

Student Driven Innovation: Designing University Library Services

Alma Leora Culén
Department of Informatics
University of Oslo
Oslo, Norway
e-mail: almira@ifi.uio.no

Andrea Alessandro Gasparini
Department of Informatics and University Library
University of Oslo
Oslo, Norway
e-mail: a.a.gasparini@ub.uio.no

Abstract— This paper addresses the question of how to engage students in design and innovation of library services. Student involvement in the design of the university library services is needed as they have distinct patterns of technology use: variety of platforms, nearly always including smart-phones and laptops, variety of social networks and often, a range of other digital tools. The involvement can take place in many different ways, e.g., participatory design projects, involvement through social media and others. In this paper, we describe our approach to innovation through student engagement in design of library services: innovation through an interaction design course and exposure to design thinking. Over a period of three years, our findings show that student projects have become increasingly original and creative. In addition, the level of engagement to produce finished products and services after taking the course has increased.

Keywords- *innovation; user-driven; design; service design; design thinking.*

I. INTRODUCTION

Innovation is as old as humankind, but where and how users could influence the path of innovation has changed significantly during the last decades [1]. Already in the 19th century a possibility was open to employees as domain experts or skilled labor, to influence processes and products within a company. Two types of internal innovator types arose: the core and the peripheral innovators [2], roughly indicating those who are paid to be creative and those who sit on the periphery but through their knowledge can participate and are interested in innovation processes [3], [4]. The third category of innovators includes everyone outside the company or organization and among them, includes users of products and services. When innovators build up their competence in the field of innovation, some problematic aspects may arise. One of them is related to the concept of “sticky” innovation, see [5], implying an accumulation of innovation forces, which are difficult to share afterwards. The consequence may be that other “innovation areas or problems” arise that always need to be delegated to the same group of innovators.

Students, at all levels, are users of university libraries. Their potential as innovators within university libraries, see [3], [6] or [7] is starting to be recognized. In this paper, we describe the case of service innovation through design and design thinking. Design is increasingly viewed as an important resource [8] and consequently companies and

organizations worldwide look at design as help to innovate [9], [10]. Innovation through design, combined with user participation in all phases of the design process, was chosen in order to facilitate and research the potential of a student-driven innovation in the context of the university library.

The possibility to get engaged in a design of innovative services for the library was offered through a course in interaction design. Students were free to choose their projects and for the past three years, eight projects in total were concerned with innovation in the library, engaging over 30 students in the design process as innovators.

The following question was the bases for our research: what if students, who are learning to design services and who, in addition, have the ability to develop them, and need them as users, get interested in innovation? Perhaps classical designer/user /developer gaps could be bridged?

The paper is structured as follows: we first describe the context for innovation within library services and why student driven, user centered view was chosen. In Section 3, we introduce the concept of the library living lab, describe projects related to innovation of library services and address the issue that our innovators are also developers, as well as the primary user group for the university library. Subsequently, in Section 4, we discuss findings from these projects and finally, draw conclusions and direction for the future work.

II. THE CASE OF STUDENT-DRIVEN INNOVATION IN THE LIBRARY

Libraries, in a world increasingly dominated by technology, are looking for ways to renew and re-invent themselves as service providers. The university library that we worked with was not an exception. In this case, a user centric perspective was a primary orientation of the library towards innovation and development of future services. Participatory design, user-centered design and co-design are all methods used in order to design systems, products or services that are more in tune with real user needs. These approaches also predict easier adoption of technologies designed with users for users [11].

The Library has a long history of offering services to users. These services were often based on a librarian’s tacit knowledge and skills related to lending, searching for information and resource guidance. These skills, and the need for them, are now under discussion. The students are

efficient in searching the net, a lot of resources are available online, as is some form of guidance. Thus, library users are generally much more self-sufficient. Some of the services offered by the libraries are time constrained, e.g., how long one can keep a book, some are requiring services from multiple departments or organizational groups, such as negotiation of copy rights, or loan from another library. These services are tangible. Yet, other services are intangible, such as exchange of knowledge between a librarian and a user. With the introduction of a large number of digital services over the last decade, an important shift in how services and communication with users are organized has occurred. For instance, the transition from the paper book to e-book was a complex process [12], where the library paid attention to technology adoption, but had a tendency to forget the user perspective in relation to these new digital services and e-books. Another example of an important change in services is the migration of many traditional library services to the web. The library, as a service provider, must adapt to the development and requirement of the information [13] related to user expectations and new technologies.

The university library also offers a range of services in situ, in the library building. These services are not always connected to lending out books, help from librarians with subject expertise and like. The library also provides services around facilities for users, such as rooms where they can read and work either alone or with others. The librarians could observe that the uses of these diverse library resources are changing, including the use of rooms in the building. One of the projects, described later, builds on this possibility, finding new ways of organizing the use of this space, enabling more democratic booking of rooms, as well as easier social and knowledge exchange.

In order to capture all types of changes and how they are reflect on users, the library initiated several projects, all with user in focus. The largest user group of the university library consists of students, and our approach in this project was to allow students to innovate with and for students. The innovating students were taking an interaction design course. Their home base was a computer science department, a program for design, use and interaction. These students work with technology as a design material. They also have the skills needed to make functional prototypes of their designs themselves, thus wearing developers hats to some extent as well. In contrast to education programs offered by design schools, such as product design or architecture, they do not focus primarily on the form but on the functionality of products or services that they design. The design thinking is used to map the problems space broad and open enough to foster creativity, as the students need to focus away from the very concrete, problem solving approach that they often have. This phenomenon is also a trend in the whole field of human-computer interaction (HCI) design. From the first wave of HCI often described as an era of usability testing in 80's, through the second wave with the "human" in the center, HCI is currently in its third wave with user experience design and situated use of technology in focus [14].

In 2010, at the start of interaction design students' involvement with library services, one could say that projects had the use of innovative technology in the library as a focus. The issues they investigated were related to digital content acquisition and use of these digital resources in course settings, using e-book readers and tablets. In 2011, students found the area of translation of web-services to mobile services to be of interest, in particular discussions such as should things be broken down into a series of apps or kept whole as accustomed. In the third year, 2012, real innovation started to happen. Students looked into what their own needs are, and there was no common denominator for the three projects other than that they are all concerned with designing services that benefit students directly. We next describe the context and methodological tools that were used, and provide examples of projects that interaction design students were involved in.

III. THE LIVING LAB PROJECTS

The central research concept that we have used in the present work is that of a *living lab*. We consider the Wikipedia definition [15] of a living lab to be appropriate, even though our territorial context is narrowed to university libraries: "A *living lab* is a *user-centred, open-innovation ecosystem*,^{[1][2]} often operating in a territorial context (e.g. city, agglomeration, region), integrating concurrent research and innovation processes^[3] within a public-private-people partnership." The citations in the definition relate to highly relevant work of von Hippel, Chesbrough and Bilgram et al. [16]–[18].

A. 2010: Engaging with innovative technology

Being the first year when the big educational disruptor, the iPad, came out, one of the projects was concerned with its implementation as a classroom tool, how digital books would replace the paper books etc. [19], [20]. Like many others, e.g. [21], we wondered if these new devices will deliver innovation, inclusion and transformation of a range of practices, from learning to communication. The second project was concerned with a much less successful e-book reader, Boox [22]. Neither the iPad nor the Boox project reported on enthusiasm and desire to innovate by the students attending classes that used these new tools. By innovate, in this context, we mean to find novel ways to organize class materials, communication with other students from the class, schedules, to use new apps or to suggest what could be cool to have in the future. It was clear that Boox does not offer a new or added value to students. The analysis with the iPad was not as clear, but in the class in which it was applied, there was no time spent with it, apart from the time that it was used for the course or pure entertainment. In other words, student did not attempt to organize their work in new ways, make new apps or even customizations. So, this first year, the design students mostly studied the use of tablets rather than innovating themselves. In the case of Boox, attempt was made to design a better interface, but it was half-hearted: the design students considered the tablet,

just like the class that used it, to be a rather lost cause in terms of design.

B. 2011: web to mobile – app it or not?

The next year’s generation of design students seemed to be missing more services made for mobile platforms as all three project teams have chosen the theme of transferring services from the web to mobile platforms, see [23], [24], and [25].

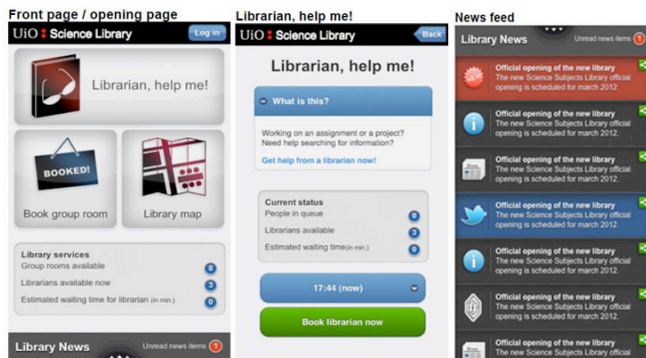


Figure 1. The students from a project [24], 2011, considering services within the library building.

The main problem that two of the project groups wrestled with were related to whether the services should be organized as they were on the net, arguing that familiarity could aid adoption, or broken into meaningful small groups and published as apps. The third group focused on the library building and what users might want to have while in the library. The group, as shown in Fig. 1, made a small selection of already existing services into an app, usable while on the premises only: get to talk to the librarian, book a room, see the map of the library and tweets, events and news feed.

C. 2012: services we did not have before!

In 2012, the library related projects excelled in terms of innovativeness and creative thinking. All three projects were different, both in terms of approach and methods used in their work.

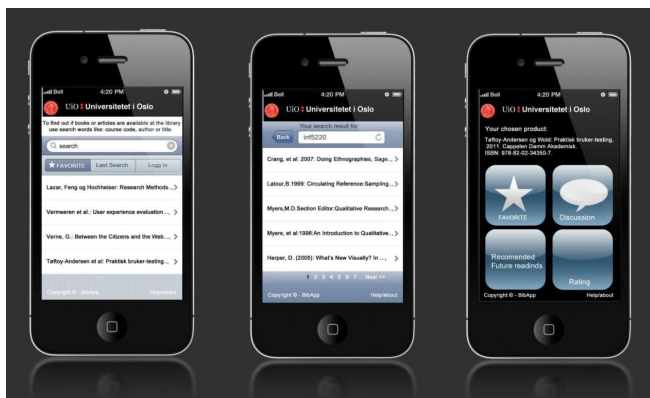


Figure 2. The students [26], 2012, implemented a syllabus search.

One of the groups, see Fig. 2, addresses a real need that students have: a much better organized curriculum literature. They used a participatory design, and did not rely on only their own perceptions, but conducted surveys, user groups and included a small group of other stakeholders in the entire design process, in the Scandinavian spirit [27]. The students paid attention to need finding at the start of the semester, and truly by understanding that need with other stakeholders, including administrators responsible for course listings, as well as BYBSYS, a library management system, currently in use by the library. Another project group, see Fig. 3 and Fig. 5, was interested in physically finding a book in the library with aid of a smart phone. Librarians traditionally were in the library for this purpose. They are still there. This engagement clearly demonstrates larger and larger individuation and need for being able to complete a task through self-service. In addition, this team was going for what we call a design of techno-cools [28]. This is the kind of applications librarians would not need, but students think it is cool.

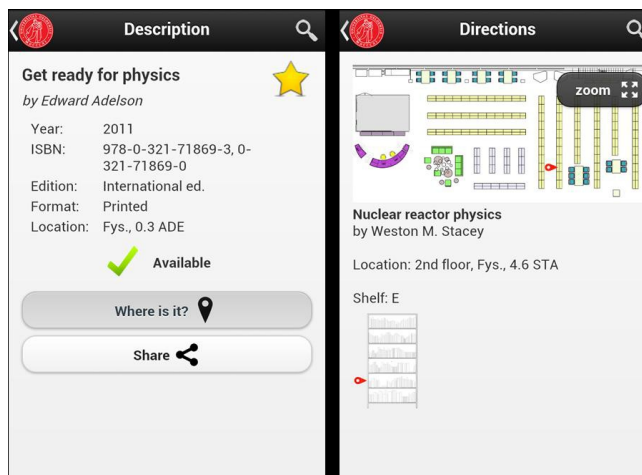


Figure 3. App for finding a book in the library, and on the shelf [29].

The last project [30], combined value-based design, focusing on producing a democratic room booking system, with a fun social spin. Their storyboard motivated the design team, see Fig. 4.



Figure 4. Motivating the democratic booking system [30].

The social spin was based on the idea that one could join interesting conversation in the rooms if there was a free seat, by following social networks and finding out what is the basis for the conversation or discussion.

The description of the projects provided here is minimal, more than be seen from the references provided. The purpose of presenting them briefly is to ground our findings from following the designers, by direct participation in their design meetings and by observing their actions during and after the course.

IV. DISCUSSION

From the library side, the support during all three years has been given in form of competence and knowledge related to services they provide, equipment, stuff, technical support, etc. During the 2012, a project team of three library employees was added. In addition, consultations with a professional user-experience consultancy company (Netlife Research) were added. The efforts invested in these projects were well worth it, according to one of the library employees and a library leadership, who were interviewed at the end of the spring semester 2013. More exciting projects are starting this fall, expanding to some new buildings. Increased resources are allocated to projects in terms of one more researcher and a high level management being involved in project leadership. Thus, through their actions, in addition to words, the library is expressing a very positive attitude towards results of student driven innovation.

Seen through students' words and actions, the library projects were very exciting. One student expressed it as follows: *"I am so happy I chose this project! At the beginning of the semester, one does not know, so many things sounded so exciting, from designing automated rescue vehicles to designing interactive games for children. This sounded almost boring, but I trusted the others in the group. In retrospect, this was the most exciting project. I learned so much."* Again, seen through actions, in 2010 no projects went any further than the final delivery in class. In 2011, there was a lot of excitement around project [24] and students were given a possibility to, as paid employees continue the work on the app until it is published. Even when the director argued for a possible huge impact of their work on the new library the interest was only moderate, they responded negatively to the offer. The primary reason was that the most active member had a full time job in addition to the studies. In 2012, two groups got the offer to continue their work, the third group did not, as technical difficulties in connecting the app to the database required involvement that was not possible to make at that point. Both groups accepted the offer and the Bookworms, [29], app is now available from the Apple app store [31] and Google Play [32]. The Minesweeper [30] is scheduled for a test run in the Science Library during the fall semester. In conclusion, actions and words of both major stakeholders confirm that the experience with student-driven innovation is positive, and adds value for both the university library and students.

In addition, further research into what are the motivating factors for a student innovator is well under way, using

qualitative methods such as ethnography and in-depth interviews with participants. Some of the main factors that we have seen during the past three years are related to the clear definition of the context for design, time and finally, added value.

The context for innovation through design may have a large impact in how innovators behave. The context is an occasional property of action whose features are defined dynamically. On the other hand, context is not a form of information. Context is produced, maintained and enacted during an activity. Dourish [33] argues for a close relationship between activity and practice. For innovation, the possibility to create an arena where innovators can produce new context in which they can be creative and cooperate to achieve common results is crucial. In the examples above, the library building itself has been used as one such context, social networks are another example of a context that was used in [30]. Even from the short presentation of the projects above, it may be seen that the projects ([29], [30]) that were having such a context were the most successful ones.

Within both contexts, we as researchers are building the awareness that the library and the social networks connected to the library (Facebook, twitter and so on) are a living lab to be used by students to try their ideas, to experiment and to be creative.

The time as a factor has several dimensions. The interesting one is what we would call a digestion time. That is the time it takes to accept concepts related to design and context. A concept, for example, such as that of a living lab takes time to understand, not only cognitively, but with the whole body, as a phenomenon. After all, it is living, dynamic, experimental environment.

Time is also important in relation to co-creation through design methods involving users, such as participatory design or co-design. It takes time to shape and share design practice and space, even when designers are also users. Other students, who were not in the design course, were also involved.

Last, but not least, the time switches from Chronos (the linear time that nobody has enough of) to Kairos (the perceived time) as the engagement increases. For example, a member of the innovation team [29], also has a full time job as a physician, alongside of full time studies. Part, or even full time work, in addition to classes, is not an exceptional occurrence. People dedicated their time to the projects, as they were perceived as both valuable and cool. Thus, the time and the value are also deeply connected. The higher the perceived value, the less importance is paid to time spent.

The "added" value is interesting for us as a subjective perception of the worth of what we leave to the world, in this case the library, as a legacy. This same factor has motivated many hackers in hacker communities to achieve things believed to be impossible. The harder it is, the better. The members of both projects that are being implemented all believe that what they do has the possibility to be a success on one hand, and useful on the other. Another positive aspect of making something cool is kind of status

among students that is achieved. One not only makes cool things, but also becomes cool him/herself.

Another finding worth mentioning is that student innovators focused on useful things rather than fun interactions. For example, they could choose to design a huge screen game, ambient art or something with near field interactions. But usefulness, at least throughout these first three years, has been important for student innovators.

V. CONCLUSIONS

In this paper, we have addresses the question of how to engage students in design and innovation of library services. Our findings show that the library living lab provides a good context for developing new ideas. The time and the added value are both important factors supporting innovation through design. In addition, we could observe a clear progress in the quality of projects from year to year, attributing this to time it takes to embody the concepts innovators work with, such as for example, the concept of the living lab. The difficulty we have observed has to do with sharing and ownership issues regarding the results of innovation.

As for the future research, we would like to take a deeper and longer look at motivation for participating in student-driven innovation. There is a volume of work on this from many perspectives, but none covers the same context, at least to the best of our knowledge. In addition, we have seen in other areas of our work that gamification has a potential to form habits. It has not been used yet, but we are looking forward to exploring what gamification can do in forming new habits for students related to library services and new ways of acting and relating to library systems.

Discussing the possible problem with innovation mentioned in the introduction around sharing and ownership of the results of the innovation and its “stickiness” is important. In our case, the transition of the ownership from innovators to the library is not entirely problem free. The reason for that is insufficient sense of ownership over these new services on the library side. It is, however, too early to draw any conclusions around this at this time. The librarians have been included in the innovation through design processes, and increased involvement is planned for the fall. This aspect will thus be considered in our future work more closely.

ACKNOWLEDGMENT

The authors are indebted to all student participants and the university library employees for their involvement in, and support of the projects in diverse ways, most importantly by giving their time when needed and resources such as location for work, equipment etc. The National Library, in part, financed the project.

REFERENCES

- [1] E. von Hippel, “Democratizing innovation: The evolving phenomenon of user innovation,” *J. Für Betriebswirtschaft*, vol. 55, no. 1, Mar. 2005, pp. 63–78.
- [2] H. W. Chesbrough, *Open Innovation: The New Imperative for Creating And Profiting from Technology*. Harvard Business Press, 2006.
- [3] Z. E. Brinkman Dzwig, “Innovative collection development for e-books at the TU Delft Library,” *Inf. Serv. Use*, vol. 33, no. 1, Jan. 2013, pp. 37–39.
- [4] S. Thomke and E. von Hippel, “Customers as Innovators: A New Way to Create Value - Harvard Business Review,” *Harvard Business Review*, 2002. [Online]. Available: <http://hbr.org/2002/04/customers-as-innovators-a-new-way-to-create-value/ar/1>.
- [5] E. von Hippel, “‘Sticky Information’ and the Locus of Problem Solving: Implications for Innovation,” *Manag. Sci.*, vol. 40, no. 4, Apr. 1994, pp. 429–439.
- [6] K. Rundblad, “The Academic Library Startup: UX, Innovation and Social Technologies,” *AJCU Libr. Deans Dir. Conf.*, Apr. 2011.
- [7] J. McCleneghan Smith and K. Clark, “Dream catcher□: capturing student-inspired ideas for the libraries’ website”, in *Studying students: the Undergraduate Research Project at the University of Rochester*, Chicago: Association of College and Research Libraries, 2007.
- [8] C. Dell’Era, A. Marchesi, and R. Verganti, “Mastering Technologies in Design-Driven Innovation,” *Res.-Technol. Manag.*, vol. 53, no. 2, 2010, pp. 12–23.
- [9] W. Lidwell, K. Holden, and J. Butler, *Universal principles of design: 125 ways to enhance usability, influence perception, increase appeal, make better design decisions, and teach through design*. Rockport Pub, 2010.
- [10] “Design Thinking for Social Innovation (SSIR).” [Online]. Available: http://www.ssireview.org/articles/entry/design_thinking_for_social_innovation/.
- [11] M. Scaife, Y. Rogers, F. Aldrich, and M. Davies, “Designing for or designing with? Informant design for interactive learning environments,” in *Proceedings of the ACM SIGCHI Conference on Human factors in computing systems*, New York, NY, USA, 1997, pp. 343–350.
- [12] A. L. Culén and A. Gasparini, “E-book Reader and the Necessity of Divergence from the Legacy of Paper Book,” in *Proceedings of the 4th International Conference on Advances in Computer Human Interaction*, 2011, pp. 267 – 273.
- [13] X. Li, “Information Literacy Composition and Training Strategies of University Teaching Administrator,” in *Proceedings of the International Conference on Information Engineering and Applications (IEA) 2012*, Z. Zhong, Ed. Springer London, 2013, pp. 47–54.
- [14] S. Bødker, “When second wave HCI meets third wave challenges,” in *Proceedings of the 4th Nordic conference on Human-computer interaction: changing roles*, New York, NY, USA, 2006, pp. 1–8.
- [15] “Living lab - Wikipedia, the free encyclopedia.” [Online]. Available: http://en.wikipedia.org/wiki/Living_lab.
- [16] E. von Hippel, “Lead users: a source of novel product concepts,” *Manage Sci*, vol. 32, no. 7, Jul. 1986, pp. 791–805.
- [17] H. Chesbrough, *Open innovation: the new imperative for creating and profiting from technology*. Boston, Mass.: Harvard Business School Press, 2003.

- [18] V. Bilgram, A. Brem, and K.-I. Voigt, "User-Centric Innovations In New Product Development — Systematic Identification Of Lead Users Harnessing Interactive And Collaborative Online-Tools," *Int. J. Innov. Manag. Ijim*, vol. 12, no. 03, 2008, pp. 419–458.
- [19] P. A. Ertmer, "Teacher pedagogical beliefs: The final frontier in our quest for technology integration?," *Educ. Technol. Res. Dev.*, vol. 53, no. 4, Dec. 2005, pp. 25–39.
- [20] A. Evenstuen, J. T. Dalen, and Ø. H. Midtbø, "Student Project: The Use of iPad as a learning tool," 2010. [Online]. Available: <http://www.uio.no/studier/emner/matnat/ifi/INF4260/h10/index.html>.
- [21] J. Traxler, "Will Student Devices Deliver Innovation, Inclusion, and Transformation?," *J. Res. Cent. Educ. Technol.*, vol. 6, no. 1, Jan. 2010, pp. 3–15.
- [22] T. A. Nygaard, N. Raaum, N. Holte, and L. Andresen, "Boox as a Course Platform," 2010. [Online]. Available: <http://www.uio.no/studier/emner/matnat/ifi/INF4260/h10/student-projects/boox-readers-as-course-platform/>.
- [23] S. Tomt, J. Walin, A. Kempton, and A. Rem, "Student project: Biblioteket On-the-Go," 2011. [Online]. Available: <http://www.uio.no/studier/emner/matnat/ifi/INF2260/h11/index.html>.
- [24] S. Berge, F. Sørensen, and Z. Yang, "Student Project Within RB with your phone." 2011. [Online]. Available: <http://www.uio.no/studier/emner/matnat/ifi/INF2260/h11/prosjekter/Within%20RB%20with%20your%20phone.pdf>.
- [25] I. Aspeli, A. Ballangrud, M. Frøyen, J. Mørkåas, and T.-M. Thomassen, "Student Project: Design for et modern bibliotek (Design for a A Modern Library)," 2011. [Online]. Available: <http://www.uio.no/studier/emner/matnat/ifi/INF2260/h11/prosjekter/>.
- [26] I. Arnesen, J. Børsting, M. Myrhistuen, L. Sun, and J. Gustavsen, "Student Project BibApp," 2012. [Online]. Available: <http://www.uio.no/studier/emner/matnat/ifi/INF2260/h12/projects/library-projects/BibApp/final-report.pdf>.
- [27] Routledge, "Routledge International Handbook of Participatory Design (Hardback) - Routledge." [Online]. Available: <http://www.routledge.com/books/details/9780415694407/>.
- [28] H. B. Reistad, J. Choi, L. Drevsjø, S. Imtiaz, and T. Slang, "Student Project Bookworms," 2012. [Online]. Available: <http://www.uio.no/studier/emner/matnat/ifi/INF2260/h12/projects/library-projects/Bookworms/>.
- [29] A. L. Culén and A. Gasparini, "Situated Techno-Cools: factors that contribute to making technology cool and the study case of iPad in education," *Psychology J.*, vol. 10, no. 2, 2012, pp. 117–139.
- [30] A. B. Sætre, E. Litovchenko, M. G. Grina, R. Bjørneberg Castro, and S. Jongsathitsathian, "Student Project Minesweeper," 2012. [Online]. Available: <http://www.uio.no/studier/emner/matnat/ifi/INF2260/h12/projects/library-projects/minesweeper/final-presentation-03.12.2012.pdf>.
- [31] "Realfagsbiblioteket," App Store. [Online]. Available: <https://itunes.apple.com/no/app/realfagsbiblioteket/id668535531?mt=8>.
- [32] "Realfagsbiblioteket" - Android Apps on Google Play. <https://play.google.com/store/apps/details?id=no.uio.ub.realfagsbiblioteket&hl=en>.
- [33] P. Dourish, *Where The Action Is: The Foundations Of Embodied Interaction*. MIT Press, 2004.



Figure 5. One of the features of Bookworms App is to show the shelf that the desired book is on, see [29].