the shelf in, Goldsmiths, University of London, an academic library which specialises in creative arts subjects and has just over 8,500 FTE students. It seeks to evaluate the extent and nature of any difficulties that surround such information seeking behaviour.

It then makes a hypothesis that the impact of introducing an online wayfinding App will positively change the experiences and ability of students to find items on the shelf following its introduction. A further aspect of this research concentrates on identifying study level differences which may exist in this area, in order to allow analysis of the results in a more granular way.

The aim of this research is investigate the information-seeking behaviour of UK Higher Education (HE) students in relation to recent innovations in relation to library wayfinding, in particular those use digital technologies to achieve this. Using a re-written and enhanced version of the App (see Appendix A), it is intended to investigate whether

lessons can be learnt that might be helpful to a wider audience, LIS practitioners in university libraries. They will then have the option to consider implementing a similar system in the context of the currently popular objective of increasing the level of student satisfaction in UK universities in a measurable way.

1.2 Objectives

The objectives of this research are as follows:

- Objective one: To review and critically assess the literature to understand wayfinding issues and approaches to addressing them.
- Objective two: To assess the impact of students' experience and study level on their ability to locate material found in the online catalogue.
- Objective three: To explore the impact of introducing a wayfinding App combined with physical signage on the ability and perceived student experience of locating such material.
- Objective four: To indicate what contribution the study has made to the field and make recommendations for future research.

1.3 Dissertation structure

Chapter Two reviews the literature on wayfinding in libraries with particular reference to finding items and any difficulties or barriers experienced by students that may exist. It also examines strategies for overcoming these, whether these are having an impact and any differences being experienced by students at different degree levels.

Chapter Three formulates a suitable research strategy, describe why this has been chosen and outlines the proposed design to be adopted including the data collection tools and chosen sample. It makes a hypothesis and then proposes a framework for how the data will be analysed. Finally, it highlights any limitations or problems which may apply to the chosen methodology.

Chapter Four presents the results of the research by objectives two and three which pertain to the research element of the dissertation. This is done without making any

comment at this stage about what can be deduced from the results. The results are discussed and analysed in detail in Chapter Five. This is conducted in relation to the literature review, in order to give an indication of how closely or otherwise the findings are aligned with current research. Finally, Chapter Six draws conclusions, again by objective and discusses the limitations which apply to the research findings. It then makes recommendations about how the research might be embedded in current library practice as well as indicating areas of for future research which might be beneficial.

2 Literature Review

2.1 Introduction

2.1.1 Background

This literature review will examine what is known about library wayfinding, particularly in respect of finding physical items in the stacks. The objectives will be scrutinized as follows:

Research will be examined that focusses upon the extent to which wayfinding issues are experienced by students looking for an item. Strategies employed to reduce barriers to a successful retrieval, such as signage, mobile wayfinding Apps and help available from staff will be investigated and an opinion given as to whether any of these have made a noticeable difference to the outcome.

Next, literature which attempts to identify differences encountered by library users with varying degrees of experience and studying at different course levels will be reviewed, in order to inform this aspect of the research.

Before addressing these however, it is necessary to step back and recognize that at the most basic level, it is Information Behaviour (IB) which is being investigated - a vast field of study in its own right. Specifically, a user who has identified a particular item in the catalogue (referred to here as a known item) and wishes to find the physical manifestation on the shelf is exhibiting an information need which they will either perceive to have been satisfied or not. It is productive to investigate what these terms mean in order to gain a clearer context for analysing the literature itself.

2.1.2 Definitions

There is a well-established and large corpus of literature which describes the concept of "information". Case & Given (2016:72) suggest that this is a primitive concept so basic to human understanding that it is therefore not necessarily essential to give it a universal definition. However, a definition which appears to correspond with this research is one from Bateson (1972, reprinted 1987:386) who argued that information is 'any difference which makes a difference in some later event.'

Information need is some sort of recognition of a "gap" which may or may not crystallize as someone seeks information. This is what Belkin (1980) describes as an "Anomalous State of Knowledge" (ASK). For example, a person guided to the Philosophy section in a library and encountering hundreds of books may decide to investigate them, or else instead, seek to consult a dictionary of philosophy in order to reduce the uncertainty in their state of knowledge (Case and Given, 2016:85).

Information seeking has been characterized by Wilson (1981) as a user pursuing one of a number of paths (with or without an information retrieval system) to find information. Savolainen (2009) expanding upon this, noted that the information "use" aspect of information seeking often receives little attention in the literature. In this research, the information being sought is the location of an item which has been identified via the library catalogue (information retrieval system) as satisfying an information need. Also related is the concept that the process of searching for information is often accompanied by feelings of anxiety. Kuhlthau (1991:370) states that

'By neglecting to address affective aspects [of information seeking], information specialists are overlooking one of the main elements driving information use.'

Another pertinent concept is that of information overload. Jacoby et al (1974) discovered that information overload led to consumers making poorer purchase decisions in a supermarket stocking 8000 product lines. To reduce this, they suggested that marketers

concentrated on "just which specific" information was needed. This recommendation appears to be readily transferable to the creation of user-friendly wayfinding tools.

In relation to wayfinding itself, there is a potential for information overload to occur with signage. Hahn and Zitron (2011:33) note that there is a tension between giving sufficient and timely information without bombarding the user with so many signs of different types in close proximity, that the extent to which they help is compromised.

Information literacy is another relevant area. Walton (2017) describes how users become information literate, the impact of context (for example being a student at a university) and many other factors which in combination shape their behaviour, leading to what Walton and Hepworth (2011:459) describe as a cognitive questioning state in the learner. Digital literacy is also a concept of relevance. Its exact definition is difficult to pin down. Originally coined by Gilster in 1997 in relation to the skills and competencies required to use the Web, Belshaw (2011:13) describes the changing and ambiguous nature of the term's definition over time, whilst acknowledging that it is predicated upon information literacy. It should be noted that information and digital literacy skills are relevant to this study, but examining them in any depth is beyond its scope.

Wayfinding itself is the specific area of IB which is being examined here. Mandel (2010:116) gives a definition:

‘Wayfinding refers to the ability of users of the built environment (i.e., a facility) to navigate through that environment to find specific destinations.’

Within libraries, this can be refined to mean the ability to find the resources and services the user requires such as items on a shelf, the location of the shelf within a stack and the stack within the building.

Mandel also notes that difficulty in wayfinding can cause humans to feel stressed or frustrated. This appears to resonate with the part of Wilson's information behaviour Model (Wilson, 1999:257) which describes the stages which a user goes through when looking for information. According to Fisher et al. (2005:34), challenging situations cause

stress/coping mechanisms to be activated which may be problem or emotion focused. In terms of wayfinding, it has been discovered that

‘The majority of students describe their initial response to the library in terms of fear and anxiety due to lack of knowledge about where things are located.’
(Hahn and Morales, 2011:420)

Similarly, Schmidt (1997) found that heightened anxiety caused subjects to pass more slowly through a complex maze.

Such anxiety can also affect levels of self-efficacy. Self-efficacy is a component of social cognitive theory and was described by Bandura (cited in Pajares, 1996:543) who described how the “self-system” (including in particular beliefs that people have about themselves) enables individuals to exercise control over their thoughts, feelings and can potentially affect their actions.

2.2 Understanding wayfinding issues and approaches to addressing them

2.2.1 Do students find it difficult to find a known physical item?

According to Jenkins (2001:234), one of the most commonly asked questions at the reference desk is for directions to physical locations. There are several other studies which support this statement through attempts to examine the various merits or otherwise of known-item searching as opposed to browsing by subject in the online catalogue. According to Behnert and Lewandowski (2017:129), "known-items" has no standard definition, but it can be safely assumed that the general intention of the user is to locate and retrieve a particular work which they already have at least some of the bibliographic details for. In terms of how frequently known-items are sought, there are several pointers. Using search log analysis, Muh-Chyun Tang (2009) showed that 68.6% of searches were of the known-item type. A similar study by Schlembach et al (2013) revealed the proportion to be 55%. Schonfield (2014:7) found that Library Directors felt

that indexed discovery services were weak with regard to known-item discovery and that this was likely to be contributing to confusion.

On a more qualitative note, McKay & Conyers (2010:79) noted that shelving assistants who are working in the stacks are often asked by students to help locate items. Also, in a "library experience" survey in which the researchers had expected comments about opening hours and furnishings, Murphy et al. (2013:104) were surprised to get many responses relating to the difficulty of locating items on the shelves. Nowhere is it suggested that users find this activity straightforward. Even within studies in which finding the location of an item is only a peripheral part of the topic being investigated (Calhoun et al. 2009:20), users indicate that more detailed location information would be desirable thus providing ample evidence that finding physical items is often a challenge. So what exactly are the problems encountered?

2.2.2 Extent of understanding of classification schemas

As an area laden with unfamiliar terminology, one might expect some confusion around the meanings of the terms class number, call number, classmark, and shelfmark, all of which are used interchangeably as synonyms. Surprisingly, no-one has conducted research in this area. For the purposes of this study, the term "classmark" will be used and is defined as the correct address of an individual item on the shelf.

Kress noted that user failure to find known items can begin as early as at the stage that they have identified the item they wish to retrieve via the catalogue. They continue:

[They might] see a call number, but not understand that they must use that call number to find the actual book.' (Kress et al, 2011:158)

Notably for this research, the above interviewee stated that they were clicking on the classmark link in the expectation of getting further help, which indicates an unsatisfied information need. Some of the participants did not even realise that a classmark indicated the physical item's location and suggested that a clickable map could reduce confusion.

In the literature surveyed, there is only one investigation into the level of perceived understanding of individual classification schemas - Library of Congress. This is by Murphy et al (2013) who specifically addressed students' understanding of a classification sequence by asking them to sort a set of cards into Library of Congress order, thus allowing for some analysis to be made about their ability to do this. They concluded that students find interpretation of classmarks difficult. However, several studies (Robinson et al, 2014; Hahn and Morales, 2011; Kress, 2011) ask participants to find specific items on the shelf, observe them doing so, and ask questions from which challenges and obstacles can be deduced.

An additional problem is confusion caused by the lack of collocation between related materials requiring special locations (Bowker & Star cited in McKay & Conyers, 2010). For example, a companion CD for a book may be shelved separately but this may not be immediately obvious.

A question arises about the place of induction in equipping users with knowledge of how classification schemas work. In the studies surveyed, no one had conducted research in this area. However, Larsen and Tatarkas (2008) found that only 30% of students attended an induction session in which class number reading was explained. Murphy et al. (2013) also noted that few students had received any significant training in finding materials in a library setting.

2.2.3 Navigating the library building

Attempts to understand difficulty of building navigation are not just restricted to library buildings and have been researched for some time (Best, 1969). Indeed indoor wayfinding has developed into a topic in its own right and contributions which examine and suggest enhancements to this in libraries have been supplied from several fields of study. For example, urban planners use "spatial syntax" which sees space as being an aspect of social life which can be affected by the way in which architecture is designed (Hillier, 2007:1). This has been adopted by researchers such as Li and Klippel (2012) to predict

areas of potential navigational difficulty within libraries due to their physical layout attributes or design. Their techniques included an analysis of how far a user can see from a specific place in the building; factors such as size, number of possible routes to destination and angle of intersection of the routes; and the interplay between these factors which are used to predict a high or low level of “connectivity”. They concluded that higher levels of visibility have higher connectivity and lower layout complexity and vice versa.

2.2.4 Strategies employed to improve navigation

Improvements in signage, orientation aids and rearrangement of shelves are some of the methods suggested for simplifying wayfinding. Casey and Stephens (2009) have argued that we should abandon the Dewey classification schema altogether, but the large financial and staff overhead required for this is frequently not available. There have been attempts to improve existing physical signage. Carr (2006) suggested that stack-end signage with both class numbers and subjects within the range listed would be effective. Hahn and Zitron (2011) have discovered that users find uniformity of signage (size is important) more straightforward to follow and that orientation aids such as maps were sought. Larsen and Tatarkas (2008) noted that wall-mounted maps could have reduce user confusion during their field exercise.

Basic forms of virtual wayfinding have also been in use for some time. For example, Li and Deng (2008) described how the library catalogue at Worcester Polytechnic University provided a “location” label in the search results page which was linked to a list of locations and floor maps.

Improvements to virtual signage that might be impactful have also been suggested by Hahn and Zitron (2011), such as "You Are Here" indicators which relate to the user's current location and the ability to view desired destination points from different perspectives based upon this.

Schmidt's research (2010) adopts more of a user-experience focus. This talks about "touch points" - the places on their journey where customers get assistance, such as a Service Desk. This could be a good source of information about strategies for finding items due to the fact that they are the place that a confused user comes to for help.

On the subject of getting help, Ruppel and Fagan (2002:186) noted that reluctance to do so has been a known issue since at least the early 1970s. Currie (cited in Xia, 2005:64) found that users may hesitate to ask for help for a variety of psychological reasons. Part of this may relate to a desire to be self-reliant which was discovered by Ho & Crowley (2003). Similarly, Hahn et al. quote from the College Students' Perception of Library and Information Report (2006) which stated that '...most college users have not asked for help using library resources and desire independence.' (de Rosa, cited in Hahn et al., 2010:109)

Regarding the nature of help sought, it has been noted that '...people are seen as more valuable in wayfinding assistance than the directories' (Schoonover and Kinsley, 2014:12).

There is a thread within the literature (largely from computing science) which proposes innovative solutions for improving wayfinding by using or building upon existing technology infrastructures such as Wi-Fi, Geographic Information Systems (GIS), Global Positioning Systems (GPS), Radio Frequency Identification (RFID), Optical Character Recognition (OCR) and QR code technology. Xia (2005) proposes a paper-based blueprint for a wayfinding App and also recognises that the level of granularity achievable (for example identification of the exact item via GPS) is linked to both the maintenance overhead and the accuracy of the result which may be compromised due to shelf-level classmark boundaries shifting over time.

In contrast to Xia's theoretical model, Hahn and Zitron (2011) created a working prototype in collaboration with students thus allowing for more practical fieldwork-based research to be conducted. Li and Deng (2008) also describe an online mapping system in use and describe some of the outlier scenarios which can occur such as identifying duplicate items held in different locations and correctly mapping both of these.

Some of the above proposals suggested are now looking rather dated. For example, barcodes have largely been replaced by RFID tags, so piggybacking upon the former as suggested by Robinson et al (2014) may no longer be feasible.

Several of the studies used handheld devices or optimised their Apps for use with small screen devices. For example, Hahn and Morales (2011) produced a mobile website wayfinding App. There was also a project at the University of Oulu in Finland in which handheld devices were loaned specifically for the purpose of wayfinding (Aittola et al., 2003). This may indicate that it was felt that there was demand for this service to be available from such devices, possibly due to their portability.

Paterson and Low (2011) found that mobile devices are being used to find known items and that 55% of users had expressed an interest in being able to search the library catalogue in this way. However, it would seem that usage of these devices for library services in general has not expanded at the rate one might expect given their ubiquity. For example, Christiansen (2015) found that many participants in his study 'did not find tablets conducive to academic study'. Having said that, such studies did not filter on the discrete function of finding a physical item on the shelf for which the demand may be higher due to the need to travel physically with a portable device. The beneficial impact of a mobile App on the user experience relates to the issue of affordance of technology as an enabler or restrictor in learning. This has been studied by Laurillard who stated that

'we must take care to maintain a narrative, in collaboration with the learner. Teachers and designers must be clear what kinds of learning activities it takes to understand a topic, and then create the affordances for those activities.'
(Laurillard, 2000:17)

Hahn and Morales (2011) made an interesting discovery that navigating use an online App can cause existing signage to be used differently because the software prompts the user to "look up" at points during the journey to the item itself. This blurring of the physical and digital would merit exploring further.

2.3 Impact of students' experience and study level on their ability to locate material found in the online catalogue.

There is no specific literature on differences between undergraduate and postgraduate student level issues relating to wayfinding. However, Zaug et al (2016) compare novices and experts drawn from the undergraduate group. The dominant finding was that whilst experts find it easier to navigate the stacks, it does not take much experience for the skills gap between novices and experts to dramatically reduce.

Also, Hahn and Morales (2011) provided evidence that novice users can successfully navigate to the general area of the stack six out of seven times using a wayfinding App. They did not test their ability to do so without an App, so it is not clear what the resulting impact on helping such novice users might have been.

Outside of wayfinding, there is research which compares library uptake of information literacy and reference services between undergraduates and postgraduates. For example:

‘Reference and instruction activities represented the lowest level of usage for undergraduate students and graduate students. Graduate student and undergraduate usage in both areas was below ten percent.’ (Nackerud et al., 2013:15)

Also, there is some relevance to the finding (in relation to searching for online information) that:

‘...as the postgraduate student’s frequency of library use increased, their information seeking anxiety related to the ‘access barriers’ dimension decreased.’ (Erfanmanesh, 2014:76)

According to Barrett, postgraduates exhibit library skills much like those of undergraduates in early stages of their courses:

‘...much like undergraduates... [postgraduates] lack personal collections and substantial subject experience of the areas which they are researching during the early stages of their programs.’ (Barrett, 2005:330)

The relatively small amount of work done on wayfinding differences at student level constitutes one of the drivers for the current research.

2.4 Conclusion

This literature review has defined wayfinding and its context. It has established that there is a discernible problem for users in locating materials on the shelf. The one investigation into understanding of classmarks (Murphy et al. 2013) has identified that users have difficulties interpreting them. However, this and the potential issue of a terminological understanding of classmarks is not evident in the literature.

The problem of navigation of buildings was reviewed and in particular studies which have concentrated on understanding library layout problems using techniques such as spatial syntax (Li and Klippel, 2012) were noted. Physical and digital strategies for improving navigation ranging from signage improvements to wayfinding Apps were examined and it is clear that there are good precedents to build upon but that some of the recommendations (for example orientation from where the user is located) are yet to be successfully implemented. It would appear that combining the physical and virtual signage (Hahn and Morales, 2011) would be something worth replicating within the current research in order to study the impact. Mobile device usage was not necessarily well embedded within library users' experiences.

Stratifying by different types of user indicates that novice users may not need much experience before they are able to navigate a library but there are very few studies on wayfinding that delineate by student level, one of the objectives of this study.

3 Research Methods

3.1 Introduction

Of the three objectives, two of them require research to be conducted. These are:

- Objective two: To assess the impact of students' experience and study level on their ability to locate material found in the online catalogue.
- Objective three: To explore the impact of introducing a wayfinding App combined with physical signage on the ability and perceived student experience of locating such material.

The main driver of the study being undertaken is to allow empirical research to be undertaken whose results can be compared with those in the literature in order to make an assessment of the impact of introducing a wayfinding App at Goldsmiths, University of London.

In respect of objective two, the literature review identified a gap in the assessment of perceptions and experiences of differing study levels in wayfinding. This study will attempt to include an assessment of this by incorporating it into the research design.

A hypothesis is made that the introduction of a wayfinding App will have a positive effect on the ability of students to find items. This will be tested via a field exercise in which users will be asked to find items both with and without the App, allowing for these contrasting experiences to be analysed.

A notable aspect of this research approach will be the inclusion of a second perspective by seeking feedback from members of library staff who will be asked to comment on any feedback they have received or observations they may have about the effect of introducing the App.

The next section describes the research strategy adopted to achieve the above objectives, including the means of collecting data and analysis, together with the site and sample selection. Following this, potential limitations and problems will be discussed.

3.2 Research strategy

The empirical aspect of this study is concerned with depth and richness ("exploring the impact...") and a number of inter-related aspects within a real academic library environment (Goldsmiths, University of London). It is useful to try to clarify the areas we wish to investigate as they may tend to point towards certain suitable types of research method and help to exclude others. These are shown in Table One below:

Table 1: Investigation, objective and proposed strategy

Investigation	Link to objective and proposed strategy
Whether there is a relationship between physical signage and the way in which the App is used.	3: Observation in the field.
How students perceive their ability to find items on the shelf.	2: Interview.
Whether this perception alters with the introduction of the App.	3: Observation in the field and log file analysis after App introduced to library and 2: Interview after field exercise.
Whether a novice library user has a different experience from a more expert one.	3: Observation in the field; and 2: Interview.

It seems clear from the above that an ethnographic observation element might be helpful, and this is backed up by the fact that the majority of the studies on wayfinding appear to include this. For example, Robinson et al. (2014) wished to evaluate the ease with which students were able to find books. This was followed by a demonstration of their Bookmark wayfinding App. They then asked participants to use the App to find some materials. Finally, another set of questions were asked to capture their experiences.

Hahn and Zitron (2011) state that ethnographic observation (which originates from the field of anthropology) is commonly used in this area as a research method. This has been defined as

‘the study of the culture and social organization of a particular group or community, as well as the published result of such study’ (Calhoun, 2002:149)

It would appear that the objectives might be most successfully investigated by virtue of a mixed methods research approach using the format of a specifically designed case study incorporating an ethnographic element. This entails using a variety of largely qualitative research techniques which allow for a more detailed focus on a practical application's use in the field. Conversely, a method such as historical research would seem to be unlikely to fulfil the objectives given the "real world" nature of the subject being investigated.

Given that qualitative research seems to be most suitable approach, a definition would be helpful here. Denzin and Lincoln, (2011:3) state that:

‘Qualitative research is a situated activity that locates the observer in the world ... [It] involves an interpretative, naturalistic approach to the world. This means that qualitative researchers study things in their natural setting, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them.’

Creswell and Poth (2018) add to this traditional definition the ability of qualitative research to "impact" upon or change the world.

The choice of a mixed methods case study is in line with similar fruitful studies in this field (Hahn and Zitron, 2011; Robinson et al., 2014).

Yin (2009:2) states that a case study approach is more likely to be appropriate when asking how or why some contemporary phenomena works. This also seems to fit well with the current subject of understanding wayfinding in a library. Specifically relating to this research area, Mandel's (2012) investigation of wayfinding in a library used a case study approach because it 'helped to understand a particular setting in its entirety'. In this case, the setting will be Goldsmiths University and the stakeholder focus will be the users of Goldsmiths library. The next question is what suite of tools and techniques will best be suited for a field of research of this sort, particularly where there is a desire to elicit depth and richness?

3.3 Data collection techniques

Referring to the various constituent parts of the case study, the following data collection techniques were deployed:

3.3.1 Online survey

A short online survey was delivered via the web using Qualtrics online data collection software during a two month period in the autumn term. The purpose was to establish a base line understanding of our target audience's characteristics and an indicative view of their broad perceptions about finding material on the shelf, to which the subsequent research could be tethered. This was used to inform the nature of the conversation in the subsequent stage, which was the conducting of semi-structured interviews. Qualtrics was chosen because it has robust anonymization options and is widely supported by universities including the Ethics Committee at Swansea University (Swansea University, no date).

3.3.2 Semi structured interview

According to Galletta and Cross (2013:9), semi-structured interviews are 'lived experiences as narrated in the interview in relation to theoretical variables of interest'.

In this case, it is the experience of finding an item on the shelf which is under investigation. They continue by advising that a data analysis plan is created first. This advice was followed and the broad themes to be investigated were categorized in order to ensure that the interview would cover the requisite areas of interest. See section 4.6 on Framework for data analysis for further details about themes.

An attempt was made to recruit subjects by advertising on University noticeboards and inviting participants of the online survey to become subjects. Galletta and Cross describe how "snowballing" can be used as a method of recruiting. This is where previous subjects recommend future ones. It was decided to discount this method as there was a risk that it could compromise confidentiality.

The incentive of a £20 Gift Voucher was used to attract recruits. The library also invited Library Student Representatives (LSRs) to participate by informing them that the research was planned.

Appendix B shows the script guide which was used during the interviews. The aim was to replicate good practice within semi-structured interviewing by splitting the session into three segments.

1. The opening segment allowed for a narrative grounded in participant experience to develop. The objective was to build up a rapport with the subject using open-ended questions which would allow them to describe experiences. Where necessary, a set of pre-considered probes were used to guide the conversation in the direction of the intended research topic. In order to maximise the possibility of fostering a good rapport at an early stage, the technique of cognitive mapping was used. Priestner (2017) has stated that this is more effective than face-to-face

question-and-answer style contact (eyeballing) and helps subjects to settle into an interview process more quickly.

2. The middle part of the process involved asking questions with a greater specificity in order to move towards depth. The aim was to try to ensure all research areas had been covered, looping back to references in the narrative stage where necessary. We were attempting to elicit meaning as opposed to simply clarity.
3. Finally, areas still requiring elaboration or which had not been sufficiently explored were covered. There was an opportunity to reference the subject area from a more theoretical angle. During this phase, signals towards closure of the interview were given after which the subject was thanked, emphasizing their contribution to the research.

3.3.3 Field exercise

Conducted within the same session as the semi-structured interview (and indeed feeding into its content as a practical "probe") was an exercise in which the participant was asked to find four items in the library – only two of which allowed for the use of the App. This ethnographic observational exercise has been successfully used by Lanclos (2013) who recommends that librarians adopt this technique to help us think how we use technology to engage users. In addition, the effectiveness of a similar technique used by Hahn and Zitron (2011) who asked their recruits to find items in the library supported the adoption of this methodology. Like the present study, they were trying to gauge the effectiveness of the introduction of a wayfinding App. Also, it is contended that given the similarities between the current study and the study conducted by Robinson et al. (2014), the addition of “before” and “after” interviewing would lead to a richer understanding of how students felt about using the software. Appendix C describes the exercise that was conducted, including the instructions which the participants were provided with.

The technique of concurrent think-aloud (CTA) protocol where the user verbalizes what they are doing during a task was adopted, in part because it had been successful in one of

the key wayfinding studies by Hahn and Zitron (2011). A comparison of CTA with an alternative technique, retrospective think-aloud (RTA) in which the user verbalizes *after* the task has been completed was conducted by Van den Haak et al (2004). The authors found that ‘the RTA method proved more fruitful in revealing problems that could only be detected by means of verbalisation’. (Van den Haak et al., 2004:1168).

However, it was decided that as there was a debrief element to this research design, some of the benefits of RTA could be picked up then and that important information might be lost along the way if CTA was not adopted.

3.3.4 Staff feedback email survey

An email was sent to Goldsmiths’ library staff with a few questions in an effort to obtain some extra qualitative feedback relating to the use of the App and any observations that staff may have had. See Appendix D for details of the email sent.

3.4 Data collection – site and sampling

The case study site was an academic library which primarily serves the community of Goldsmiths, University of London, which is located in south-east London. HESA statistics for 2016/17 indicate that Goldsmiths has 8,525 Full Time Equivalent (FTE) students of which 2,870 are recorded as studying at postgraduate level (33%) (Goldsmiths, 2016:8). The UK average at the same time was 30.4% postgraduate (HESA, 2018), meaning that Goldsmiths has slightly more postgraduates than average.

Convenience sampling was used to choose this site. The researcher was able to gain access to this library via an existing professional relationship with the Library Director. The population is registered users of that library. Findings cannot necessarily claim to be representative of other libraries, particularly not those which are from outside the academic sector. In terms of the subjects recruited for the ethnographic portion of the study, a stratified sampling approach was taken based upon the student level cohorts of undergraduate, post-graduate (taught), and post-graduate (research) students. An

attempt was made to select some participants with little experience of using the library in order to investigate whether the variable of experience affects the findings.

3.5 Quantitative elements

Whilst the majority of this case study takes the form of a qualitative approach, there are two elements which are of a more quantitative nature. Before looking at this, it is useful to define “quantitative research”. Given (2008:225) has defined this as ‘approaches to empirical inquiry that collect, analyze, and display data in numerical rather than narrative form’.

3.5.1 Quantitative element 1: Log files

Log files were examined from the Wayfinding App in order to deduce how many map requests had been made during the research period of 7th Dec 2017 to 6th April 2018. These were compared with loan circulation statistics for the same period, to provide a general barometer of demand. The techniques for extracting the data and the parameters chosen are listed in Appendix E.

3.5.2 Quantitative element 2: Task times during field exercise

In terms of the items to be found (either with or without the App), times to find items were compared as part of objective three relating to the impact of the App. An attempt was made by the researcher to select candidate items so that they would be broadly similar and not located so near to each other as to influence the results. In order to assist with this, the walking times were excluded from each task (see Appendix F) so that raw “time to travel” was removed as a variable.

3.6 Framework for data analysis

3.6.1 Themes

In order to provide the maximum amount of clarity when interpreting the findings, a number of thematic categories have been identified which relate to objectives two and three listed in this chapter's introduction. These categories are as follows and are defined here:

3.6.1.1 Wayfinding barriers

This refers to aspects of the library's architecture or signage which in some way impair the ability of users to find an item. Examples of this might be incorrect, unnoticed or ambiguous signage.

3.6.1.2 Study level and familiarity

This is about how or whether the study level of the student (whether undergraduate or postgraduate) affects their perceived experience and ability to find material. Familiarity relates to experience of using Goldsmith's library as opposed to any wider familiarity with libraries.

3.6.1.3 Specific information literacy skills

This is a very narrow definition relating to the users' ability to decode the classification schema once a particular stack-level area of the library has been successfully found.

3.6.1.4 Ability

This permeates a number of the other themes. In this context, it refers to a user's observed level of skill (during the field exercise) rather than their perceptions of this.

3.6.1.5 Experience

Whilst this is designed to probe slightly wider than the tertiary academic experience, it also includes looking at a subject's experience of wayfinding at the current or other libraries whether at tertiary or an earlier level of their education.

3.6.1.6 Seeking assistance

Drawing on a variety of methods of getting help, this covers issues such as how likely help is to be sought, what the nature of that help might be and who or what might provide it. It includes self-help where a user takes some action independently to further their progress.

3.6.1.7 Self-efficacy and resilience

Self-efficacy relates to particular beliefs that people have about themselves and is more fully defined in section 3.1.2.

Kurbanoglu et al. (2006) developed a scale to measure self-efficacy which related to information literacy. In her 28 point scale, C8 "locate information sources in the library" is the one which most closely matches this study which is interested in the level of self-efficacy displayed in relation to finding items on the shelf. This study will test for self-efficacy before and after the field task to see if a difference is discerned.

The link between low self-efficacy and an avoidance of challenging activities correlating with less inclination to develop information literacy competencies was established by Kurbanoglu (cited by Ross et al, 2016). This links to resilience and this study will attempt to observe the extent to which resilience in the face of adversity is exhibited.

3.6.1.8 User experience design (UX)

User experience (UX) has been defined as

‘..a consequence of a user’s internal state (predispositions, expectations, needs, motivation, mood, etc.), the characteristics of the designed system (e.g. complexity, purpose, usability, functionality, etc.) and the context (or the environment) within which the interaction occurs.’ (Hassenzahl and Tractinsky, 2006:95)

In this study, it relates to how the way in which the information is presented via the App (or online catalogue results page from which the user derives location information) affects the perceptions or performance of the user. Also, whether there is anything about the physical layout and signage which impinges upon this.

3.6.1.9 Time impact

This refers to time either wasted or saved and is measured in the field exercise.

3.6.1.10 Emotions and feelings

There has been debate about the extent to which these terms are synonymous. Manstead et al. (2004) argue that using different terms allows for clearer communication. They state that emotions have bio-regulatory reactions that promote (directly or indirectly) well-being, whereas feelings are ‘the perception of an emotional state as enacted in the body’ (Manstead et al., 2004:50).

The words “emotion” and “feeling” will be used in this study in the sense that Manstead has used them.

3.6.1.11 *Unexpected themes*

A place for findings which we may not have been expecting but which have nevertheless emerged.

3.6.2 Capturing the data

Monnett et al. (2011:184) have described how taking notes during an interview can damage rapport and cause the researcher not to probe where necessary. Therefore, the decision has been made to record the interviews and field exercise (with participants' consent) on audio and transcribe them as soon after the interview as possible. This means that full attention can be given to the interview process as opposed to the capturing of results.

3.6.3 Coding the data

According to Pope (2000), there are two methods of analysing qualitative data – inductive and deductive. Inductive (referred to as “grounded theory”) assumes no categorization before the research is undertaken. Deductive (or the “framework” approach) identifies some themes beforehand as this study has done. These themes are not immutable however and new ones will be created or current ones reframed if the results indicate that this should be done.

The chosen themes were designed to help with codifying the semi-structured interview results in order to allow suitable inferences to be made. The method followed was to become immersed in the data and assign codes via an iterative process. Tracy (2013:189) has described how during the first stage, open coding is used which seeks to describe basic activities and processes in the data. Through a process of lumping and fracturing the codes, a set of more focused codes can be arrived at via constant comparison. A process of “negative case analysis” was then undertaken which Tracy describes as a process to

'..actively seek deviant data which does not support the emerging hypothesis' (Tracy, 2013:196).

Finally, a loose analysis was created which forms the basis of the results.

3.6.4 Reflections on the data collected

An important aspect of the research will be to reflect on the nature of the data collected in this case study and any emerging themes which appear to emulate findings in the literature. In order to do this, results from the literature will be compared with the results from this study. If matching themes are discovered, this would tend to support any conclusions drawn from the results.

3.6.5 Triangulation

Triangulation is a method by which results from two or more of the methods in a study can be compared in order add evidence that a result is as it seems (Rothbauer, 2008:2). In this study, the results of the survey will be compared with the emerging themes from the semi-structured interviews; the field exercise results; and usage evidence that the log files generate. The results of a brief email survey of members of library staff concerning the impact of introducing the App will be compared with the interviews and field exercise, giving perspectives from two different user groups (staff and students).

3.7 Limitations and potential problems

3.7.1 External validity

External validity is defined as the extent to which results be generalized. (Aronson and Wilson, 2007:46). Pickard (2013:109) has stated that case studies are not designed to produce generalizations but instead are intended to allow for findings to be transferred based on how applicable they might be within a given context.

This study cannot therefore be necessarily generalized to the university library community. Immediate generalization has been sacrificed for depth, what Thomas (2011:4) calls 'drilling down as deep as possible'. Foucault (cited in Thomas, 2011:4) adds that case studies allow for multi-dimensionality allowing the situation to be viewed from a number of differing perspectives. Aronson and Wilson (2007:48) advise that replicating the entire study in a different setting can increase external validity.

3.7.2 Reliability

Another pertinent issue is reliability and concerns whether the research methods chosen are appropriate and can be trusted. Case and Given (2016:227) state that this can be demonstrated by repeating the same study under the same conditions. Some steps have been taken to try to increase the likelihood that the study is reliable. First, it uses techniques of data collection which are well known in research circles and use robust methodologies. This enables one to 'look over the shoulder of the researcher' to judge whether indeed the research is likely to be reliable (Yin, 2009:45). Interviewees may exhibit bias or poor recall. We have tried to address this by incorporating the practical exercise so that things that may not be remembered may instead be enacted. Additionally, by using the technique of probing, it is hoped that this may jog the memory of the subject.

3.7.3 Personal reflexivity

Personal reflexivity considers the extent to which ‘our own values, experiences, interests, beliefs, political commitments, wider aims in life and social identity shape the research’ (Willig, 2001:10)

The author of the software is also the author of this research and naturally would prefer to see a successful deployment of the software. In order to try to counter any bias that may exist towards this, the use of rigorous and well-known data collection methodologies as described above have been instigated.

3.7.4 Semi-structured interviews

Galletta and Cross (2013:33) describe how the ideal way to conduct semi structured interviews is to keep interviewing recruits until saturation point is reached and no new themes are emerging. They continue by stating that commonly, practical considerations preclude this. In this study, resource is only available to interview a maximum of six subjects and it will be noted in the recommendations if there are still themes which would benefit from further exploration.

In order to elicit full and frank discussion, participants will be informed that anything that is attributable or identifiable to a subject (including quotations) will be anonymized.

3.7.5 Unobtrusive observation

In designing her wayfinding research which focussed on differing routes taken by users of a library in Florida which had two entrances, Mandel (2010) recognised that there is a potential for the obtrusiveness of the researcher to inhibit the user. She therefore placed herself in a discreet location from where she could observe behaviour. Given that in the present case study a relationship has already been established with the subject prior to the task in the semi structured interview – specifically by using cognitive mapping as a way of helping the participant to become comfortable, it is argued that this problem will

be somewhat mitigated. Conversely, the Hawthorn Effect (Mayo, 1924) implies that the user's behaviour might be being affected positively by the study itself:

3.7.6 Hawthorne Effect

Payne and Payne (2004:108) describe the Hawthorne Effect in which the user's behaviour can be affected by the study itself. For example, there is a potential for the artificial way in which certain items have been chosen in the field exercise to trigger this, as they are not items which the user has been driven to find themselves to meet a particular academic goal.

3.7.7 User interface

The App was tested by library staff at Goldsmiths as part of user experience testing of their new Library Management System. Whilst this is very far from being a fully UX tested piece of software, it does recognise and attempt to mitigate the possibility that the user interface may be adversely affecting the results achieved by the user of the App.

3.7.8 Log file analysis

There are several limitations when using the log files to analyse the usage of the App which have dictated that a relatively simple approach to this should be adopted. First, there are many things which are pertinent, but which log files do not record. For example, the usage of items retrieved from a shelf within the library itself, but which were not borrowed. The scenario in which an item which was successfully located, but was rejected by the user as not relevant to their requirements after a perusal at the shelf. Also the external variable of rising usage of e-books noted in recent years (SCONUL, 2015:2) and its attendant impact on print loans cannot be successfully isolated.

3.7.9 Spatial differences in the library

The relative ease of finding one item in one part of the library versus another is difficult to quantify. The technique of spatial syntax might help to control for this, in that one could allocate a weighting of "difficulty" to the item. However, there is not resource available to conduct this here. Some attempt was made however to equate raw distance between each item to be found during the field study (see Appendix F).

3.7.10 Specific learning disabilities

The researcher was anecdotally aware of an opinion that levels of dyslexia were high at Goldsmiths. Wolff (2002) has found that levels of dyslexia amongst art students was significantly higher and as Goldsmiths is an institution which specializes in art, it is therefore a high risk that the sample will include such students. Whilst field study participants will be asked to volunteer this information if they wish to, it is not within the scope of this study to investigate the reasons that this may affect wayfinding.

3.8 Adjustments which had to be made in the field and effect

In the event, all the semi-structured interviewees were drawn from the LSR group as advertising on the university noticeboard was unsuccessful in attracting recruits. There is a risk that this sample group exhibits bias when compared with the general student population, something which is discussed further in the discussion chapter.

Similarly, it was not possible to find post-graduate (research) volunteers and so an equal number of postgraduate (taught) and undergraduates were chosen instead. This was deemed as satisfactory as it still allows the objective of study level as a variable to be investigated.

4 Case study findings

4.1 Introduction

This chapter presents the results from the research, the design of which is described in the research methods chapter. The reader is reminded that objectives two and three are the ones which are pertinent to the research conducted in this study:

Table 2: Objectives

Objective number	Objective description
2	To assess the impact of students' experience and study level on their ability to locate material found in the online catalogue.
3	To explore the impact of introducing a wayfinding app combined with physical signage on the ability and perceived student experience of locating such material.

4.2 Characteristics of recruited sample

Participants A and B both declared that they had Specific Learning Disabilities (SpLD) which is defined as an umbrella term to describe difficulties which affect the way information is learned and processed (British Dyslexic Association, 2018). Participant A identified as having dyslexia and B as having dyspraxia.

It is reasonable to assume that these conditions may have contributed to impairing ability to find materials to some degree. However, it is not within the scope of this research to investigate why this might be.

4.3 Survey questionnaire results

There were 69 responses to the online survey which ran from 6th September to 5th November 2017. The main results are shown in Figures one to eight below:

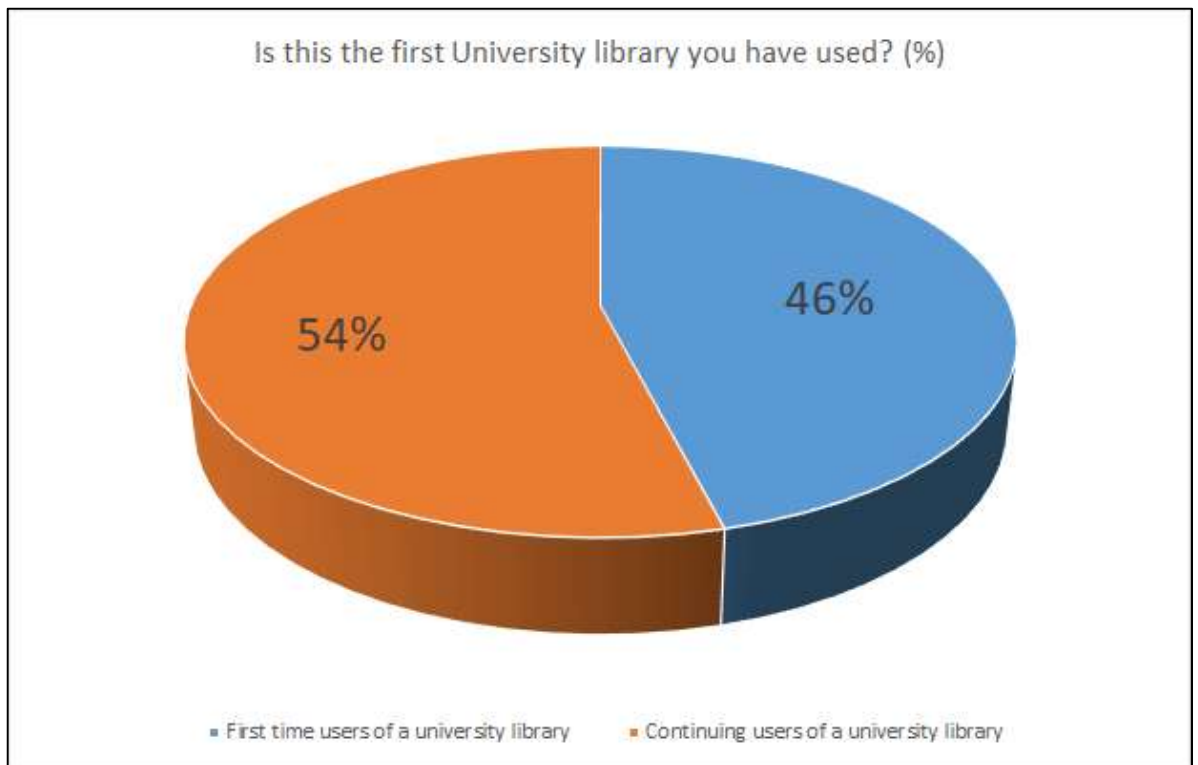


Figure 1: 46% of respondents were first-time users of a University library

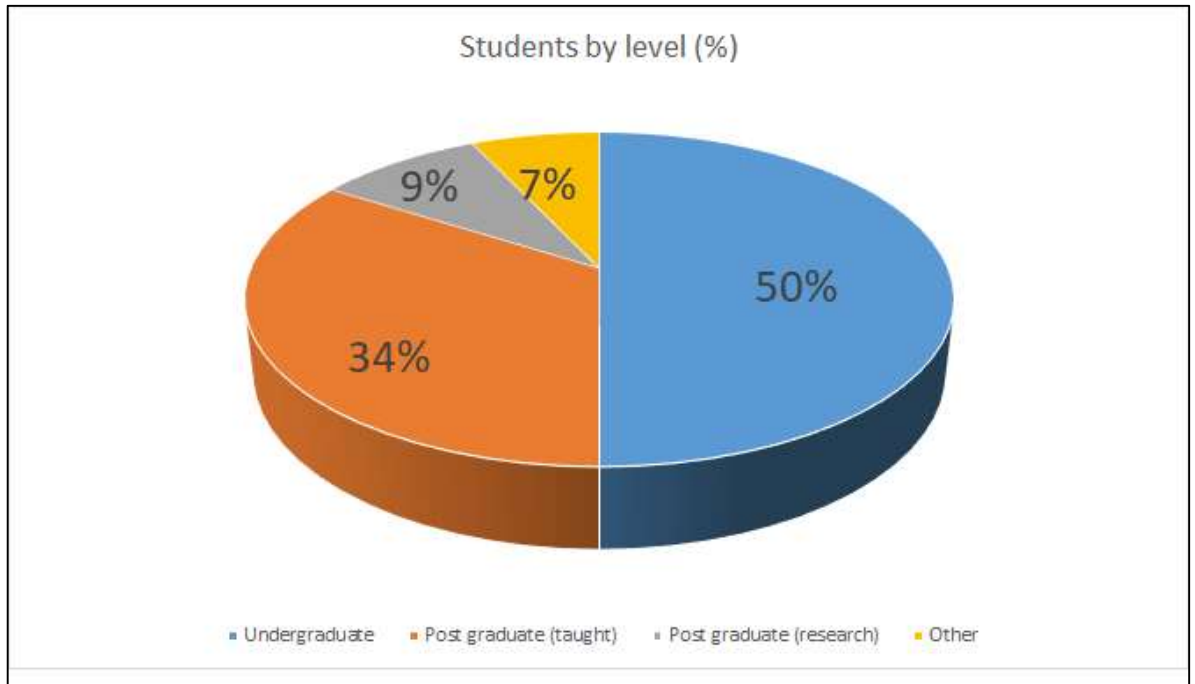


Figure 2: 50% of participants were undergraduates

It can be noted from the above that the profile of the sample's study levels (50% undergraduate; 50% post-graduate) matched well with the answer to the survey question about the submitter's study level.

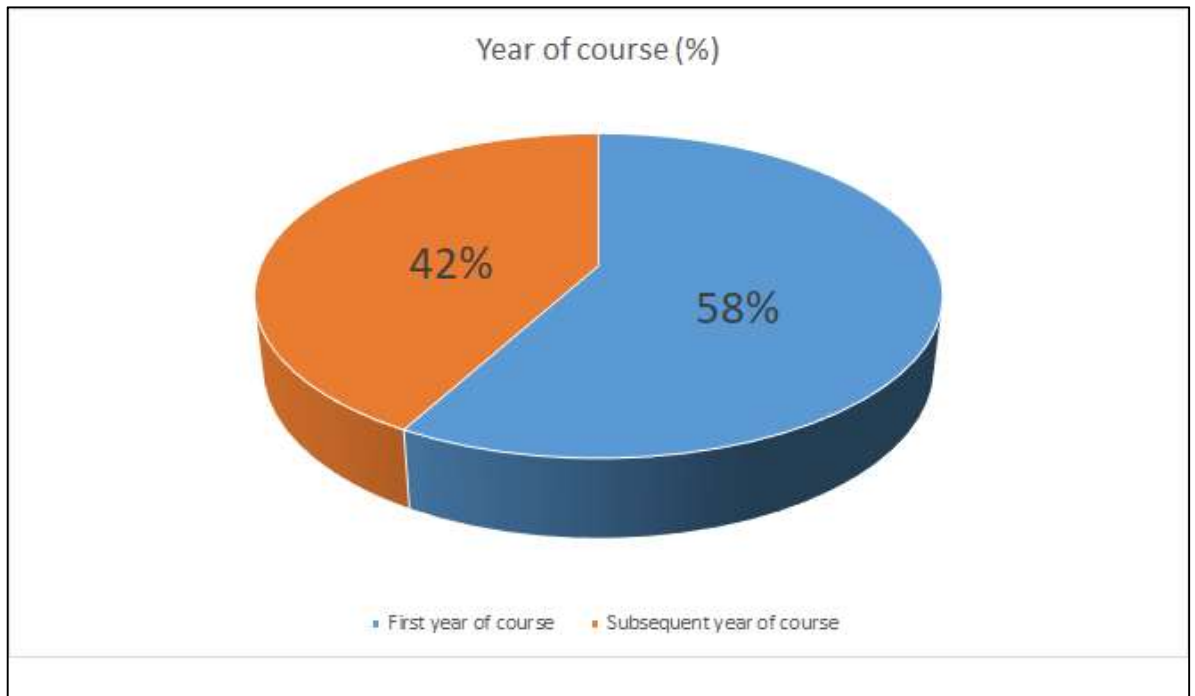


Figure 3: 58% of respondents were in the first year of their course

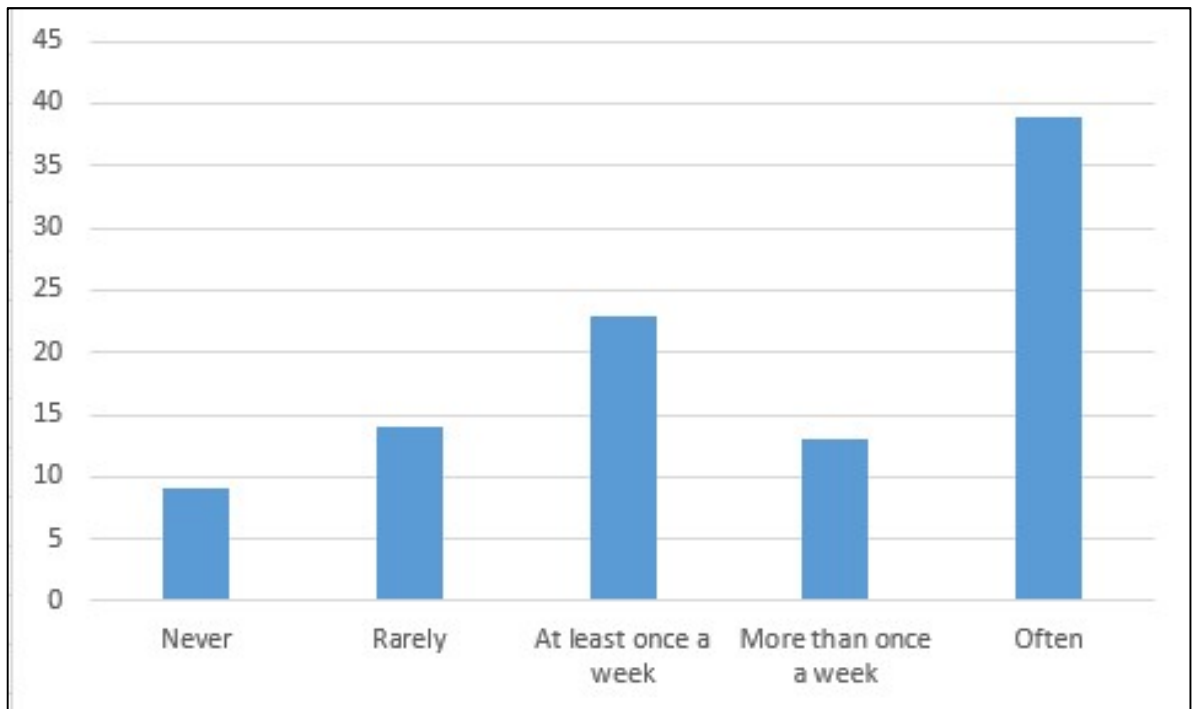


Figure 4: Frequency of use of library: 52% used the library more than once a week or often

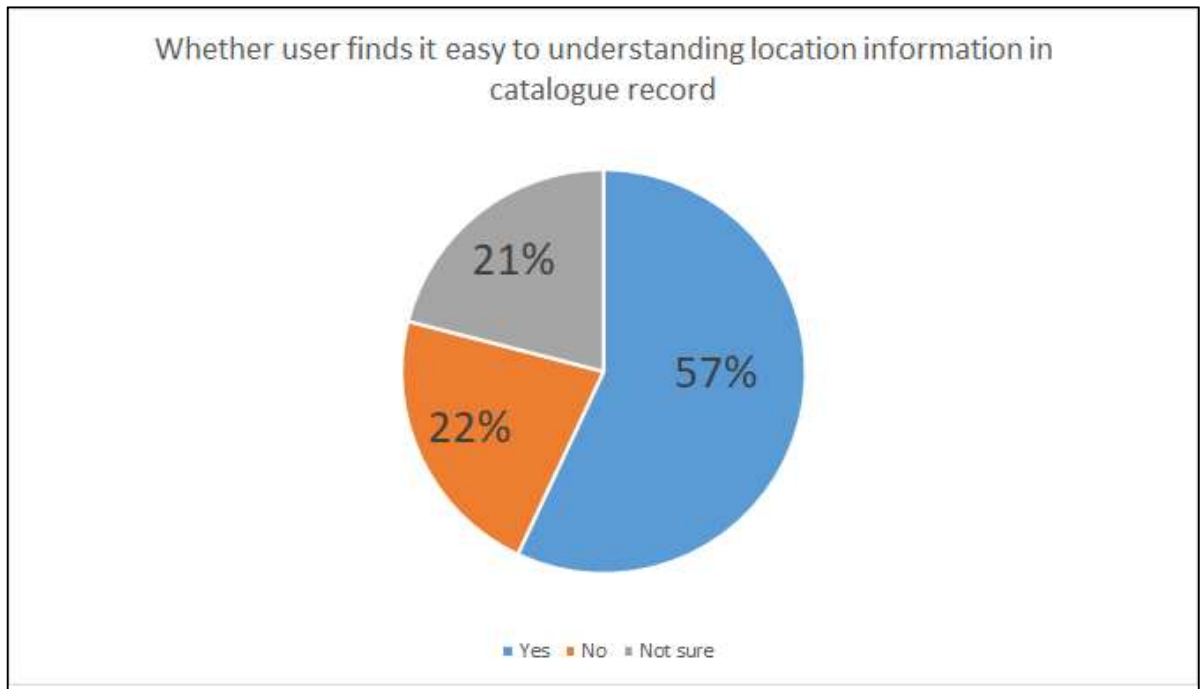


Figure 5: Catalogue ease of use in relation to item location information: 57% claim to find it easy to use.

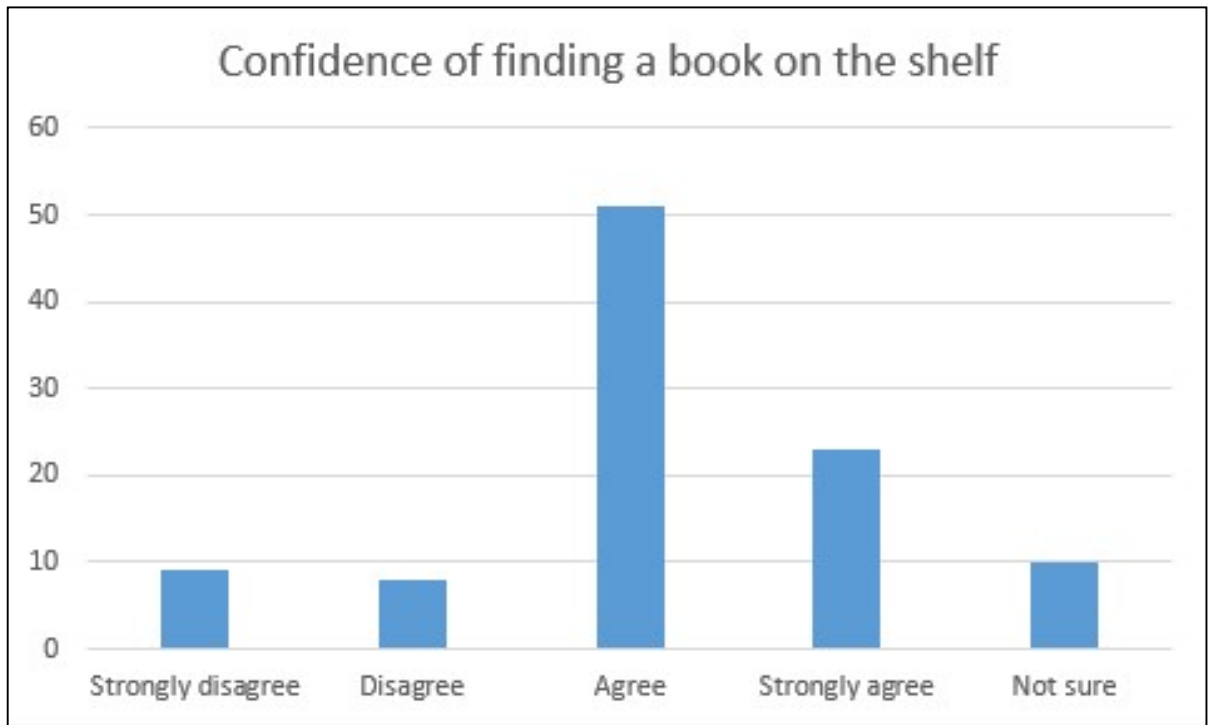


Figure 6: 74% of respondents strongly agreed or agreed that they were confident finding books on the shelf.

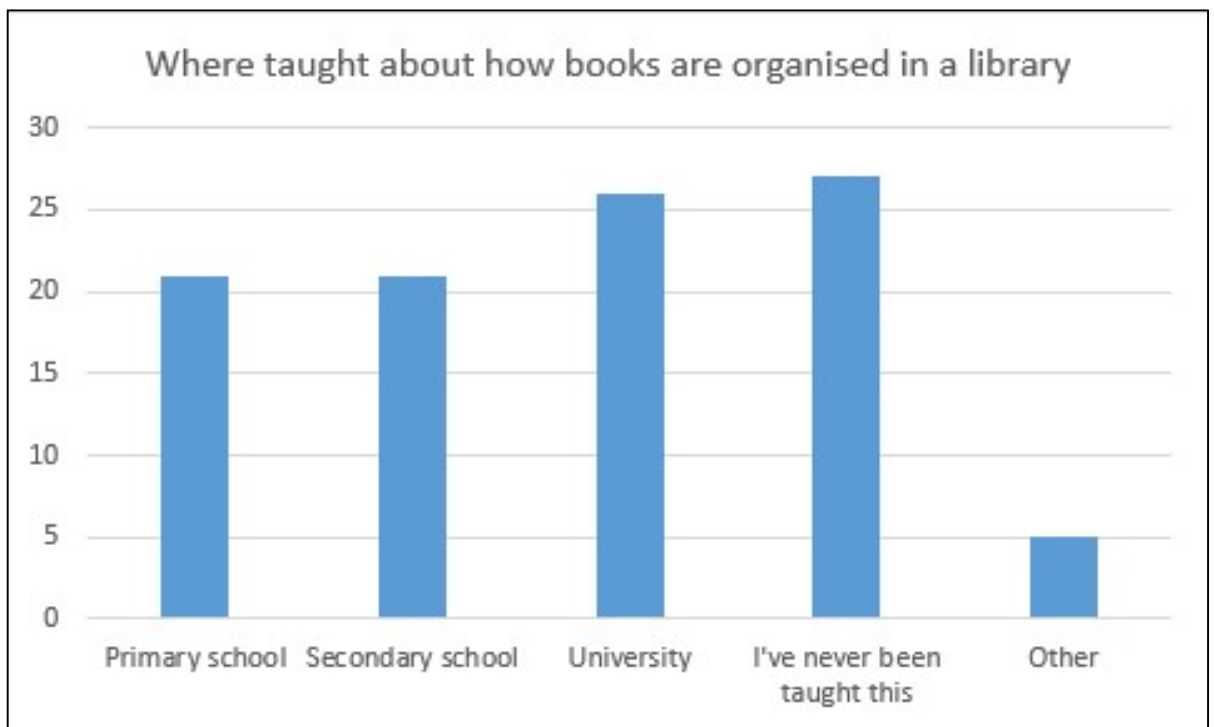


Figure 7: 26% of respondents have had information literacy training at university level

In terms of what respondents would do if they were unable to find the area in which material was shelved, 57% stated that they would ask a librarian, rising to 64% if they were having problems finding the actual item. Figure eight shows these findings:

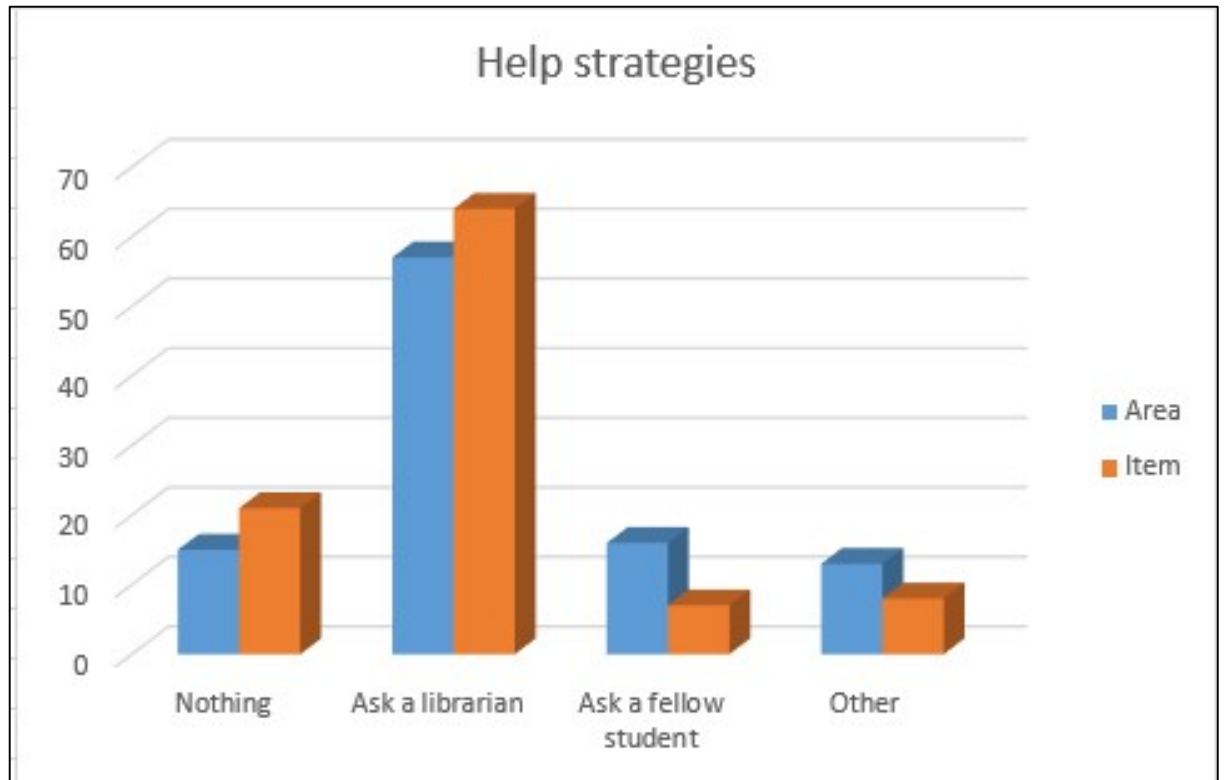


Figure 8: Help strategies

4.4 Semi structured interview and field study results

4.4.1 Participant profiles

Table three shows the characteristics of the participants in the field study.

Table 3: Sample characteristics

Participant Code	Study level	Year	Course duration	Sex
A	Undergraduate	3	3	F
B	Post Graduate (Taught)	1	2	F
C	Post Graduate (Taught)	1	1	M
D	Post Graduate (Taught)	1	2	F
E	Undergraduate	3	3	F
F	Undergraduate	1	3	M

4.4.2 Field task results

There were four tasks completed by each of the six participants (24 tasks in total). Two were to be completed using the App and two without. Appendix G describes the tasks set. Of the 24 tasks, 21 (87%) were completed successfully without prompting. Of the three tasks which were not:

- Participant F failed to complete task two (for which the App was not available) due to identifying the wrong area of the library which happened to have the same classmark range but was in an entirely different collection.
- Participant B would also have failed task two if she had not had assistance from a librarian to find the correct stack location.
- Participant F initially thought he had found the right book for task one (for which the App was available) as it had the correct classmark. However, the title was not

the one which had been requested. When this was pointed out, he then completed the task.

4.4.3 Results from interviews and field exercise

4.4.3.1 Ability

In terms of completing the task and finding an item, all participants were able to do so, regardless of whether the App was being used. There were however, distinct differences in the total times taken to resolve the tasks which help to analyse ability. This is shown in Table four below:

Table 4: Task completion times – see also Appendix H for details of how these calculations were derived

Participant	Task 1	Task 4	Task 2	Task 3	Total Times (secs)	Average time per task	Ability ranking
	With app		Without app				
A	02:53	05:04	04:32	06:11	17:50	04:25	6
B	04:05	02:08	04:33*	02:17	13:03	03:16	5
C	00:56	01:05	01:19	02:03	05:23	01:20	1
D	02:31	01:21	02:17	04:06	10:15	02:33	4
E	00:52	01:07	01:32	02:13	05:44	01:26	2
F	01:41*	00:56	02:29*	03:05	08:11	02:02	3
Average completion time	02:10	01:57	02:47	03:28			
* = FAIL							

This demonstrates that on the basis of time taken participant A exhibited the lowest ability level and participant C the highest.

4.4.3.2 Wayfinding Barriers

During the exercise and interviews, a number of issues which led to participants finding it more difficult to locate items became evident.

a. Sequence issues

Three participants (A,D and E) confirmed that they were unsure of the directional flow of books on a shelf, shelves within a bay, bays within a stack and a stack's place within a group of stacks. In particular, almost every participant was confused by a gap in the sequence (see Figure none) during task two when being asked to find a book without the App.

005.3 – 006.68	006.68 – 070	GAP	133 - 150	150 – 150.19
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Figure 9: Gap in shelf stack sequence

For example, participant A said 'It's like no man's land in between the trenches'.

Participant E stated that gaps had caused her confusion in the past and she was only now able to resolve them due to experience:

'It did not make sense to me at first when I had to look for these. I think we have one of those in the anthropology section as well and I spent a lot of time circling one shelf to be able to find [it].'

Progress from here depended on the subject's prior knowledge of the layout of the library.

b. Collection confusion

Four participants (A, B, E, and F) mentioned that finding oversize material, shelved in a different location was both confusing and illogical from a user perspective.

c. Signage confusion

Incorrect end-stack signage which was not known about before the exercise (task three) caused all subjects a certain degree of anxiety because they had to browse through further stacks until they reached the correct one. Figure 10 illustrates the problem encountered:

End stack labels	821.79-822.33	822.33- 822.99	822.99 -823.83	823.83-823.99
Actual range of books	821.79-821.99	821.99-822.4	822.4- 822.99a	822.99g - 823.29
Location of book	X			

Figure 10: Subject is looking for **822.99 Pr** which is in another stack.

Three participants (B, C, and E) stated a wish to see subjects delineated within a stack so that they could tell where one subject boundary ended and another began. Even those who were not so specific (e.g. participants A and F) stated that subject lists on ends of stacks might be helpful. There were also indications from participants D and E that the end stack signage granularity was too generic, as a classmark range referred to both sides of the single physical stack as opposed to stating the range for each side. Figure 11 illustrates this last issue.

Current end stack signage:	
← 125-150 →	

Preferred signage :	
←125-137 138-150 →	

Figure 11: Current and preferred end stack signage

General signage in the lobby areas was underused (or not noticed at all) by the participants. Participant D said she would not have known that the numbers on the existing signs even related to classmarks as opposed to room numbers and thus the researcher observed some room for ambiguity and misinterpretation here. A number of

participants wished that there was something more visual in the lobbies (e.g. a map) rather than the solely text-based signs.

Three participants (B, D and F) could think of no solutions (or chose an incorrect solution) to find items for which the App was not available whilst not knowing where to go to find signage which might assist them, or for which no signage was available at all. For example:

‘123 LIB but I’ve got no idea how to find that so I’m going to go downstairs and ask the librarian.’ (Participant B)

d. Ergonomics

Two participants (B and C) stated that books located on the bottom shelf were too difficult to browse and that they felt it was easier to find books if the bottom shelf was unused. The proximity of desks to the stack in one location was mentioned as problematic by participant A because it was difficult to access the stack to find the book.

e. Virtual barriers

The catalogue was described as lacking floor numbers by all participants. For example, participant A (talking about what was available to her for task three) stated ‘No floor number’. Two (C and E) requested that extra locational information such as floor number should be presented in the catalogue record itself and not just the App.

4.4.3.3 *Time Impact*

It was evident that most participants had limited time for finding items in the library and would like to minimize this.

Four participants mentioned time spent walking up and down (or ‘cruising the aisles’ as participant B described it) and one (C) described his strategy to get in and out of the library as quickly as possible so that he could take his books to read elsewhere.

4.4.3.4 Self-efficacy

Participants were asked to state their confidence levels on a scale of one (low) to ten (high) both before and after completing the field task and the results were as follows:

Table 5: Confidence levels before and after the field exercise

	A	B	C	D	E	F
Before	4 or 5	Quite	7	7 or 8	9	5
After	10	Quite	7 or 8	9.5	9	8 or 9

Participant A elicited the lowest level of confidence in her ability to find a book on the shelf but her confidence level improved the most dramatically during the field exercise.

4.4.3.5 Study Level

There were a mixture of views on the extent to which study level affected wayfinding but a broad theme appears to be present which relates to lowered anxiety levels about this at post-graduate level. This is discussed further in the chapter six.

There was a disparity within the study levels regarding familiarity with finding books on the shelf. All the participants were aware of an “area” of the library which held material directly related to their courses. There was however a recognition by post-graduates that they would need to branch out from this as their courses developed and find other resources which were less tightly aligned to their core subject areas.

4.4.3.6 Familiarity

Familiarisation with the library was mentioned by two participants (C and E) as a reason for their need for the App being more marginal. However these both also stated that they could see why it would be of use to novice or more typical users of the library and for occasions when users needed to visit less frequently used areas of the library which might relate to the subjects they were studying.

4.4.3.7 UX

a. Landmarks

Several participants mentioned the importance of landmarks as a way of navigating and wished they were more prominently marked on the App image. In particular stairs and doors appeared to be critical. Participant D stated: 'So I don't necessarily see the stairs as well...'.

Participant B stated

'And also, it's very helpful for me because I navigate with landmarks as well, so being able to orient myself in relation to, for example the stairs...'

b. Library catalogue

In terms of the library catalogue record, most participants would have liked extra location details (in particular floor number) to be directly available without having to click for further information. For example:

'I think that there's some information on the App that could also be on the catalogue anyway that could make life easier, for example, the floors'
(Participant B)

In addition, there was confusing location information relating to collection which was meaningless to participant A said 'Where's the main library collection? We're in the main library aren't we?'.

45

Participant F liked the fact that you could access the App immediately from the catalogue search result.

c. The App

There were requests that the button from the catalogue record be made more prominent or some extra text added to explain its purpose. Participant E stated 'I think even just a stronger colour ...'.

Participant B mentioned "click fatigue" as being an issue for her:

'...if I click on it so I try not to waste too much time here if I possibly can so it needs to really tell me this is relevant'.

Participant F initially found the orientation rather confusing to grasp and said 'Sometimes it's confusing because it depends on your orientation like where you're facing'.

4.4.3.8 Experience of Other Libraries

There was little formal induction with libraries at pre-tertiary level available to the majority of participants. No-one stated that they had been taught how to use a classification schema at any point before they reached university. The majority of users had either browsed shelf (by author) or had access to simple subject divisions to browse. Participant D was typical when she stated (about her use of the public library) stated 'I had no conception of how the library was organized.'

At least two participants (A and D) claimed that their first experience of using an academic library (and trying to find books) had been an overwhelming one. For example, Participant A stated:

'...and you had these students come, straight from school. Everybody seemed to know how to embrace this system and actually, it's only about the second time I'd used an institution library.'

4.4.3.9 Help Strategies

A variety of strategies were employed when a user was unable to find an item as shown in Table six.

Table 6: Strategies employed when a user was unable to find an item

Subject	Strategy
A	Asked a librarian. Repeatedly disappointed with the level of help received; she perceived an over-reliance on results of the IT system by library staff and felt that her issue was rarely resolved.
B	Asked a librarian during the task
C	Confident that if he couldn't find the book, it was either missing or in use by another student in the library. Described himself as "stoic". Not overly concerned if he could not find it. Described using a netbook to compile a digital surrogate with elements of the book being sought as an alternative (self-help)
D	Asked a librarian (was unaware that reference books were returned to a recent return location instead of the shelf); mentioned that her previous library had offered a book-finding service for users who were unable to find an item.
E	Described herself as stubborn. A self-helper. Confident that she would be able to find the book if she perseveres (and if it was there) felt that there was no point in asking staff for help. If it is not there, she would also look for a book nearby which is similar and be content to use that instead.
F	Random browsing (walking around) or may ask library staff. Preferred to use online helpdesk chat than visit the help desk, even if on site.

Most participants felt that if asked for help, the librarian should look up the book on the system, verify if it is in the library and describe how to get to the location rather than actually accompanying the student, although they would appreciate the latter.

No-one used online help and only participant C asked a colleague for help and then only in the context of a group project team.

4.4.3.10 Information Literacy

Post-graduate study level students were less likely to attend induction sessions at the start of their course feeling that they had already been introduced to an academic library before and that the principles should be similar. Participant B stated that she had found more productive sessions to attend instead.

Participant E stated that Induction were held too early to be beneficial, having been run during Freshers' week when students would still be settling in to the university.

The following table lists comments made about how subjects learnt to navigate the library via any form of instruction available to them:

Table 7: Comments about learning how to navigate a library via instruction

Subject	Comment
A	'[the induction] was so fast I couldn't remember what we did afterwards and you probably needed to do it three times'.
B	During task two, on-the-fly training was given by the librarian asked, to help the user understand the general layout of the library and numbering sequence.
C	Expressed a view that finding books 'could not be taught' and that he had learnt 'by osmosis'.
D	She had learnt to use Dewey at a previous university where she had a library job.
D	Expressed a view that induction via PowerPoint was not enough and there was a need to 'venture out'.
F	Remembered being shown the subject area stacks at induction by the subject librarian.

4.4.3.11 Resilience

Four respondents to the survey and two of the interviewed participants (B and E) demonstrated resilience in the face of not being able to find an item immediately.

‘...with a little searching I can usually find what I’m looking for it’s just with the shelves the way they’re arranged’ (Participant E)

Participant B said ‘This will come eventually’.

Comments from the online survey respondents included ‘look harder’ ... ‘look around until I can find it’ ... ‘walk around till I find it’.

In addition, all field task participants displayed an impressive level of resilience in task three where the end stack signage was mislabelled and where they were experiencing varying levels of stress.

4.4.3.12 Emotions and Feelings

Participant A displayed by far the strongest emotional relationship regarding finding books in the library. A flavour of the language she used illustrates this:

‘What you've got here is a sort of panic attack ...; ... then I went back myself because I knew it was in the library and I found it. And I was very angry’

Emotions and feelings which more than one subject mentioned included:

a. Claustrophobia

‘...although I am very fond of [another university library], that library feels quite oppressive. It’s dark, it’s hemmed in...’ (Participant B)

b. Apprehension

Fear of an unsuccessful outcome featured as part of an apprehensiveness felt by some.

‘I am going to change the colour [on my drawing] from green to black. It’s interesting because I’m gonna draw all the stacks in black [Researcher: any reason why?] Right now I’m finding the reason I’m choosing a bit of black is that ominous feeling.’ (Participant D)

‘then I might look around there, but then I wouldn’t really know that there might be a book better suited for my needs in the sociology section which is very very similar.’ (Participant E)

c. Frustration

Two quotes sum this up well:

‘To be honest, I’m going into each stack without resolving the problem and it’s causing a lot of emotional ... like ... I don’t like this’ (Participant D)

‘It’s a choreography of my brain and increasingly frustrated search for the elusive book.’ (Participant B)

d. Stress

This was demonstrated by most users in task three in which the end stack signage was incorrect. A typical example is: ‘That was stressful.’ (Participant D)

e. Relief / Joy

Table Eight shows comments pertinent to this:

Table 8: Comments relating to relief or joy

Context	Comment
Participant B explaining her drawing.	‘That’s the site of relief’ .
Participant D explaining her drawing.	‘I’m gonna draw like a face that emotion of like when I finally find the book, it’s really like joyous’.

Participant A during the field exercise.	'Oh hold on a minute, I've just seen the aisle number, 46 so thank you. So that's Shelfmap.'
Participant D at the debrief stage.	'...but I think given that I was able to find the book with such ease, and emotionally not feeling overwhelmed in the first task, I think that was definitely helpful.'

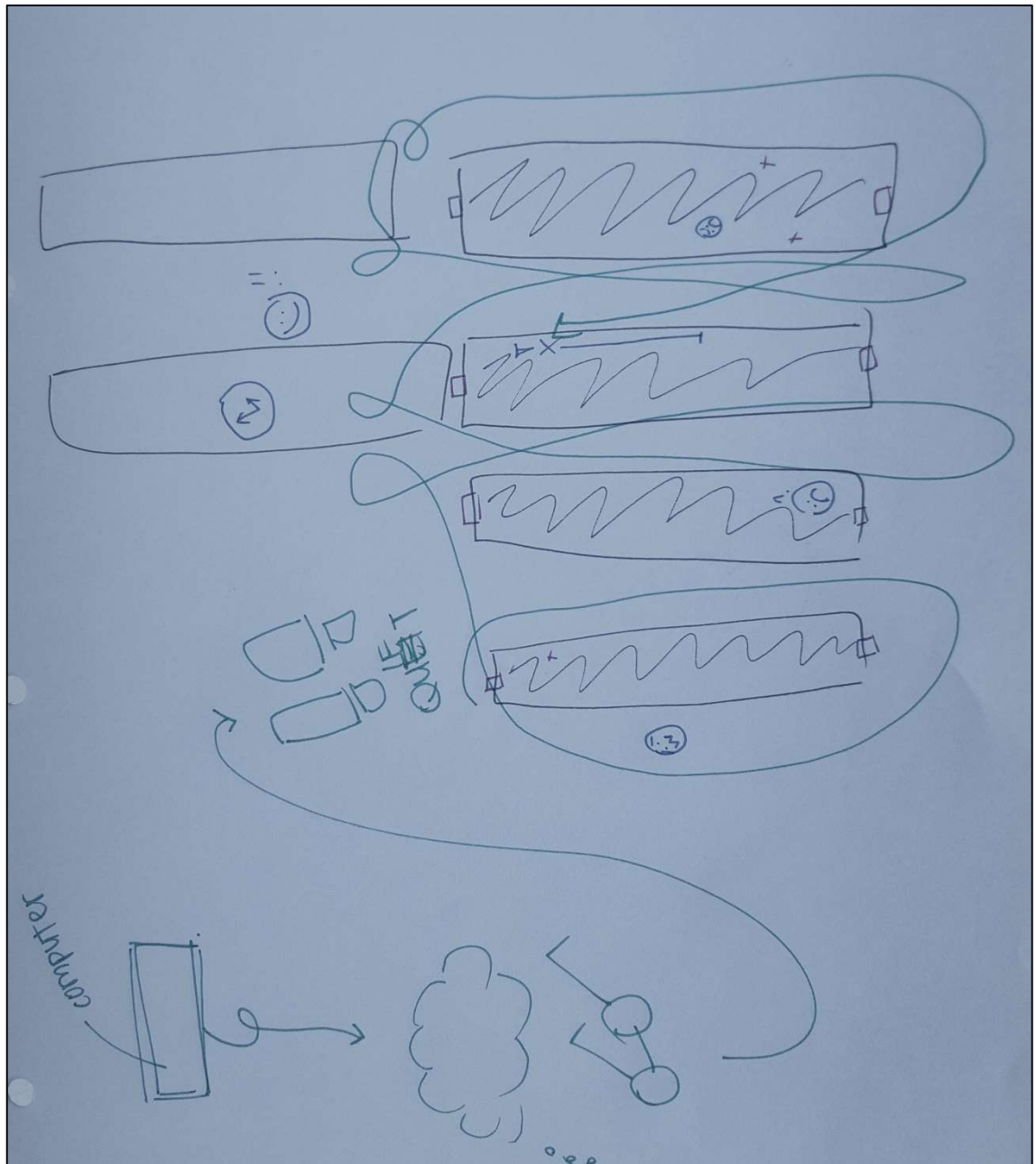


Figure 12: Participant D's cognitive mapping drawing showing a number of emotions (see also quotes above where she explains this). See Appendix I for the other cognitive mapping drawings

4.4.3.13 *Unexpected Themes*

a. Effect of Specific Learning Disability (SpLD)

Two participants voluntarily stated that they had been diagnosed with learning disabilities. Participant A reported dyslexia and participant B with dyspraxia. They both explained difficulties which this caused for them in respect of finding books on the shelf. Participant A stated that 'If you're dyslexic, you might also be dyscalculia and the numbering system drives me barmy because the numbers float around ...'.

Participant B stated that moving in space was a problem and that:

'It has an impact on your ability to do I suppose may be more basic sequencing and organisation tasks in the moment because your working memory is under a lot of pressure from the other processes'.

In relation to the App, B noted that the three dimensionality of the image improved her ability to position herself within the physical space saying she felt more comfortable '...as long as it's 3D so I can imagine I'm immersed in it and I can see what's on eit'her side of me...'.

b. Visual: Use of colours and alternative systems

Three participants stated that they would prefer a more visual route into the material (A, B, D). Participant A felt that colours should be used in the end stack signage saying 'I've often thought why don't they have these more in colours?'.

Regarding signage in the lobby, participant D stated 'I think for someone who's very visual, the signage itself was not visually appealing'.

Participant A mentioned another Higher Education library which she had visited in which there was a more appealing (in her view) way of finding material:

'They've got a different way of finding books, via serendipity. So you go somewhere in the area that you might think but books are deliberately placed either side for you to maybe not pick up that book, and you learn...It's set up in a very particular way with great care. It's an organic process.'

c. Unusual strategies

Participant C described that he still likes to browse print journals

‘Yes. Particularly in [another university library] because the Reading Room has all the journals around the side. So I’ve actually found really impressive journals just by browsing...’.

d. Mobile Device Usage

Participants D and F specifically mentioned that the ability to use the App on a mobile device was helpful. For example:

‘...because I have Shelfmap on the phone so I think like having it on the device is definitely helpful because I can refer back to it.’ (D)

e. Floor level – International convention assumptions

Participant E had found confusion in the floor numbering system because he was used to the Ground floor being labelled as “zero” instead of “Ground” in his country of origin.

4.4.4 Usage of App during trial period

The App was installed in Goldsmiths between 7th December 2017 and 6th April 2018 during which time there were 13,582 requests to the App which would have resulted in a map being displayed.

The monthly breakdown is given in Figure 13 below:

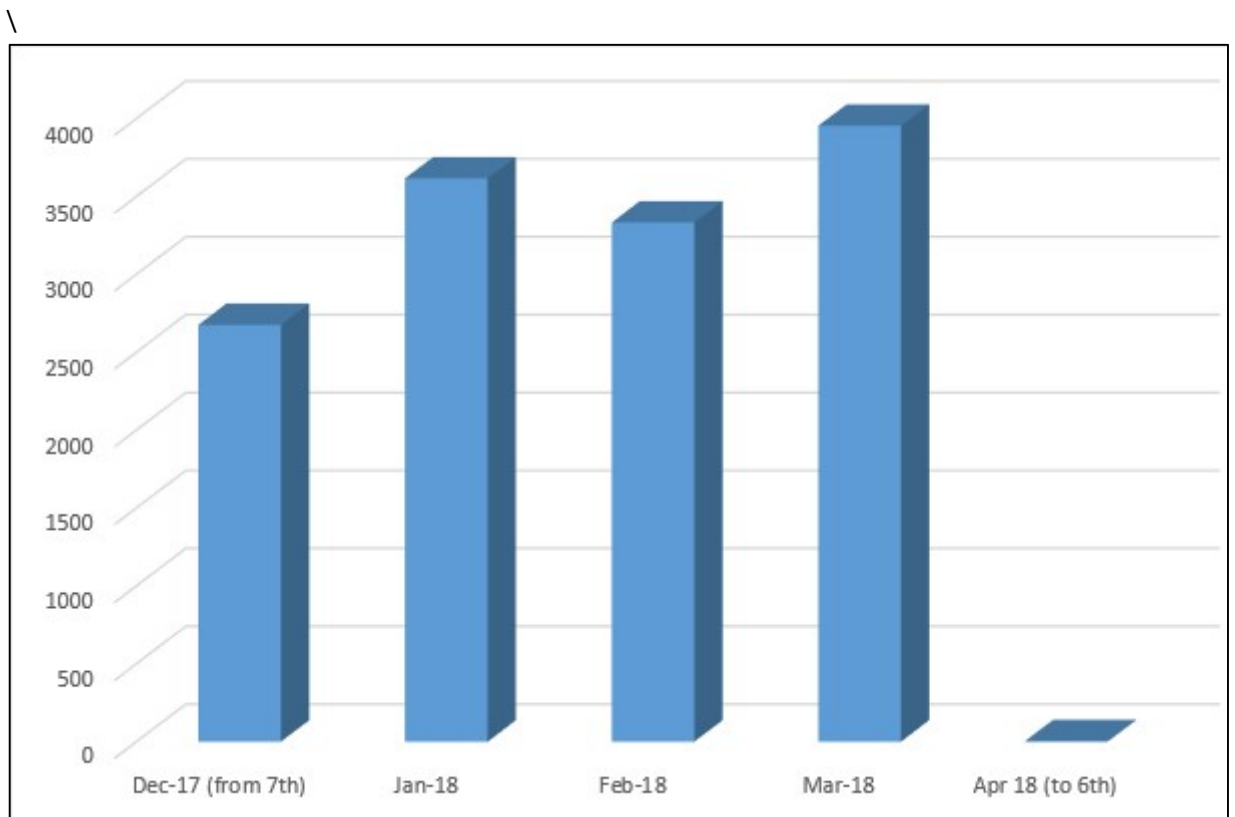


Figure 13: Requests per month to the App

4.4.5 Library staff feedback

Responses to the email survey were received from five out of 40 library staff (12.5%) and repeating themes are listed in Table nine below.

Table 9: Library staff survey responses

Response theme	Number of responses	Example quotation
App is being used	3/5	'Just to let you know that I have had students come to the front desk and when I have been shelving, clearly demonstrating that they have been using Shelfmap.'
Maintenance of class mark ranges is important to ensure accuracy	4/5	'Some library users have complained that the Shelfmap is not accurate. This can be true as books can move around, especially after shelf tidying. I expect this could be resolved by updating our systems after shelf-tidies or book moves.'

4.5 Synopsis of results

The key results from this research are that the introduction of a wayfinding App has a positive impact, in particular on ability to find the area of the library in which an item is to be found in a timely manner. The effect on ability is more significant for users with less familiarity with a library than expert users, but expertise does not necessarily align with a user being an undergraduate (inexperienced) as opposed to a post-graduate (experienced). Use of the App appears to reduce perceived stress associated with finding items and increase self-efficacy. The next chapter interprets the results in the light of the existing literature in order to draw better some inferences about the validity of the results.

5 Discussion

5.1 Background

This chapter discusses and analyses the results in the context of the objectives of the research and the existing literature. It takes both objectives two and three and subdivides them into their constituent parts allowing for a more focussed discussion.

5.2 Discussion of results which relate to objective two:

Objective two seeks to assess the impact of students' experience and study level on their ability to locate material found in the online catalogue.

5.2.1 Ability to locate material

5.2.1.1 Ability analysis

We can analyse the results of the field tasks by limiting them to those undertaken without the aid of the App in order to measure finding ability. The success rate for finding items without the App was 83.3%. In an experiment in which Eaton (1991) asked school students to find five items in the same area and timed them, there was a success rate of 97%. In Carr's study (2006), 92% of items were successfully found by public library users. Whilst these are different sample groups, it can nevertheless be said that they all represent a high success rate. Library stack navigation was one of the top two fail points noted by Hahn and Zitron (2011:31), the other being understanding of the library classification schema. For this study, the former was the top fail point.

5.2.1.2 Wayfinding barriers

There were various wayfinding barriers which the participants claimed impaired their ability to find items and which were observed by the researcher.

a. Signage

i) Stack

Regarding stack signage, the anxiety displayed by most of the field task participants to the mislabelling of end-stack classmark ranges in task three, demonstrated how this can adversely affect performance and cause users to suffer stress. The reaction to stress observed is in line with the stress/coping theory aspect of Wilson's Information Behaviour Model (Wilson, 1999). In particular, the two coping strategies described by Folkman (1984) were observed.

First, "problem focussed" coping in which the participants took control by continuing to search regardless of the fact that they had identified the signage was incorrect.

Participant E said 'Again, this is only because I've already had that problem so I kinda knew I could probably solve it'.

Second, "emotionally-focussed" (particularly with participant C) who released pent-up emotion following the task during debrief. She said 'I feel like I'm sitting with like stress of definitely the mislabelled – the 3rd task'.

Li & Klippel's (2012) observation that consistent signage played an important role in successful wayfinding was also aptly demonstrated by task three.

ii) General

Concerning general signage, the researcher observed that only two participants noticed lobby signage which may have helped them to determine the correct floor to visit at an earlier stage of their journey. The finding by Larsen and Tatarkas (2008) that a wall-mounted map could reduce user confusion was reflected in this study with comments about the non-prominent and non-visual nature of the signage:

‘I think much better overall mapping of the different floors on each floor and of the overall library would help enormously.’ (Participant A)

The lack of floor information was mentioned several times and echoes the finding of Bosman and Rusinek (1997:76) that users had problems identifying the floor to go to in their research. For example, participant F said ‘Yes but it’s only the Dewey decimal number itself, there is no like the floor’.

Confusion exhibited about whether the existing lobby signs’ information was referring to classmark ranges or room numbers was exhibited by participant D and suggests that redesigning such signage might have improved users’ ability to locate the correct floor. This is somewhat analogous with findings of Kress et al’s (2011) that users did not necessarily understand that the number in the catalogue record was a classmark. It simply transfers the same problem into the physical world. This is also echoed in the finding of Hahn and Zitron (2011:33) that the size and prominence of signage has a bearing on wayfinding.

b. Symmetrical ambiguity

At the lobby, there were two identical looking doors which caused confusion during the exercise due to the symmetrical nature of the library’s design. Figure 14 illustrates this:

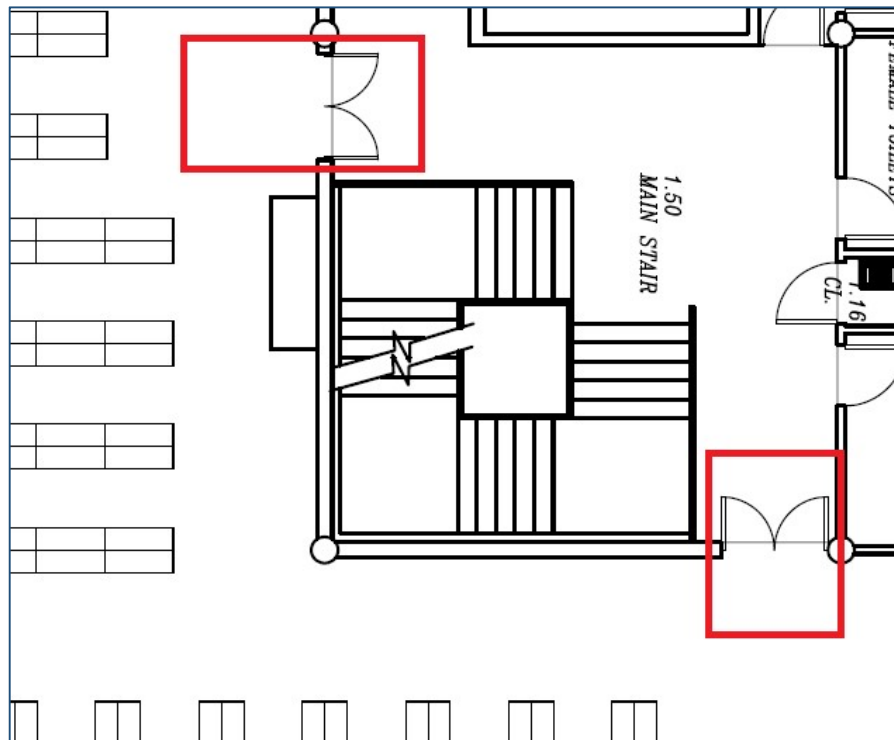


Figure 14: Showing two exits, from which it is difficult to decide which is the right one.

For example, participant C stated ‘...I wouldn’t know which door to exit from’.

This chimes with some of the findings in Li and Klippel’s (2012) study of wayfinding in a library which used the spatial syntax methodology which was described in Section 2.2.3. At this study’s site, when inside the lobby and contemplating which door to exit through, there is poor overview visibility in each of the two cases which makes the decision about how to proceed more difficult and demonstrates a low connectivity level. Further formal spatial syntax research would be needed to determine whether this is a problem in other challenging areas of the library.

c. Ergonomic

Difficulty in accessing bottom row of shelves was cited by two users as an impediment and matches findings by Rooney (1994) who noted that top and bottom shelves are difficult for many users.

‘What really annoys me is almost inevitably I’ll be carrying a bag and the books will be right at the bottom of the shelf so I have to bend over.’
(Participant C)

5.2.1.3 *Finding the area versus finding the item*

In respect of finding the item once an area had been successfully identified, five out of six interviewees and 73% of survey respondents claimed to be confident about their understanding of how to decode Dewey decimal class numbers and find an item on the shelf. A high level of aptitude was demonstrated during the field exercise. Further evidence comes from one of the responses from a member of Goldsmiths staff who stated:

‘We regularly solicit feedback and undertake UX tasks in the library and while we found little evidence that DDC is confusing to our users, there have been suggestions that a finding aid such as a floorplan is made available.’

In contrast, participants claimed to be less confident about their ability to find the “area” in which the item was housed. This was demonstrated to be an accurate assessment in the field, in that both the “area level” failures in the exercise related to tasks for which the App was unavailable. The reactions to these problems are reminiscent of Belkin’s Anomalous State of Knowledge theory (Case and Given, 2016:85). For example, participant B, having discovered that she was unsure where a particular stack was located, discerning an “information gap”, said ‘I’ve got no idea how to find that so I’m going to go downstairs and ask the librarian’.

This study’s findings partially reflect Murphy et al. (2013) who received many responses about the perceived difficulty of finding items on the shelf. It matched well in respect of difficulty in finding the area in which an item was located, but slightly less so in respect of ability to decode Dewey decimal numbers themselves. This is more obvious if the two candidates who declared a Specific Learning Disability are removed from the sample, on the basis that other variables may be interfering with their ability in this respect. The difference found by Murphy et al.’s research may result from their inclusion of a task to sort sequential cards which includes more complex (longer) classmarks, requiring a higher skill level than those chosen for the field task items during this research.

G 246 .B8 H37 1978	HG 22 .J68 PER	HG 186 .G7 C35 1978	HG 221 .M64 1985	HG 221 .W43 1965	HG 221.3 .C65 1994	HG 1971 .G7 B36 1999	HG 2201 .J38
301.227281	123	822.99	658.401				
STO	LIB	Pr	END				

Figure 15: Murphy's sorting task showing a greater degree of significance (4 levels) than the classmarks to be found during this research (2 levels)

5.2.1.4 *Ease of use of cataloguing interface*

All the interviewees and 74% of the survey users stated that they found it was easy to understanding the cataloguing interface in respect of presentation of item location information which rather flies in the face of Kress et al (2011) who found there was lack of understanding about this. Further reinforcing the argument that their understanding is good is the fact that the interviewees also demonstrated clarity about what information was not presented which might impede their progress, notably in respect of lack of floor level. Participant F said 'I think it would be great if the floor was here...'.

This also matches the findings of Calhoun et al (2009) whose respondents said they would like more detailed and explicit location information in the catalogue as well as the finding by Schonfield (2014) that Library Directors felt that known-item discovery was weak in indexed discovery services.

5.2.2 Impact of students' experience

5.2.2.1 *More on wayfinding barriers*

a. Artificial separation of sequences or collection

The barrier of collections not being co-located physically, whether for reasons of stack sequence order, (for example, out of sequence diagonally positioned stacks making use of the available space given the constraints of the library's architecture) or the common practice of artificially separating oversize material (for physical reasons) from normal sized material that relates to the same subject, was noted as hampering users' ability to find material. Table ten shows their comments.

Table 10: Problems with split collections and out of sequence stacks

Participant	Comment
A	'For a long time I couldn't find [the art journals] as they were on a diagonal [stack] and that to me, I didn't even know existed'.
B	Also, the oversize and books with large text and images often are put in a very different section away from their subject area, and that doesn't seem to make an awful lot of sense to me'.
D	'sometimes it says reserve stack, oversize and I don't know where that is'.
F	'Because I'm from the art department, the Q books the oversize books so like when I started I got a bit confused why I couldn't find this book because I missed out the letter Q'.

This matches the opinion of McKay and Conyers' (2010) that special locations cause wayfinding obstacles. It also reflects Bowker and Star's (2000) findings regarding related materials being located in multiple places.

b. The right amount of signage dilemma

In relation to ensuring that there is the appropriate amount of stack signage and that information overload (Jacoby et al (1974); Hahn & Zitron (2011)) is accounted for, the researcher noted that Goldsmiths used a minimalist approach, with signage being limited to a single Dewey Decimal classmark range for an entire stack (both sides). The signage had recently been re-configured in this way in order to comply with the university's branding policy but there was evidence that this had removed some useful information. Participant D noted that the classmark range signs alone were insufficient:

'And my biggest frustration basically with looking for books are the label tags on both sides of the stacks. They seem very unclear.'

In contrast (See Figure 16 below), the App aisle number added for the purposes of this research which is more specific, being granular to one-side of the stack was seen as being helpful by the interviewees and suggests that users can withstand more signage of this sort before information overload will take over. As participant A put it, 'Oh hold on a minute, I've just seen the aisle number, 46 so thank you. So that's shelfmap'.

The positive reaction to the presence of aisle sequence signage is also in line with the finding of Xia (2005) that such signs enabled users to navigate shelf ranges without difficulty.



Figure 16: One-sided granularity (aisle numbers) versus two-sided granularity (for the classmark range 155.7-204.4)

The lack of subject specific listings (removed during the rebranding exercise) at the stacks was highlighted as a concern for three people. For example:

‘...signs in the library aren’t really very clear. So it doesn’t really – it say’s like the numbers, it says from this number to this number on the shelf but it doesn’t explain the subjects’. (Participant E)

There was also some demand (from participants B and F) that indicators should be placed on the shelves to denote exactly where one subject ended and another began:

‘[it] would maybe be helpful if there was some way of indicating ... what the subjects of some of the adjacent shelves were so that as you are walking along you know you’re going in the right direction’. (Participant B)

However, there was a recognition of the maintenance overhead that this would generate which recalls the observation of Xia (2005) that there is a trade-off between specificity of shelf mapping systems and the ease of maintenance. End stack signage which listed the subjects within the stack was seen as being sufficient. These wishes also echo the findings of Carr (2006) who recommended that classmarks and stack subject lists should be available on end stacks. It also supports the finding of Hahn and Zitron (2011:32) that this technique was particularly useful in relation to first-year users of the library whose overview of classification schema as a whole may still be developing.

One participant (A) noted that there were unused sign holders above the stacks which she described as a 'lost opportunity'. The researcher observed that if used these would provide a perspective which allowed stack sequences to be viewed in a sweep (see Figures 17 and 18).

User must be at 90 degrees to see end cap signage and can only see one or two stacks at once



Figure 17: Current signage orientation

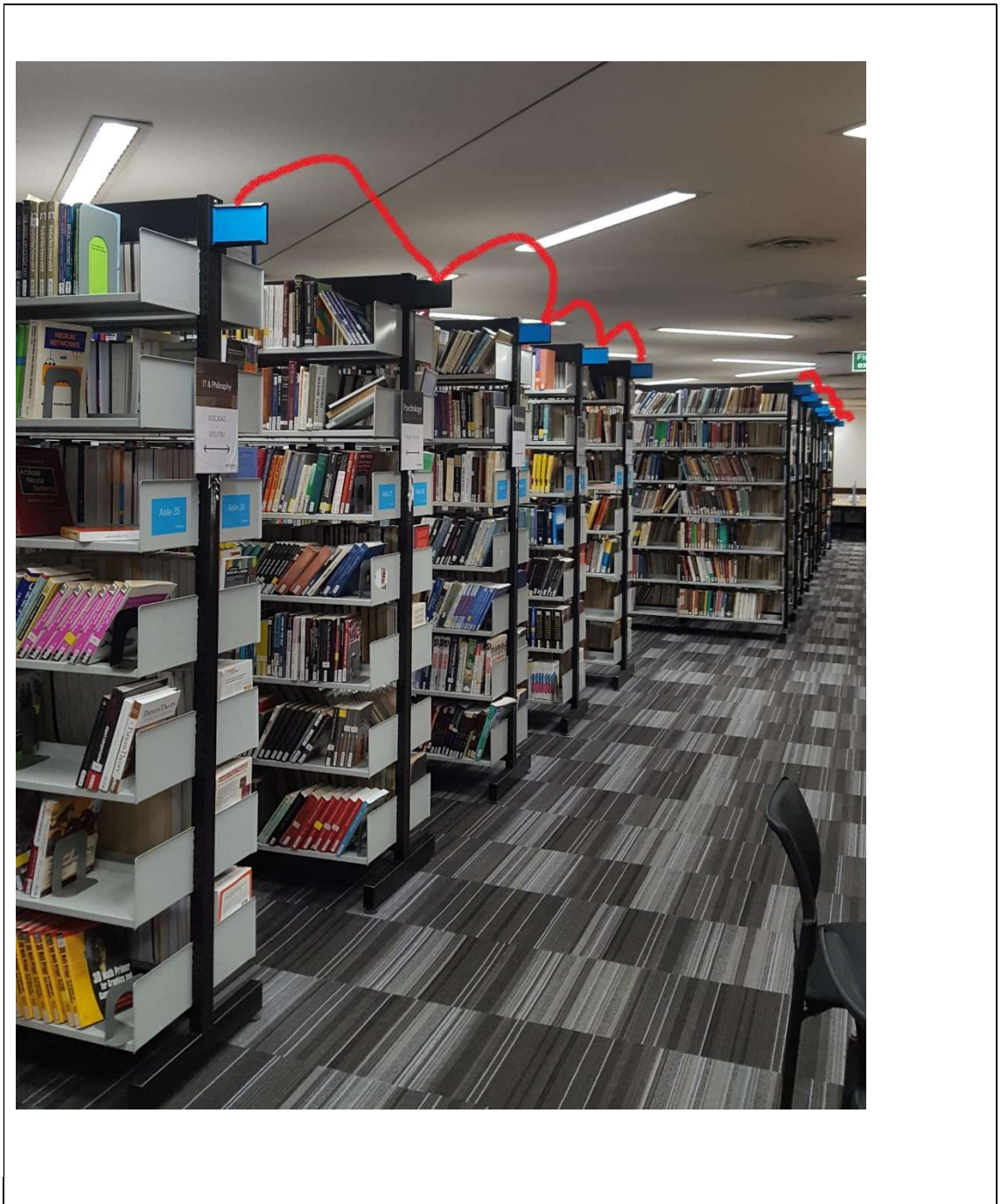


Figure 18: Suggested signage orientation in which a user can see a set of classmarks (shown by the red line).

5.2.2.2 *When do they ask for help?*

There was an impressive level of resilience displayed by all the participants, most notably in task three where there was mislabelled signage. Several participants claimed that they would be more likely to accept that the item was not there or to try different self-help strategies to find the item rather than seek help. For example:

‘But if the book isn’t there you can often find preliminary papers and chapters which approximate a large proportion of what the book is about. So I’m quite stoic about it.’ (Participant C)

The reluctance to ask for help chimes with the statement by Ruppel and Fagan (2002:186) that this has been a known issue since at least the early 1970s. Also, the finding of Currie (cited in Xia, 2005:64) that users may hesitate to ask for help for a variety of psychological reasons seems to apply here.

From the point of view of desiring independence, it also echoes Ho & Crowley (2003) who found that users wanted to be self-reliant in locating physical resources as well as Hahn et al (2010) whose handheld wayfinding devices were made available to satisfy a desire by the users for independence.

In both the survey and the interviews, the nature of the help sought was heavily skewed towards asking a librarian (60% on average chose this route), as opposed to the other methods potentially available such as collegiate help or seeking assistance online. Participant A used the analogy of wanting assistance from a person when describing help provided by a librarian who she felt was too reliant on the computer system. She said ‘...there's me a person telling you physically as a librarian it's not there "but the computer says it is’.

This partially (in relation to the librarian or collegiate help at least) fits with the finding of Schoonover and Kinsley (2014) about people being seen as more valuable for wayfinding assistance than online systems when you need help.

5.2.2.3 Feelings and emotions

The frequent and well described references by participants to terminology such as frustration, anxiety, a sense of foreboding or apprehension fits with the finding of Hahn and Morales (2011) that lack of knowledge about where things were located caused fear and anxiety. This also reflects the findings of Kuhlthau (1991) in relation to anxiety being embedded in the information seeking process. Figure 19 below demonstrates this visually.

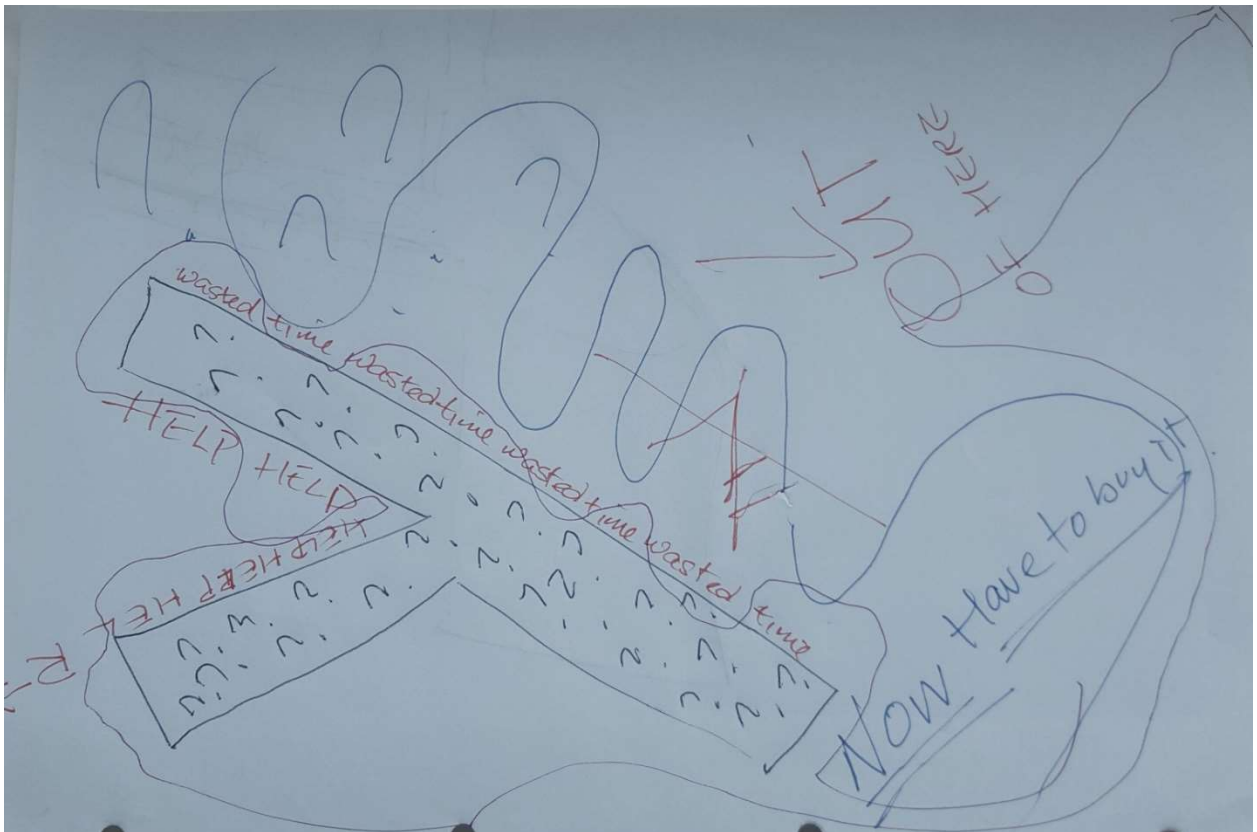


Figure 19: Cognitive map from Subject A displaying emotional distress caused by wayfinding problems. See Appendix I for the cognitive mapping drawings

5.2.2.4 Impact of users' experience of libraries

Three of the six interviewees had used academic libraries before which roughly matches the survey result of 43% of respondents being continuing users of an academic library.

Over half of the survey respondents used the library at least once a week and the interviewees displayed a negative relationship between increased familiarity with academic libraries and decreasing anxiety. This resonates with the finding of Erfanmanesh et al. (2014) that information seeking anxiety decreases following increased frequency of library use.

The transition from using public or school libraries to using higher education libraries was described as challenging by the participants:

‘Everybody seemed to know how to embrace this system and actually, it's only about the second time I'd used an institution library. I can't tell you how intimidated I was when I first came here.’ (Participant A)

‘...when I first came to an academic library, I really couldn't make head or tail about how it worked’. (Participant B)

As there was only one novice user in the sample (F), the following inference should be treated with some caution, but the fact that F demonstrated competence in Dewey class number decoding suggests that even a modest amount of academic library experience aids finding ability and that this increasing experience (regardless of study level) may be just as significant if not more so than course level alone. This would fit with the findings of Zaug et al. (2016) who discovered that it does not take much for the skills gap between novices and experts to be reduced.

5.2.2.5 Information literacy instruction

The low number of survey respondents who had received information literacy training at university level (26%) may partially be explained by the fact that the survey was conducted at an early part of the academic year meaning that induction sessions were still pending. However, Larsen and Tatarkas (2008) who noted that only 30% of students

attended induction sessions which showed how to read a classmark suggests that the figure might not rise very much. Of some concern is that 24% of survey respondents said they'd had no such training at any level of their education.

No interviewees stated that they had received formal instruction on how to use libraries before reaching university in relation to finding books or using a classification system. This echoes the findings of Murphy et al. (2013:110) who found that training on finding materials in libraries was often lacking.

5.2.3 Impact of study level

5.2.3.1 Ability

The researcher found that gaining a deep understanding of study level differences in ability remained elusive, which may explain to some extent why the literature in this area is fairly scant.

The survey showed that 46% of respondents were first-time users of a University library, and it is likely these were studying at undergraduate level. That 50% of respondents also declared that they were undergraduates appears to reinforce this assumption.

A large proportion of the 58% of respondents who declared that they were in the first year of their course are also likely to be new users of the Goldsmith's University library. One cannot tell what proportion of these are undergraduate versus post-graduate level.

The field task results revealed that in both undergraduate and post-graduate cases, the task success rate per group was five out of six tasks or 83%. In terms of average times taken to find an item, undergraduates as a group took 1:48m per task and post-graduates 1: 39m, so these times are broadly similar. As the two participants who declared Specific Learning Disabilities were in studying at different levels (one post-graduate and one undergraduate), it is not expected that this will have made much difference to the comparison.

With the exception of participant A, both undergraduate and post-graduate levels demonstrated a broadly similar ability in terms of decoding Dewey-decimal classmarks during the field task. It was noted that at least two of the three post-graduate participants had decided not to attend the general library induction, whereas all the undergraduates had all done so. Participant B said 'I didn't turn up [to the induction] because I'm quite familiar with libraries.' Participant C stated 'No I didn't [attend induction] as I'd already spent five years at Uni'.

This somewhat detracts from research by Nackerud et al (2013) who noted low induction participation levels, not only at post-graduate but also at undergraduate level. The undergraduates' ability was boosted by having most recently attended induction, whereas post graduate ability was boosted by experiential factors thus narrowing any ability gap between the groups. This would fit with the analysis by Zaug et al (2016) relating to the fast pace at which novices catch up with more experienced users.

There was some confusion about the order in which shelves are sequenced within the stacks which matches McKay and Conyers (2010) who discovered that some users did not know how shelving bays worked and thought they ran straight across. For example:

'...especially if there are other stacks and I don't really know where, which way the number sequence goes. ...or if it's a zigzag.' (Participant D – Postgraduate, concerning the way the stack shelving runs)

Participant F, an undergraduate said in relation to task 3 and the direction of stack shelving that 'because I didn't know whether it was ascending downwards.'

However as this was exhibited by both undergraduate and postgraduates, it reinforces the view that the study level skills gap is not particularly wide.

5.2.3.2 Anxiety and study level

Participant D stated that in the first two years of a four-year undergraduate course at a previous HE institution, she completely avoided the stacks because she found them intimidating and went straight to the desks in the library to work instead. This appeared to be echoed by participant E who said 'I'm in my 3rd year and I'm still trying to make sense of the Dewey decimal system ...'.

However, participant E also demonstrated a high level of resilience in the face of adversity (for example the mislabelled shelf in the third task) and referred to her study level as being a factor which added to her ability to resolve this. She stated that 'I don't know if a first year had that problem and they didn't really have any ideas of how to solve it if they would be a lot more confused'.

Participant B felt that in terms of layout, Goldsmith's library was 'a very humane space' in comparison to the library in her previous (undergraduate) institution and also cited previous experience using that institution's library as a reason for not needing to attend the Goldsmith's induction session.

However, in contrast, participant D felt her previous (undergraduate) institution's library had been organized in a way that she felt better able to understand.

Participant C (who had studied at both undergraduate and postgraduate level at Goldsmiths) felt that he was "much more focused" than he had been as an undergraduate. However, he had also studied at two previous universities for undergraduate degrees, so was an outlier in terms of having an unusually extensive vault of experience in comparison to the other subjects.

The wide and contrasting range of views given make it difficult to say much more than there seems to be a negative relationship between higher study level and reduced anxiety.

5.2.3.3 Skill expectations at differing levels

In terms of skills perceived to be required at the differing study levels, the post-graduate interviewees stated that they had either had to, or expected to need to (at a subsequent stage of their course) find material from a wider range of locations within the library than undergraduates, whose expectations were that their material would be largely housed in

the same place. For example, participant F (undergraduate) said 'I mostly hang out around level 2 because that's where the art books are.'

Participant D commenting on her undergraduate library use being focussed on one place, in contrast to her postgraduate use of the current library said 'So I kinda knew which shelves and kind of the types of articles I was assigned to look for'.

Participant B noted that she would need to be more "niche specific" in the next year of her course which could lead to difficulty finding items and require her to ask for help.

Her experience chimes with (Barrett, 2005) who found that like undergraduates, postgraduates lacked experience in areas they were studying during the early stages of their programmes.

5.3 Discussion of results which relate to objective three

Objective three seeks to assess the impact of introducing a wayfinding App combined with physical signage on the ability and perceived student experience of locating such material.

5.3.1 Impact on introducing the App on ability to find items

5.3.1.1 Background

The fact that participants were able to find 87% of the required items without prompting during the field study exercise suggests that the availability of the App is, in general, not a prerequisite for the objective of finding material itself to be achieved.

Annualised, the log files during the trial period predict 45,000 requests of the App per year at Goldsmiths would be likely to be made. The site loaned 61,000 items during the same period of the study. The requests made to the App during the three month trial when compared to the loan statistics show that there is demand of substance for such a service. This tends to reinforce the anecdotal evidence that the author experienced when a wayfinding system was trialled previously (Scaife, 2013).

5.3.1.2 Is there a difference in ability with or without the App?

Of the twelve tasks, eleven were completed successfully with the App (92%). During their study, Hahn and Morales (2011) found that six out of seven tasks were completed successfully using their App (85%). This indicates a broadly similar level of ability resulting from the introducing a wayfinding App. This study found a success rate of ten of twelve tasks (83%) without the App being available. As the Hahn study did not measure the “without” App equivalent, it is not possible to say whether the result difference was comparable and there are no other studies available to make such a comparison with.

However, it is the time taken to find items which was the most striking finding regarding ability. The two participants who fared worst (A and B) were, perhaps not surprisingly, those who had declared Specific Learning Disabilities. The descriptions of the kind of problems that participants perceive that their learning disability created are listed in Table 11 below and they are likely to have impaired their ability to some extent.

Table 11: Examples of problems caused by Specific Learning Disabilities

User	Impairment description
A	'the numbering system drives me barmy because the numbers float around and they change and I look up and down the corridors of the shelves just trying to remember that book if I've got it written down - it's horrendous'.
B	'And sequencing. So what that then has an effect on is because it's very difficult to coordinate, multitasking is a problem, so moving in space is a problem. It has an impact on your ability to do I suppose may be more basic sequencing and organisation tasks in the moment because your working memory is under a lot of pressure from the other processes'.

There was a positive relationship between the two fastest finders of items (participants C and E) and their high levels of information literacy expertise were demonstrated during the interviews. For example, C (the fastest) mentioned the concept of creating a surrogate of the book being sought which was not available by using search engines and database citations to partially recreate it for their own purpose.

Table 12 compares the average times to find the correct stack when the App is available as opposed to when it is not.

Table 12: Average time per task to successfully find the stack in which an item is located

Scenario	Average completion time - all	A and B (lowest ability)	C and E (highest ability)
With shelfmap	01:12	02:04	00:58
Without shelfmap	01:59	03:11	00:42
Saving (secs) per item	47	67	16
% time saving	39%	35%	27%

From this, it is possible to discern an overall time saving benefit from using the App of 39%. The time saved was of slightly less consequence for the highest achievers (four seconds) but appears to show that their perception of there being only marginal benefits of the App may be somewhat incorrect.

The time saving of 35% for the lowest ability participants (not far below the average) indicates that there is a positive impact here too and the relationship between negative effects of SpLD and App benefits is not strong. Similar but slightly lower time savings are found in relation to time to find the actual item.

Table 13 calculates the time savings to successfully find the actual item:

Table 13: Average time per task to successfully find the item

Scenario	Average completion time - all	A and B (lowest ability)	C and E (highest ability)
With shelfmap	02:03	03:33	01:00
Without shelfmap	03:03	04:23	01:46
Saving (secs) per task	60	50	46
% time saving	33%	19%	43%

Interestingly, the greatest benefits are achieved by the highest ability participants when looking at time to item, which further reinforces the view that the actual benefits are less marginal than this group perceive them to be.

5.3.1.3 Analysis of potential to resolve issues experienced when the App was not available

Of the three tasks for which users without the App exhibited problems, the explanations indicate that the App may have been able to assist in two of those cases (66%):

Table 14: Potential impact of App to resolve issues encountered

User/ task	Issue	Potential impact of App
F/2	Similar classmark identified as the correct one but was in a completely different collection	The App would have indicated the correct location of the stack and may have led to correct retrieval of the item as the user had a good understanding of the workings of the Dewey system itself.
B/2	User unable to find the stack at all without assistance	The App would have indicated the correct location of the stack without a librarian having to be asked.
F/1	User selected correct classmark but wrong title	This was (in the participant's own words) a "careless mistake" and probably a side-effect of the research itself in which a user was being asked to find a pre-selected item rather than starting by looking for a particular title they required. The Hawthorne Effect (see Section 3.7.6 above) is in evidence here, as the user's behaviour is being affected by the study itself. No App impact here.

5.3.1.4 A little familiarity makes a difference

The researcher observed that even during the field study, a little familiarity with the App inspired confidence for its use during later tasks. This was also backed up by debrief comments after the event. For example:

'I saw one of my course mates in the upper year and she had books and I immediately wondered, how did she find all those books and does she use shelfmap?' (Participants C during her second time using the App)

One of the comments made by Goldsmiths Staff seems to reinforce this finding. One of the respondents said ‘...people who do use it [the App] tend to love it and depend on it.’

5.3.1.5 Orientation

Participant F claimed to have had some initial difficulty in orientating himself within the map supplied by the App. Chia (2014) has suggested introducing intelligent path guidance with a 360 degree panorama in order to combat this. Instead of a map, you follow a path which is constructed from where you are to the destination. However, participant B indicated that this would confuse her. She stated ‘I’d much rather use [the App] like that rather than a Google Streetview thing’.

5.3.1.6 Signage and the App

There was also evidence in the field task that combining physical signage with the App was effective. Whilst following the participants, the researcher observed that the aisle number signs acted as “cues” on their journey, helping the user to move to the next stage. Participant A said ‘A bit more in relation to your [aisle] numbers actually well you saw it, I zoomed. A real plus. 10 / 10.’

This echoes the finding of Hahn & Morales (2011) that the software can cause signage to be used differently, with the user “looking up” at points during the journey, thus blurring the physical and virtual boundaries. In addition, Stempler (2013:507) noted that patrons returned less often to the reference desk after aisle numbers and colour coded signage had been installed. It is argued that the joint use of the App and signage is helping to avoid the information overload which could occur as a result of poor signage (see Section 2.1.2 above).

5.3.1.7 *Mobile device portability*

Two of the participants noted during the task that the portability of the App using a mobile device might eliminate the need to write down the classmark before hunting for the item, thus making the process less unwieldy. For example:

‘So that’s gonna also remind me of like the exact layout of the book – what I’m looking for without having to write any of this down. Typically I’d still write all this information down and that still takes time as well.’ (Participant D)

This indicates an improved student experience and chimes with Hahn and Morales (2011) who found that subjects expected the App to keep track of the class number in case they forgot it during the journey. It also matches the opinion provided by Laurillard (2000) that technology is beneficial where it is an enabler of learning.

5.3.2 *Impact of introduction of App on the perceived student experience*

5.3.2.1 *Emotional factors or feelings*

Four of the six participants described negative feelings in relation finding items on the shelf (see Section 4.4.3.12). These included claustrophobia, frustration, anxiety and stress. These same four participants also noted during the field task that the App had reduced one or more of these negative feelings. In addition, they reported positive feelings of relief and joy on successfully finding material. This matches Hahn and Morales (2011) who stated that ‘some responded with joy when they found the desired book’.

These findings demonstrate the positive relationship between the introduction of the App and an improved student experience. Table 15 below shows the contrasting emotional responses which were evident between the tasks for which the App was available and those for which it was not.

Table 15: Emotional factor contrasts

User	Keyword(s) describing emotion from interviews	Without App	With App
A	Anxiety	'This is where I get confused. [The sequence of the stack call numbers] is going down'. (task 2)	'so <i>that's</i> Shelfmap' - on the presence of aisle number combined with Shelfmap had in task 4.
B	Claustrophobia; Frustration	'If you had to do that all the time, you had to get multiple books, it would get quite frustrating'." (task 3)	Comment on task 4 (using the App): 'That was very easy'.
D	Apprehension; Frustration	'now I'm finding this very confusing [the gap which she has walked through to another set of stacks] so I don't know if it's on this side or this side and how it's related to the other stack'. (task 2)	'Whereas in the 4 th [task], I just went with according to what Shelfmap said. That was a lot easier and I think what I found most valuable about the experience and one that gave me like the least anxiety'.
E	Apprehension	'OK I'm not sure where this is so we'll just walk round the library.' (task 2)	On being asked if any comments about task 4 (using the App): 'It was really quick'.

Again, the findings in the field fit with those of Hahn and Morales (2011) that lack of knowledge about where things were located caused fear and anxiety.

5.3.2.2 Time saving benefit

The comments made five participants (A, B, D, E and F) relating to their perception of time having been saved (or not wasted) when using the App is something which was confirmed by the task completion times (see Section 4.4.3.1) and appear to indicate that

this is a factor which contributes to an improved student experience. The quotes in Table 16 regarding time saving add qualitative evidence to this:

Table 16: Comments on time saving showing improved student experience

Participant	Positive student experience
A	'Look I'm whizzing through.' (A)
B	'I feel like with the app, using it would save me time.' (B)
D	'I would have identified the book [in task 3] a lot quicker [if using the App].' (D)
E	'I feel like with the app, using it would save me time.' (E)
F	'...so we found the book really quick.' (F)

5.3.2.3 *Change in perceived self-efficacy*

As shown in Table three above which maps perceived self-efficacy changes on a scale, the outlier here is participant A, who during her interview described very low confidence levels in both finding material and the library service in general. However, her confidence in finding items increased by more than 100% having completed the task and had the opportunity to use the App. Her comments reflect this:

From:

'Every time I go to the oversize section I can't find anything at all.'

To:

'We saw it there. I was zoomed to finding that shelf. And I have been in that area before and I was there 20 minutes.'

There was also a healthy average increase of 19.5% in perceived self-efficacy within the remaining pool of subjects, which reflects Hahn and Morales findings (2011:420) that 'the

App can be a confidence builder and may help to lower feelings of library anxiety'. Two of the three participants (C and E) who described their confidence level as the same both before and after the field task had described how they were already familiar with the library and demonstrated a high ability level in the field exercise so it is perhaps not surprising that they viewed the App as being of more limited benefit to them.

5.4 Summary

This chapter has shown that students find more difficulty locating the area in which an item resides, than the item itself. The degree to which item location difficulty was not observed should be treated with some caution given that this contradicts findings in the literature. Having relevant information (both physical and virtual) available at the right time but which avoids information overload, aids navigators and reduces anxiety. Study level difference appears to be less significant than amount of experience in predicting ability. Although the introduction of a Wayfinding App only increases successful outcomes modestly, it has been demonstrated that it saves users time and increases self-efficacy and gives them a more positive student experience.

6 Conclusions and Recommendations

6.1 Introduction

This project has sought to discover whether users find it difficult to find materials located in the online catalogue and if the introduction of a wayfinding App can reduce barriers which may be restricting them from doing this successfully. The objectives will be discussed separately.

6.2 Summary of conclusions by objective

6.2.1 Ability to locate material found in the online catalogue

In assessing the impact of students' experience and study level on the ability to locate material found in the online catalogue, this study concludes that students find it rather more difficult to find the stack than to find the item when they get there. With regard to the latter, this somewhat contradicts the literature as it implies little difficulty in reading classmarks. However, it this cannot be ruled out as being a problematic factor due to the differing levels of complexity of classmarks users were being asked to decode in this study as opposed to others like Murphy et al. (2013).

Experience is a more significant factor than study level in regard to predicting ability of students to find items. The lack of study level differentiation has led to little new information being elicited in the area of study level as was originally anticipated, which may go some way to explaining the lack of literature in this area.

6.2.2 Impact of introducing a wayfinding App and companion signage

In exploring the impact of introducing the App on the ability and perceived student experience of locating such material, this study concludes that doing so allows students to find a book more quickly than they would otherwise do, although it has only a modest impact on changing the eventual outcomes themselves. A unique contribution of this research is that it compares times without and with the App in order to give a more

quantifiable idea of difference between the two scenarios. A time saving of 32% to find the book and 39% to find the stack was observed when using the App. Benefits were also observed for both low and high ability users. It is also clear from the log file analysis that there is a healthy demand for a service of this type.

Using a wayfinding App improves self-efficacy, reduces anxiety and improves the perceived student experience. There is some evidence that the three-dimensional layout of the maps, with prominent landmarks judiciously added can help a user to more easily place themselves within the space. Additionally, there is evidence that those with Specific Learning Disabilities benefit from the technology almost as much as those without.

Aisle numbers used in conjunction with the App reduce barriers to wayfinding more effectively than simply using the App in isolation.

6.3 Limitations

6.3.1 Generalisation

As this is a case study, the extent to which this research can be generalised is limited. Nevertheless, it gives a good indication of what can be expected in a small to moderate sized university library setting. In order to be able to make any further generalisation about its applicability in different library sectors, it would be required to repeat the research and make an assessment of whether the findings resemble those found in this study.

6.3.2 Hawthorne Effect

The Hawthorne Effect (Payne and Payne, (2004:108)) was in evidence in one participant's task during the field exercise, in which the correct item would probably have been retrieved if they were starting from a library catalogue result they had searched for as

opposed to being presented with a particular result which the researcher had chosen beforehand.

6.3.3 Sample bias

As Library Student Representatives (LSRs) made up the whole sample, there is a possibility that this means they do not fully represent the student population at Goldsmiths in general. The researcher was informed that the LSR role does not involve any end-user training (which such students are expected to have gained via the usual induction routes) which somewhat mitigates against the problem of “library user bias” which this might introduce. Nevertheless, it is possible that a sample comprising non LSRs would have yielded slightly different results.

Also, it was not possible to recruit PhD students and therefore these results are limited to Postgraduate (Taught) and undergraduate levels. Had PhD students been included, it is possible that more information would have been elicited relating to varying experience at differing levels.

6.3.4 Specific learning disabilities

The researcher had predicted a possible excess of these students in the research methodology and indeed it transpired that two of the six participants in the sample (33.3%) declared a Specific Learning Disability. Although it was not within the scope of this study to investigate the reasons this may affect wayfinding, there were some unexpected and interesting findings here which may benefit future researchers. In particular, there are plenty of ways in which signage and finding aids might be designed and developed in collaboration with such users which might reduce cognitive load. This could help such students successfully find materials by using the self-help techniques which students have demonstrated that they appreciate. The gap between the needs of these two groups certainly does not appear to be as large as one might expect.

6.4 Recommendations

6.4.1 Key recommendation

This study's key recommendation is that academic libraries introduce an online wayfinding system with companion signage which matches aisles displayed in the system. It should be embedded in the online library discovery system so that it is available at the point of use. The reason for making this recommendation is threefold. First, this research demonstrates that students can save time in finding materials when using an App, thus releasing further study time which may benefit overall student outcomes. Second, an App can reduce information seeking anxiety by providing the student with relevant but distilled wayfinding information. Finally, an overall improvement in the student's perceived experience matches a key objective of many learning institutions which is to increase student satisfaction levels.

6.4.2 Subsidiary recommendations

1. Ensure that end stack signage is maintained and accurate.
2. Place prominent maps within lobbies and areas of key wayfinding decision making where visual distance is restricted and there are multiple direction choice.
3. Ensure that a signage policy exists which has been developed, preferably involving users in its creation, building on this study's finding that a student perspective offers a unique insight into the problem of wayfinding.
4. Review location information included in the library catalogue to ensure that only relevant locational information is displayed, and only where this contributes to finding the item, as opposed to irrelevant or non-contextualised information which may simply confuse the user. For example, a collection name that is not related to a geographical location should be excluded.

6.4.3 Recommendations which relate to the App

1. Ensure that the button which is embedded in the library catalogue record is sufficiently prominent and descriptive enough for users to understand its purpose.
2. Where possible, ensure that images in the wayfinding App are oriented to highlight the position of landmarks within the building such as stairs and lifts, in order to reduce the cognitive load of deciphering the location of the stack being sought.

6.4.4 Areas for future research

- There is a trade-off between the maintenance overhead of labelling each shelf and bay within a library and the perceived and actual benefits that a student might accrue from this. A study in which the App was used in a shelf-level library setup, comparing the results with this study might help to calculate this cost-benefit more accurately.
- Explore the impact which might be achieved by presenting different App views based on the current location of the user in order to afford a perspective which might further reduce wayfinding anxiety.
- The impact of Specific Learning Disability on ability to find materials in libraries and the contingent benefit from wayfinding tools would benefit from further research as it appears to be an area in which a positive impact can be made.
- A watching brief on developments in the area of indoor navigation should be maintained. Organisations such as Indoor Atlas (2018) are working on the ability to use satellite navigation and other technologies inside buildings. These are not yet accurate enough to use in a library shelf mapping setting, but if that changes, there may be benefits in incorporating it into a library wayfinding App.

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Appendices

Appendix A: ShelfMap (the App)

An example result can be viewed at http://34.250.242.89/fp_test/fp.php?icode=44GOL&id=000361502

User finds item in Goldsmith's library catalogue which displays a link to the ShelfMap App:

The screenshot shows a library catalogue entry for the book "Microsoft Office 2010 : inside out" by Ed. Bott Carl Siechert. The entry includes a book cover, title, author, and availability information. A yellow banner indicates the item is "Out of library? Log in to place a reservation" and provides a "Sign in" link. Below this, the item is listed as "Available, Main Library collection (005.369 Of /BOT)". A table shows the item is "In library" with a "Reference" link. A red box highlights a "ShelfMap" button with a location pin icon. The "Details" section at the bottom shows the title and author.

BOOK
Microsoft Office 2010 : inside out
Ed. Bott Carl Siechert
Available from Main Library collection (005.369 Of /BOT) >

TOP
SEND TO
GET IT
DETAILS
LINKS
VIRTUAL BROWSE

Send to _____

EXPORT BIBTEX EXPORT RIS CITATION PERMALINK PRINT E-MAIL

Get It _____

Out of library? Log in to place a reservation Sign in

Available, Main Library collection (005.369 Of /BOT)

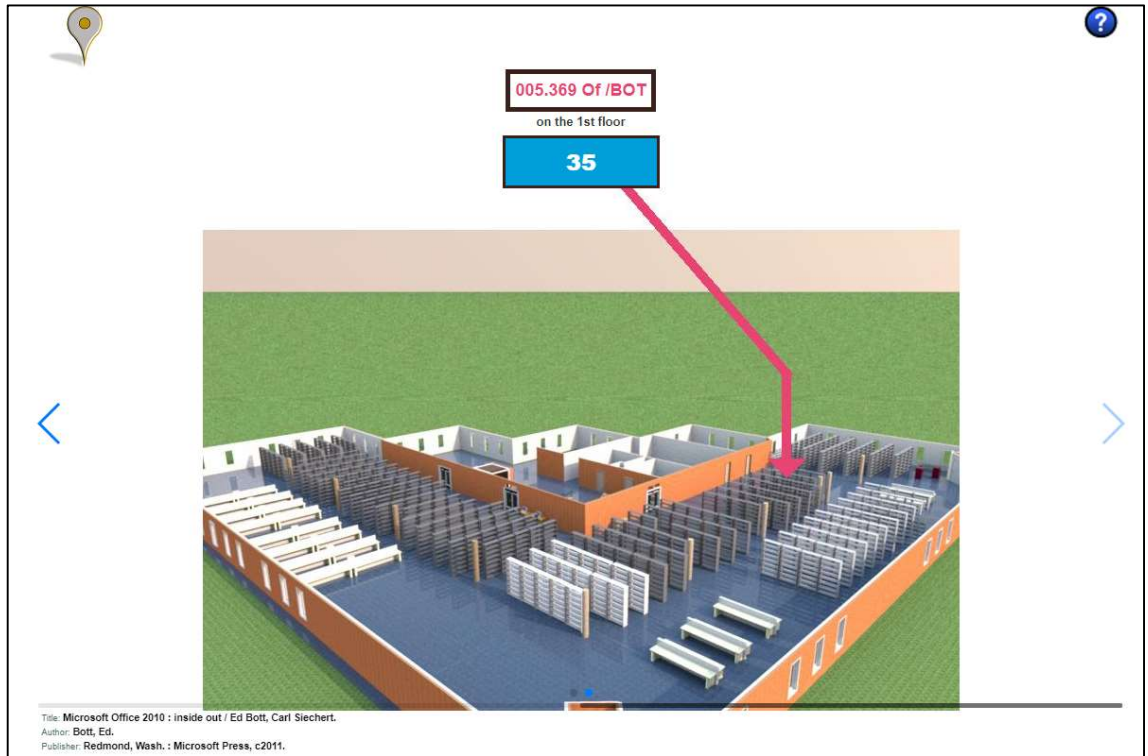
In library	Reference
Main Library collection 005.369 Of /BOT	

ShelfMap

Details _____

Title Microsoft Office 2010 : inside out
Author Ed. Bott >

On clicking the ShelfMap button, the App is presented in a new window thus:



Appendix B: Script for semi-structured interview

Preliminaries:

- Welcome participant and thank them for sparing their time.
- Show them the participant information sheet and consent form and give them time to read it.
- Ask them if they have any questions and then ask them to sign their consent.
- Briefly outline the session format:
 - a. Examining subject's experience of using libraries and how they use them when looking for material on the shelves.
 - b. Practical task - Find some books on the shelf both with and without using the ShelfMap wayfinding App.
 - c. A debrief to discuss the exercise and what issues if any may have emerged.

PHASE 1: Open-ended narrative

THEME: CONTEXT

Cognitive Mapping exercise:

- Draw a picture in any style you wish, perhaps with some keywords if you like, but not lots of text.
- Picture should try to sum up your experience and feelings regarding the process of finding an item on the shelf in the library.
- Good drawing skills are not required.
- You have two minutes starting now.

After the exercise, spend a few minutes talking about the picture:

Q1. Please can you explain to me what your drawing represents?

[PROBE: try to elicit information on any of the key areas such as confidence and perceived ability, anything that impinges on wayfinding, how and if the user may resolve problems they identify]

PHASE 2: Deeper and more detailed

THEME: STUDY LEVEL AND FAMILIARITY

Q2 What study level are you at? [Undergraduate, Post-graduate (taught), Post-graduate (research), Other]

[PROBE: If at a higher study level than undergraduate, whether anything about finding items on the shelf differs for them this time than with their previous study level]

Q3 What year of your course are you in and how many years does the course last?

[PROBE: If in a second or subsequent year, is there any difference they have detected in their need or effectiveness in finding items on the shelf?]

THEME: SPECIFIC INFORMATION LITERACY SKILLS:

Q4: Which of the following have you had the opportunity to make use of whilst at Goldsmiths?

- **Library Induction or training session**
- **Online help**
- **Asking library staff for help**
- **Asking your fellow students for help**
- **Other**

[PROBE: Specifically in the area of finding books on the shelf; gaining and understanding of how the classification schema works]

THEME: EXPERIENCE

Q5: Before you came to Goldsmiths, can you tell me about any other libraries you've used where you needed to find books on the shelf and how you found that process?

[PROBE: Was it easy or not?; Any training? School induction curricular based or otherwise; informal help]

THEME: SEEKING ASSISTANCE

Q6: Thinking about a time when you couldn't find a book on the shelf, what kind of help did you seek to try and find it?

[PROBE: How?; Who?; Did it help? What helped the most? If not, why not?]

THEME: SELF-EFFICACY LEVEL

Q7: How confident do you feel about your ability to find an item on the shelf?

[PROBE: 1-10? Building layout, decoding the classification schema; signage and any part that may play]

THEME: UX

Q8: Show the user a full detail record with ShelfMap icon and related item details. Looking at the item location details, do you have any observations regarding its clarity of design and ease of understanding?

[PROBE: Point to the important pieces of information and explain what they mean to you]

END OF PHASE 1:

Move to field task

PHASE 2: FIELD EXERCISE

PHASE 3 (DEBRIEF)

Q9: How did you find that exercise?

[PROBE: Thoughts about finding the items with or without the aid of the App; Refer to the specific items again to jog memory and ask them to talk through what happened]

THEME: LEVEL OF SELF-EFFICACY

Q10: We have nearly finished. What is your confidence level at this point in finding books on the shelf?

[1-10?, Extremely confident; Confident; OK, Not very confident; Not confident]

Q11: [Optional at discretion of interviewer] To draw together any emerging themes that benefit from discussion at this point.

[PROBE: Do you have any final thoughts you'd like to share on what we've covered?]

MISC

Q12: Do you have any specific learning disabilities? Y/N/Prefer not to say

Thank you for your assistance.

Appendix C: Field exercise instructions to user

Instructions given by researcher to user

- You will be asked to find four items – two using the ShelfMap App and two without. You can use my phone. There is no catalogue searching involved as I have linked to the relevant catalogue records for you
- Please verbalize what you are thinking as you conduct the task. If you are unable to talk in a silent area, we can stop in a corridor to confer.
- I will ask you when to start each task and whether you can use ShelfMap.

Things for you to note

- Do not worry about the researcher following behind you as you do the tasks.
- Be reassured that if you are unable to find an item and wish to move to the next one, that will be fine. This is not a test or a race, but an opportunity for me to observe and learn from your experience.
- No advice will be given during the task itself, but there will be a chance to review it after the test is completed and ask me questions.
- If you wish to abandon the whole task at any point, just let me know.

Appendix D: Email to Goldsmiths' library staff following the trial of the App

Hello All

Bernard Scaife, the creator of Shelfmap, has requested that if you have had any feedback on Shelfmap from users, please could you let him know. He is using Shelfmap usage data as his Masters dissertation and now requires this information.

Here are his questions:

1. Have you received any feedback from students about Shelfmap since we implemented it? If so, what was this?
2. Have students made any comments about it when you were on front desks? If so, what were these?
3. Have you any comments yourself that you would like to share?

Please contact Bernard directly via email:

<email address>

Many thanks for your help.

Appendix E: Log File Analysis and comparison with loan statistics

App Statistics workings

The trial period during which the App was available to all Goldsmiths users was 7 Dec 2017 to 6 April 2018.

Apache log file was analysed for presence of url pattern <http://<url>/fp.php?icode=<ANYTHING>> as this equates to one request for a map.

Of the 13,582 requests, the breakdown by month was as follows:

Date range	Hits (raw)	Total number of days	Closed Days	Adjusted days	Hits per day (adjusted)
Dec-17 (from 7th)	2676	24	9	15	178
Jan-18	3616	31	2	29	124
Feb-18	3333	28	0	28	119
Mar-18	3954	31	3	28	141
Apr-18 (to 6th)	3	6	3	3	1
TOTALS	13582	120	17	103	131

Extrapolating over an annual period:

Days per year = 365

Number of closed days in a year = 20

Number of open days per year= 345

345 days x 131 = 45,195 per annum (estimated)

Loan Statistics workings

Loan statistics for period 7 Dec 2017 to 6 April 2018 (excluding renewals) were 61,037

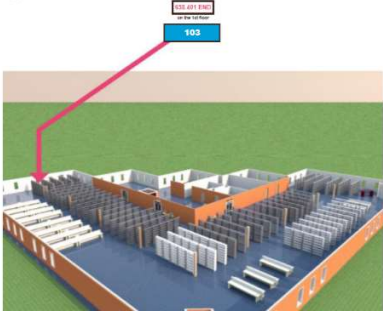

Daily loans: $61,037 / 103$ open days = 592 loans per day

Annualised (on same basis as for App):

345 days x 592 = $204,240$ per annum (estimated)

Appendix F: Walking times between tasks with adjustments to actual task completion times to average these.

<div data-bbox="443 519 708 689" data-label="Image"> </div> <div data-bbox="422 804 751 902" data-label="Text"> <p>Enquiry desk – Level 0</p> </div>	<div data-bbox="895 465 1278 779" data-label="Image"> </div> <div data-bbox="952 804 1323 902" data-label="Text"> <p>Item 1 – Level 1 – App ✓</p> </div>
<p>Walking time to here: N/A</p>	<p>Walking time to here: 60 seconds</p>
<div data-bbox="320 1055 678 1346" data-label="Image"> </div> <div data-bbox="363 1386 732 1485" data-label="Text"> <p>Item 2 – Level 1 – App ✗</p> </div>	<div data-bbox="895 1055 1238 1328" data-label="Image"> </div> <div data-bbox="957 1373 1323 1471" data-label="Text"> <p>Item 3 – Level 2 – App ✗</p> </div>
<p>Walking time to here: 20 seconds</p>	<p>Walking time to here: 58 seconds</p>

 <p data-bbox="368 566 730 674">Item 4 – Level 1 – App ✓</p>	
<p data-bbox="316 748 687 779">Walking time to here: 55 seconds</p>	<p data-bbox="890 748 1177 779">Walking time to here: N/A</p>

Average walking time between tasks = 193 seconds / 4 = 48 seconds

Appendix G: Field exercise tasks

Task 1: Find this item using ShelfMap

301.227281 STO

BOOK
Between two armies in the Ixil towns of Guatemala
David Stoll 1952-.

Available from **Main Library collection (301.227281 STO)** >

ShelfMap

TOP

SEND TO Send to _____

GET IT

DETAILS

LINKS

VIRTUAL BROWSE

Get It _____

Out of library? Log in to place a reservation [Sign in](#)

Available, Main Library collection (301.227281 STO)

In library	Ordinary loan	Request not available
Main Library collection 301.227281 STO		

ShelfMap

Task 2: Find this item *without* using ShelfMap

123 LIB

BOOK
Liberty : selected readings
Joel Feinberg 1926-2004.; Hyman Gross

Available from **Main Library collection (123 LIB)** >

ShelfMap

TOP

SEND TO Send to _____

GET IT

DETAILS

LINKS

VIRTUAL BROWSE

Get It _____

Out of library? Log in to place a reservation [Sign in](#)

Available, Main Library collection (123 LIB)

In library	Ordinary loan	Request not available
Main Library collection 123 LIB		

ShelfMap

Task 3: Find this item *without* using ShelfMap

822.99 Pr

The screenshot shows a library catalog entry for the book "Time and the Conways, and other plays" by J. B. Priestley. The book is available from the Main Library collection (822.99 Pr). The page includes a sidebar with navigation options: TOP, SEND TO, GET IT, DETAILS, LINKS, and VIRTUAL BROWSE. Below the navigation is a yellow banner that reads "Out of library? Log in to place a reservation" and "Sign in". The availability section shows "Available, Main Library collection (822.99 Pr)" with a dropdown menu for "Request not available".

Task 4: Find this item using ShelfMap

658.401 END

The screenshot shows a library catalog entry for the book "The end of the experiment? : from competition to the foundational economy" by Andrew Bowman. The book is available from the Main Library collection (658.401 END). The page includes a sidebar with navigation options: TOP, SEND TO, GET IT, DETAILS, LINKS, and VIRTUAL BROWSE. Below the navigation is a yellow banner that reads "Out of library? Log in to place a reservation" and "Sign in". The availability section shows "Available, Main Library collection (658.401 END)" with a dropdown menu for "Request not available". A ShelfMap icon is visible next to the availability information.

Appendix H: Task completion time calculations

Method

1. Calculate time from user being allocated task to finding item (whether correct or otherwise), or when the user decides to aborts the task.
2. Adjust for average walking times (see appendix G) to account for distance differences between item locations.
3. Add the four task completion times together per user and divide by the number of users to find the average time to complete a task per user.
4. Add the six participants' times per task and divide by the number of users to find the average time to complete a particular task.
5. Rank according to ability.
6. Repeat above for time to find the area (the correct stack which contains the book) or when the user decides to aborts the task.

Times to find item

Time (secs) to find book	1			4			2			3			Total Times (secs)	Number of tasks completed	Avg	Ability ranking	Student type
	Raw	Adjusted	Final	Raw	Adjusted	Final	Raw	Adjusted	Final	Raw	Adjusted	Final					
	With app						Without app										
A	03:05	-12	02:53	05:11	-7	05:04	04:04	+28	04:32	06:21	-10	06:11	17:50	4	04:25	6	Undergrad
B	04:17	-12	04:05	02:15	-7	02:08	04:05	+28	04:33*	02:27	-10	02:17	13:03	3	03:16	5	Postgrad
C	01:08	-12	00:56	01:12	-7	01:05	00:51	+28	01:19	02:08	-10	02:03	05:23	4	01:20	1	Postgrad
D	02:43	-12	02:31	01:28	-7	01:21	01:49	+28	02:17	04:16	-10	04:06	10:15	4	02:33	4	Postgrad
E	01:04	-12	00:52	01:14	-7	01:07	01:04	+28	01:32	02:23	-10	02:13	05:44	4	01:26	2	Undergrad
F	01:53	-12	01:41*	01:03	-7	00:56	02:01	+28	02:29*	03:15	-10	03:05	08:11	2	02:02	3	Undergrad
Avg completion time			02:10			01:56			02:47			03:19					
Note: Subject C completed tasks 1 and 2 in reverse due to researcher error (in grey)																	
* = FAIL																	

Times to find area

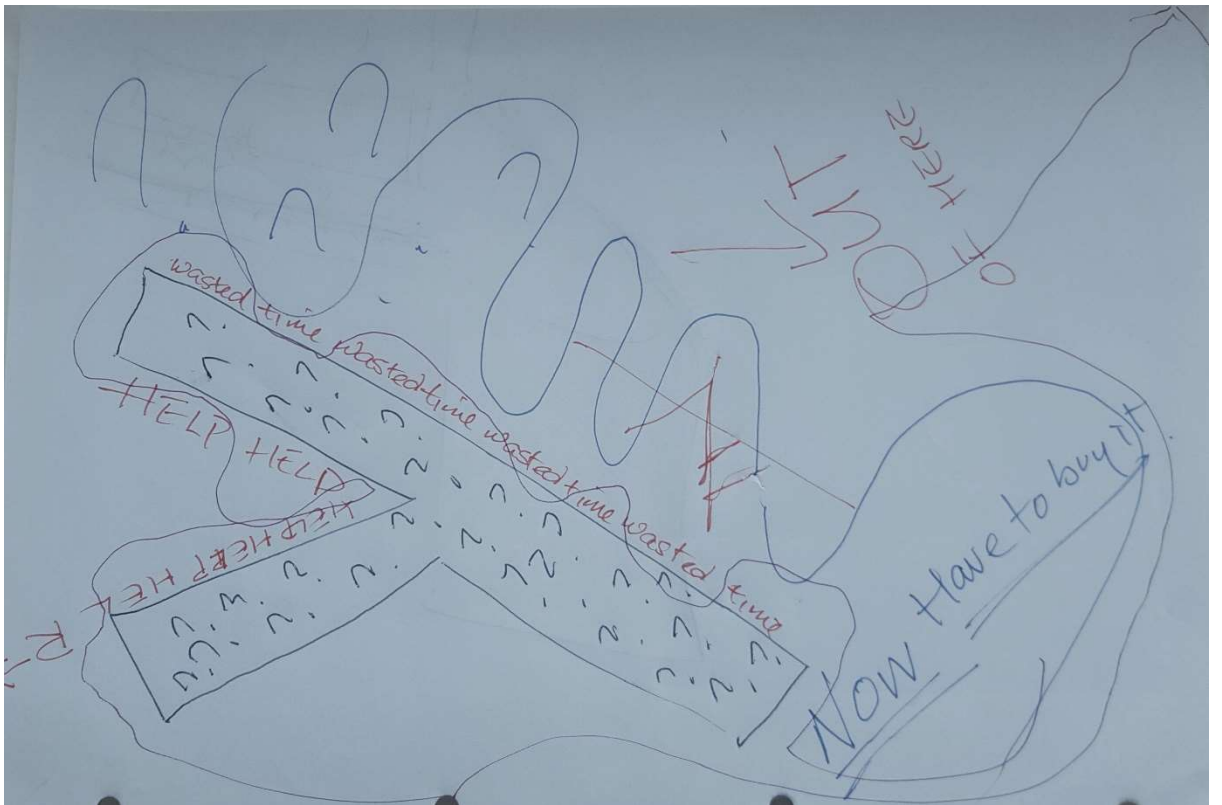
Time (secs) to find book	1			4			2			3			Total Times (secs)	Number of tasks completed	Avg	Ability ranking	Student type
	Raw	Adjusted	Final	Raw	Adjusted	Final	Raw	Adjusted	Final	Raw	Adjusted	Final					
	With app						Without app										
A	01:54	-12	01:42	02:26	-7	02:19	03:49	+28	04:17	03:41	-10	03:31	11:49	4	02:57	6	Undergrad
B	03:11	-12	02:59	01:25	-7	01:18	03:35	+28	04:03*	01:03	-10	00:53	09:13	3	02:18	5	Postgrad
C	00:40	-12	00:28	00:55	-7	00:48	00:28	+28	00:56	00:50	-10	00:40	02:52	4	00:43	1	Postgrad
D	01:16	-12	01:04	00:59	-7	00:52	01:26	+28	01:54	02:08	-10	01:58	05:48	4	01:27	4	Postgrad
E	00:50	-12	00:38	01:01	-7	00:54	00:44	+28	01:12	01:15	-10	01:05	03:49	4	00:57	2	Undergrad
F	00:56	-12	00:44	00:49	-7	00:42	01:32	+28	02:00*	01:25	-10	01:15	04:41	2	01:10	3	Undergrad
Avg completion time			01:16			01:09			02:24			01:34					
Note: Subject C completed tasks 1 and 2 in reverse due to researcher error (in grey)																	
* = FAIL																	

Notes:

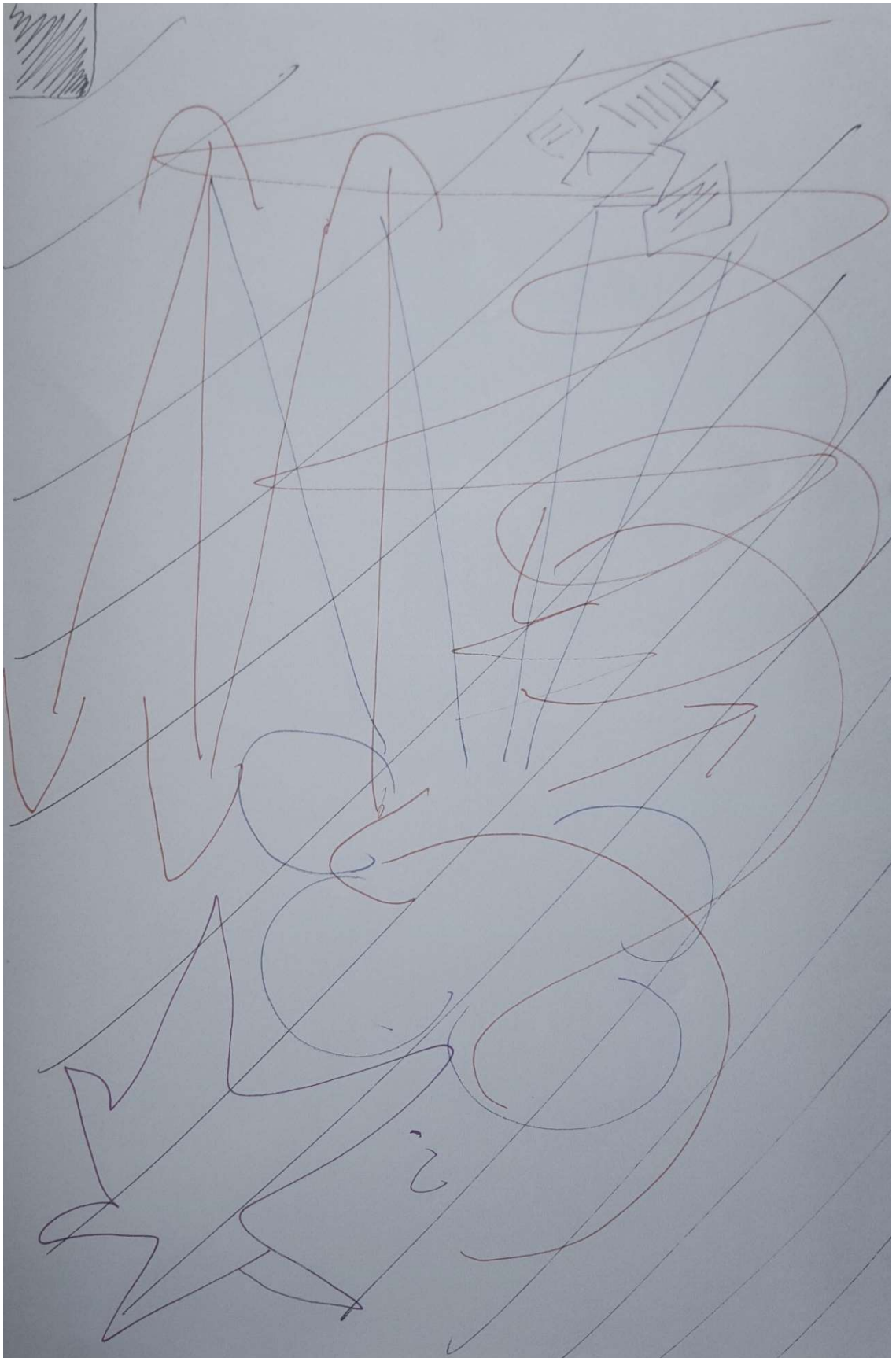
1. Subject C completed tasks 1 and 2 in reverse due to researcher error (in grey). 2 * = fail

Appendix I: Cognitive mapping drawings

Subject A:



Subject B:



Subject C:

Finding an item

either

Gold Catalog

New Forests Think

FILTERED!

-
-
- EBOOKS Books
-
-
-
-

Check the classmate

OR . . .

Not there

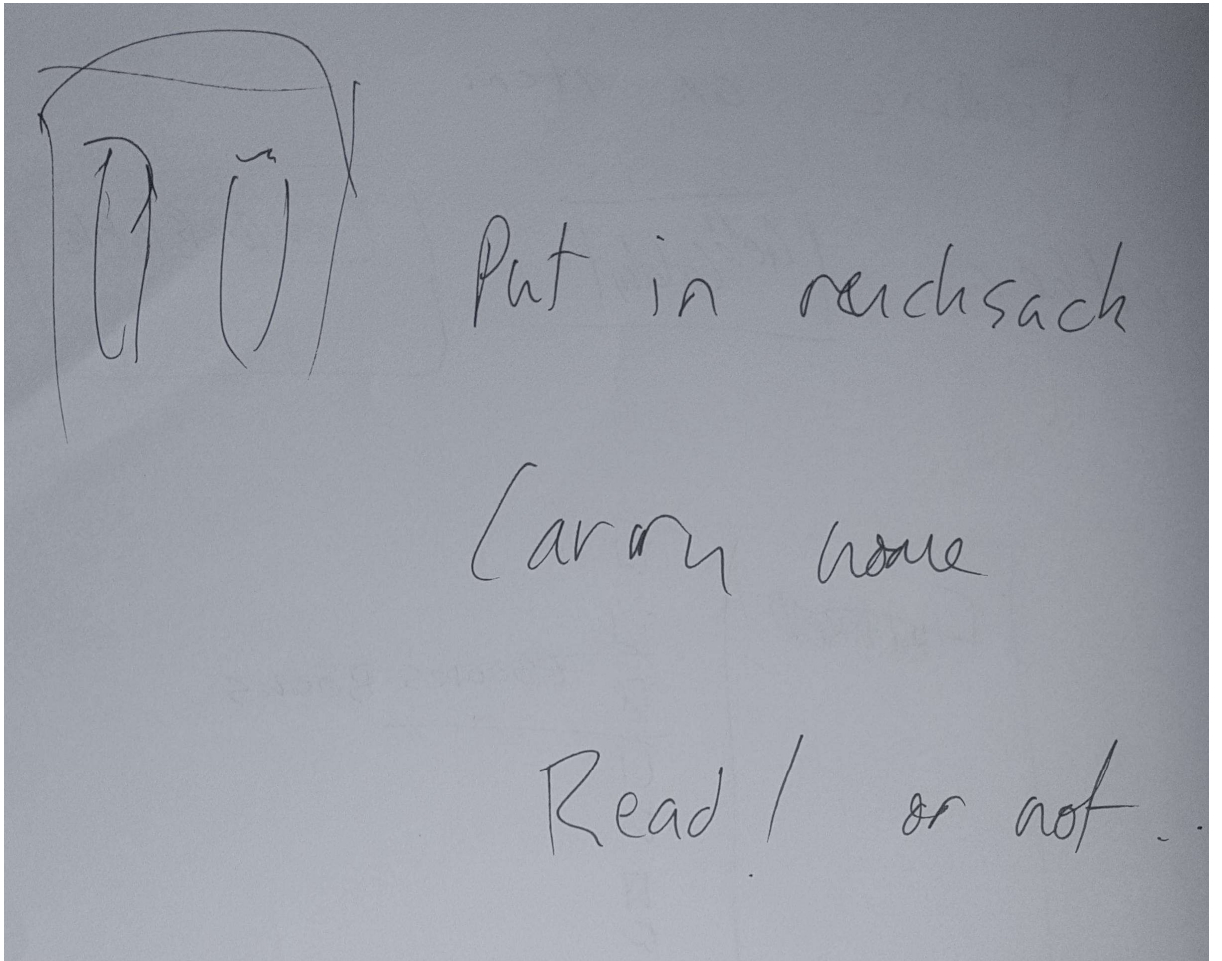
if want it

(reserve item or

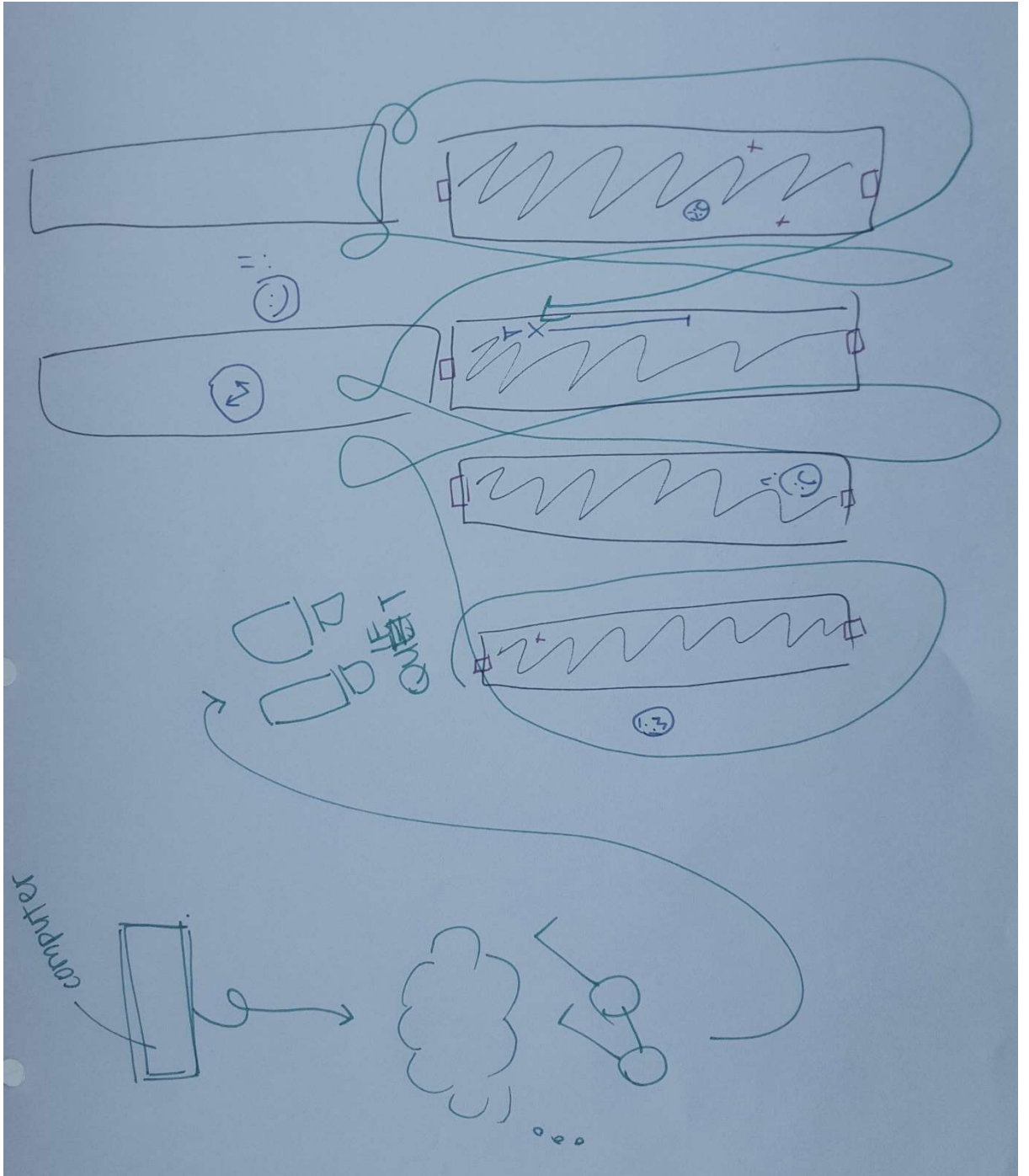
if not $\circ \circ$ mean
")

take book out

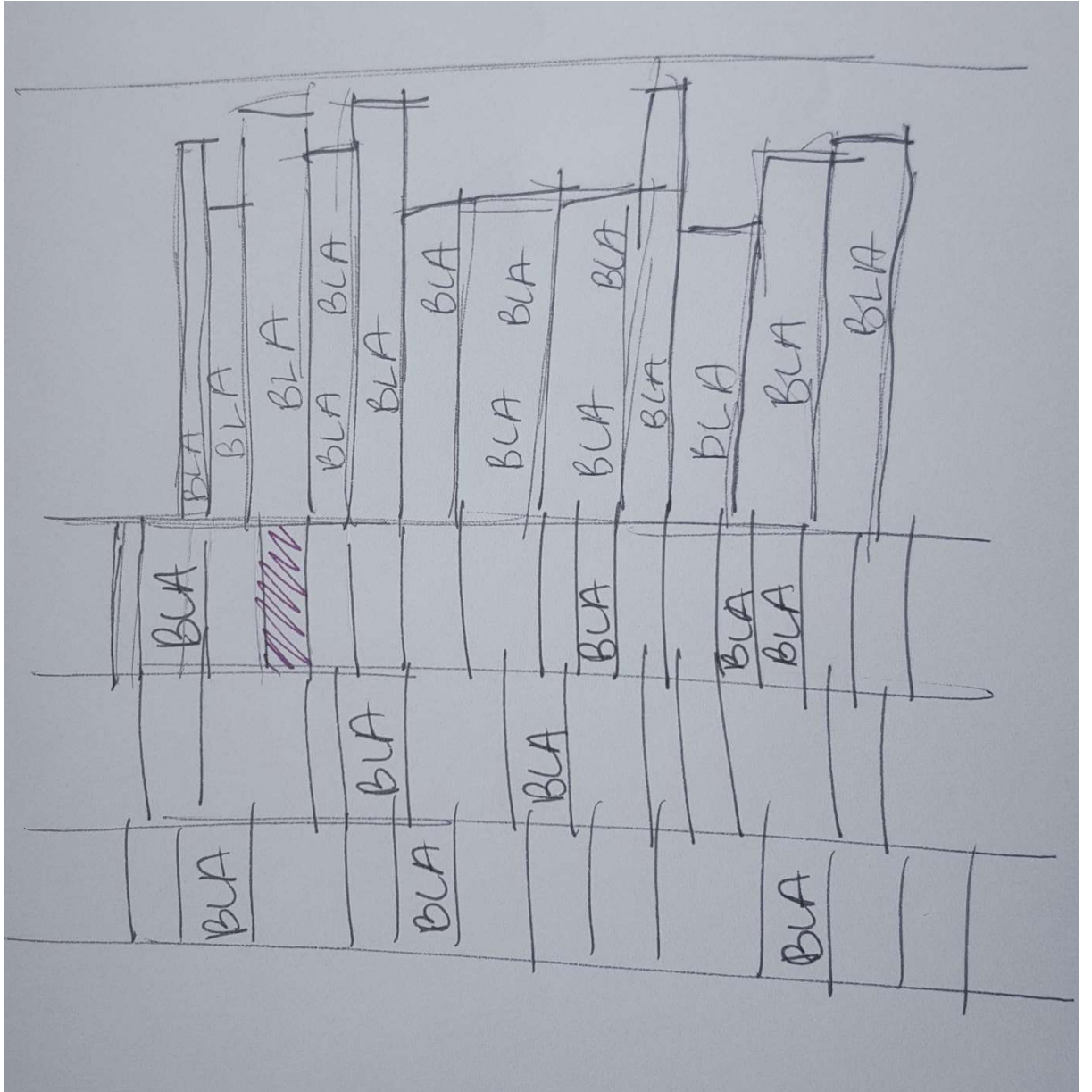
continued.../



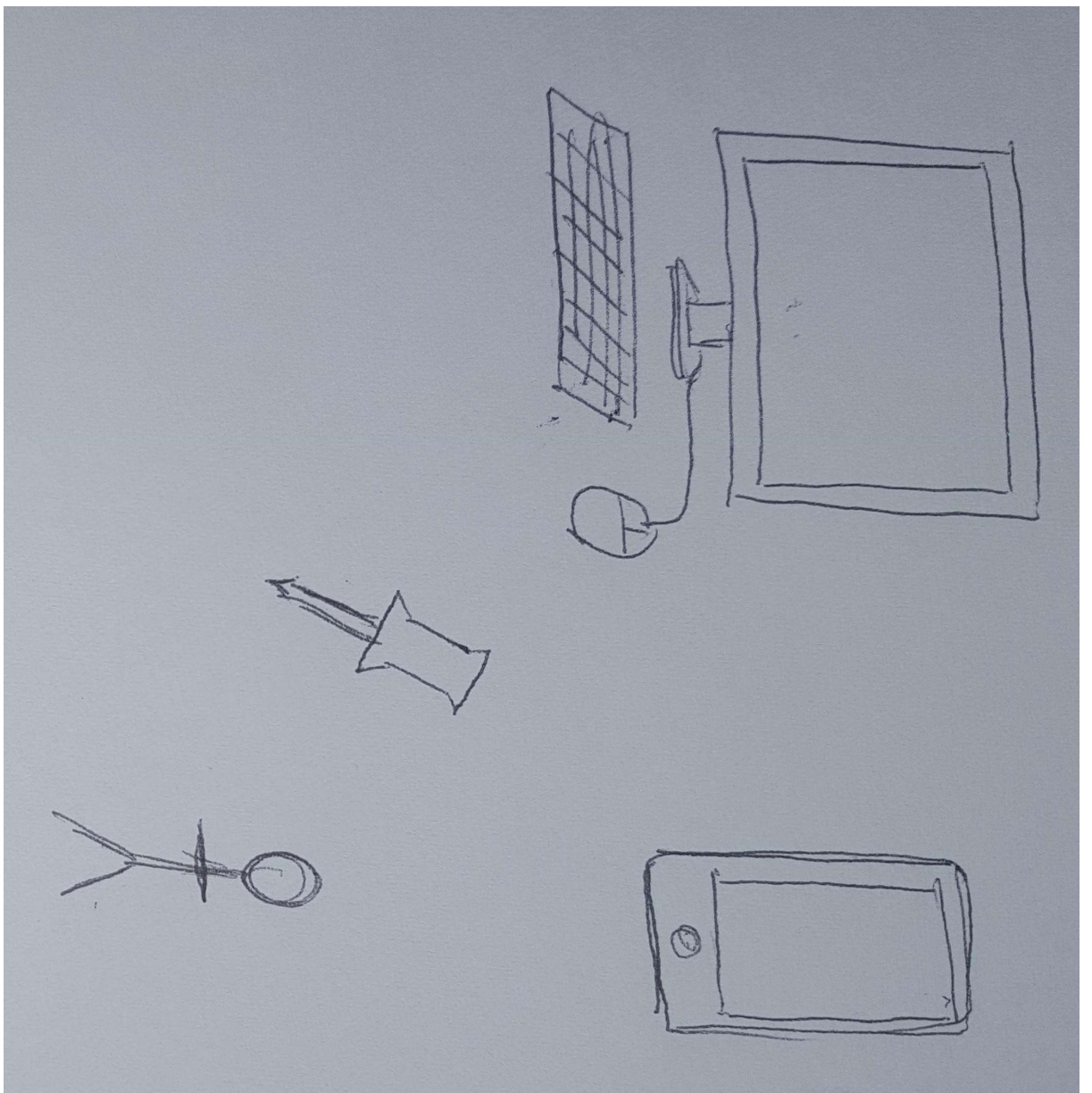
Subject D:




Subject E:



Subject F:



Appendix J: Online survey questions



Manchester
Metropolitan
University

Hello. My name is Bernard Scaife and I'm a research student at Manchester Metropolitan University. My research focusses on whether a *Wayfinding app* can make it easier for students to locate books on the shelf in the Goldsmiths library. I'd be grateful if you would complete this short survey which should take no more than 2 minutes.

Your participation in this study is entirely voluntary and you can withdraw at any time. You are free to omit any question. Any personal information which may be collected about you during the course of this research will be kept strictly confidential and the raw data destroyed after the research has been completed.

Do you agree to participate in this survey on the above terms?

I agree

I disagree

>>

How often do you use this library?

- Never
- Rarely
- At least once a week
- More than once a week
- Often

Is this the first university library you have had access to?

- Yes
- No

Are you in the first year of your course?

- Yes
- No

Continue (1 of 3)

Do you feel that the information in the catalogue about where a specific book is located is easy to understand?

- Yes
- No
- Not sure

I feel confident about my ability to find a specific book on the shelf.

- Strongly disagree
- Disagree
- Agree
- Strongly agree
- Not sure

Where were you taught about the way in which books are organized on the shelf in a library?

- Primary School
- Secondary School
- University
- I've never been taught this
- Other (please specify)

If you find a book on the catalogue but are unsure which area it is located in, what are you most likely to do next?

- Nothing
- Ask a librarian for help
- Ask a colleague or fellow student
- Other (please specify)

And what are you most likely to do if you have found the right area but were unable to find the actual book?

- Nothing
- Ask a librarian for help
- Ask a colleague or fellow student
- Other (please specify)

Continue (2 of 3)



What type of student are you?

- Undergraduate
- Post-graduate (Taught)
- Post-graduate (Research)
- Other (please specify)

Submit

Appendix K: Feedback from Goldsmiths' library staff after the trial of the App

Questions asked with responses received:

1. Have you received any feedback from students about Shelfmap since we implemented it? If so, what was this?

Respondent A: We recently hid Shelfmap temporarily due to an error (Shelfmap was guiding users to shelf locations for e-books) and one user (via a LibChat) asked where it had gone because they found it helpful.

Respondent B: I have received verbal feedback several times from students saying that they found shelf map really helpful in locating books in the library.

2. Have students made any comments about it when you were on front desks? If so, what were these?

Respondent A: On three occasions students have asked at the desk why the shelving scheme had changed. On explaining how Shelfmap works they asked, 'but I can still just use the Dewey number to find my books, right?'

Respondent B: I'm also aware that we had a student LibChat us to point out that ShelfMap wasn't available briefly which although sounding like a complaint was really them missing a service they use and found useful.

Respondent D: Just to let you know that I have had students come to the front desk and when I have been shelving, clearly demonstrating that they have been using Shelfmap.

Respondent D: There certainly is clear evidence that students are using Shelfmap but it is qualitative rather quantitative.

Respondent E: Some library users have complained that the Shelfmap is not accurate. This can be true as books can move around, especially after shelf tidying. I expect this could be resolved by updating our systems after shelf-tidies or book moves.

3. Have you any comments yourself that you would like to share?

Respondent A: I think the ShelfMap system is well-intentioned but I have several concerns about it. Most fundamental is that it operates between a finding aid and a new shelving system but rather than supplanting DDC it just adds an additional step in locating the item. The process still depends on the user understanding the existing shelving system. Our Subject Team sometimes have as little as fifteen minutes during the induction period to introduce the library, having to explain a latch-on location system that sits on top of DDC is confusing, time-consuming and unnecessary.

My colleagues and I have also repeatedly found errors in ShelfMap locations and have regularly fed these back. It seems that the items it would be most useful to have a ShelfMap for - because they are in more than one location for example - are the ones ShelfMap displays incorrectly or not at all.

We regularly solicit feedback and undertake UX tasks in the library and while we found little evidence that DDC is confusing to our users, there have been suggestions that a finding aid such as a floorplan is made available. A more deft solution to this problem seems to be StackMap which shows a clear birds-eye floorplan of the relevant section of library as well as the shelf mark.

Respondent C: In general people seem to either depend on Shelfmap or not use it at all. It seems to be a good tool for visual learners and people who do use it tend to love it and depend on it. My main criticism of it as a tool are its accuracy which seems to be susceptible to two main problems, the first being the prevalence of items in the collection that sit in a 'strange' place in the collection and, secondly, the movement of stock in the collection.

This second problem is primarily down to the large amount of withdrawals and book moving that have occurred the past 12 months. If this settles down at any point (which it should do by the start of the new academic year) then it should cease to be a problem until the next book move (although these are fairly frequent).

The first problem pertains to items such as journals that have multiple locations or sequencing quirks (such as three letter cutters appearing before two letters etc). Again, if these locations are accurately represented in the system, this problem may go away.

Obviously these inaccuracies can be corrected by human intervention when a student cannot locate an item. My fear is that for those who depend on ShelfMap for locating something simply abandon the search if they can't find it in the aisle it is supposed to be in. I have had dozens of occasions where a student has said a book is not on the shelf because they were looking in the aisle determined by ShelfMap and did not recognise that the Dewey number in that aisle was incorrect (in all these cases the book was in the correct place in the sequence). There will also be a large amount of students who do not come to the Help Desk once they cannot find the book.

So in general, for those that use the tool it seem to be an excellent addition to the catalogue when it determines the correct location but could potentially dissuade users from greater library literacy when it does not mesh up with the correct item location.

Respondent D: What I think confuses them is when there have been recent stock moves and when a book is missing from the shelf which is a frequent occurrence in academic libraries. Trying to explain to a student that another student may be using "their" book somewhere else in the library often bewilders them!

Respondent E: Most students asking for help looking for particular books approach me with their mobile, having found the location on Library Search. They have normally seen the Shelfmap number and location but some seem unaware of this function. What they normally need help with isn't the shelf row but the precise location in relation to other books (normally in areas with long cutter numbers). Not all users are familiar with the Dewey Decimal system so Shelfmap can be useful, even if it just gets them to the right area.