Suggesting Structure and Direction of a Library and Information Science Curriculum Applying Design Thinking Methods

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ABSTRACT

In response to the changing needs of users and library services, there is a need to develop a library information science curriculum that reflects such change and to foster competent librarians. Recent studies abroad have emphasized the need for librarians who can apply design thinking methods which is a problem-solving methodology that expansively explores various alternatives and derives results, in response to recent changes and problems occurring in libraries. In this study, in order to understand how design thinking methods can be taught and to understand the perceptions of the students and librarians involved in the course, a case study is conducted of a class that applied design thinking methods and students and librarians have been interviewed who had experience participating in the class. By reflecting on the needs of students and librarians', this study explored new directions of what forms courses can take for future librarians. Based on the results of the analysis, among the different characteristics of design thinking, the value of cooperation, problem-solving ability, flexibility and iteration of design characteristics was considered as the value of a class for LIS students and librarians where design thinking methods were applied. From the findings, the research suggests future directions of creating more structured courses that involve an element of design thinking.

Keywords: Design Thinking, Design Methodology, User Study, HCI, Studies in North America

1. Introduction

The curriculum of the Library and Information Science have changed over the years reflecting the advancement of technology and the changing needs of the patrons in libraries. Many libraries have also demonstrated moving from merely providing access to materials to providing multiple learning experiences reflecting the changing needs of the patrons (Hopwood, 2012; Lee et al., 2017; Phillips, Recker, & Lee, 2019; Rogowski, Recker, & Lee, 2018). Especially with the advancement of new technology being introduced to the community, for equitable use, librarians have shown interest in offering different opportunities for patrons to extend such expertise in that area through different digital learning programs in not only public libraries (Lee & Phillips, 2018) but also school (Yoon, Andrews, & Ward, 2022) and special libraries (Tse, Chiu, & Lam, 2022). For instance, in the YOUMedia learning space at Harold Washington Library center, there are multiple programs like the DJ box, podcast, and video production to name a few (Austin et al., 2011). In general, librarians have grown interest in creating a space for the patrons where they are encouraged to develop their learning pathways based on self-interest.

In many studies on digital learning opportunities in the libraries, it points out how there is an importance for the librarians to be guides, collaborators (Clegg et al., 2006), or design partners (Yip & Lee, 2018; Yip, Lee, & Lee, 2019) who facilitate sessions as opposed to instructors (Braun et al., 2014). Prior studies indicate how librarians have limited knowledge of STEM education, and computational knowledge (Subramaniam et al., 2018; Yip, Lee, & Lee, 2019). Therefore, calls out the librarian to work with outside partners to obtain such expertise for digital learning and programming. Studies have suggested how working with the end-users early in the process allows space for relationship-building to occur. In facilitating interest-driven learning in libraries (Clegg & Subramaniam, 2018), prior studies (Koh, Abbas, & Willett, 2018; Clegg et al., 2006; Yip, Lee, & Lee, 2019) outline the roles of what librarians need to do which is fostering skill development, supporting user engagement, and helping patrons to take leadership roles in their communities. While prior research briefly states that the librarians would need to navigate the tensions in the differing position, we have limited knowledge on how such librarians are fostered. Additionally developing and updating new courses or teaching technology related courses that are of current interest to the patrons is not an easy task. Scholars abroad in the library and information science have stated how LIS can utilize the method of design thinking in finding creative solutions to the different problems that arise when meeting the different needs of the patrons and utilizing current technology.

Design thinking is a mindset and a method which has a focus on creating artifacts to solve problems through different iterative processes (Brown & Katz, 2011). While there are different models that attempt to define the design thinking process, mainly there are five phases: Empathize, Define, Ideate, Prototype, and Test. The design thinking approach is the iterative ways of thinking through the multiple phases which allows reflection and improvement from each stage. Multiple business sectors have utilized design thinking strategies which is particularly useful in changing environments where the customers expectations and needs change constantly (Martin & Martin, 2009). Therefore, through design thinking, new strategies are made. Comparative studies have shown that businesses who have applied such a model do better in profit than businesses who relatively do not apply such a model (Carr et al., 2010). While public libraries have a different model than businesses Clarke, Amonkar, & Rosenblad (2020) explored the interest in applying design thinking methods in library practice in the United States and found that librarians perceived that there was much relevance of design thinking and methods to library work. However, states that there is a growing need to develop a curriculum where the education supports students with design thinking practices as the term could be vague.

This paper identifies and discusses the opportunities of applying design thinking methods in a library and information science course. This study examines a course titled "Participatory Design in Libraries" through a single case study method in which the instructor applied the design thinking methods in the course. Next, a total of 3 librarians and 26 students was interviewed over the period of 2017 to 2020 to learn about their experience as part of the course. The data is triangulated to analyze the design thinking workshops that occurred during class and the interview data. Drawing on prior literature (Clarke, 2018) of design thinking, the study then followed a deductive approach by mapping out what design opportunities emerged from the interview data. Based on the results of the analysis, the value of cooperation, problem-solving ability, flexibility and iteration of design characteristics can be considered as the value of a class where design thinking methods were applied. Overall, through the findings, this study shares implications in opportunities in developing courses using design thinking methods.

2. Related Work

This section introduces three main areas of research. First, it states about the evolving information environments due to the factor based on more digital technology being introduced in the public

library for patrons to use. Second, it states about how the Library and Information Science curriculum has evolved in meeting the change by examining the overall curriculums around the world and next specifically Korea. Lastly, it introduces the concept of design thinking and the relationship to Library and Information Science to understand the opportunities and worth of applying design thinking methods in LIS.

2.1 Evolving Information Environments Using Digital Technology

As there has been a growing need for people to use digital technology, many libraries have created spaces such as the maker space and media labs where people can tinker with new technology (e.g. virtual reality, augmented reality, and Arduino). Koo, Jong-Hwa, Cho, Yong-Wan (2021) analyzed the best practice cases in North America public libraries that have won either the AIA/ALA Library Building Awards or the ALA/IIDA Library Interior Design Awards. The scholars noted that all the libraries listed had a characteristic of incorporating the most cutting edge technology within Makerspace, Tech Center and Media Lab that holded technologies such as 3D printers, robotics and different new technologies. Noh, Younghee, Shin, Youngji (2021) analyzed library policies in the 3rd Comprehensive Library Development Plan that was announced in 2019 which is a plan that ranges from 2019 to 2023. As a result the scholars noted the importance of strengthening digital media use education for social inclusion. Overall, we are able to see that the libraries that are accepted as excellent libraries have a space for new technology and there are national level development plans in Korea in building more spaces for digital media use.

While, there is a growing need for policy change and user's need, in 2021, Kang, Pil-Soo, Noh, Younghee, Kim, Yoon-Jeong (2021) examined the perceptions of public librarians in how they perceived in introducing smart digital environment-based technologies in the library. Among the librarians who were in charge of the task of implementing technology, 72.3% showed a positive attitude toward implementing more technologies in the library and the majority checked the box of 'very necessary' in providing these technologies and related services to the users. In a more recent study, in 2022, Hong, Hyun Jin, Noh, Younghee, Jung, Young mi, Jeong, Dae Keun (2022), conducted a survey to examine the overall perception of the current public librarian's job status and the findings indicated that among the different operating subjects planning reaching culture programs and user information services had high proportions regarding the total amount spent for services. In understanding the librarians' perception on values of specific ability and skill sets Cha, Sung-Jong, Kim, Jinmook, Park, Heejin (2021) conducted an offline questionnaire of 83 librarians

in 2020. The result showed that among the different scores, effective communication skills such as persuading, educating and motivating users were scored low and therefore called for the need to include more communication methods with users in the curriculum for fostering prospective librarians. The studies show the importance of implementing smart technology in the library field and therefore, indicate the importance of preparing prospective librarians to hold such necessary skill sets upon graduation. While the studies above have shown the overall current situation of users, library policy and perceptions of libraries through questionnaires, it calls for more needs in research creating curriculums that can strengthen the professionalism of librarians in public libraries.

2.2 Changes in the LIS Curriculum

To prepare students in the evolving information environment, there has been multiple changes in the LIS curriculum. Noh Young-hee, Ahn In-ja, Choi Sang-ki (2012) analyzed the Korean library and information science curriculum for 20 years from 1991 to 2011, summarized the trend of changes in subjects, and found that information technology had a significant impact on the process of changes in education policy and development. Choi, Sanghee, Ha, YooJin (2019) analyzed the subjects opened in the US library and information science curriculum in 2017. In many universities, library and information center management and user service were added as core courses, and the number of information technology-related courses was growing. In addition, Chung, Eun-kyung, Schalk, and Yoon, Jeong-won (2022) analyzed the statistical reports from 1997 to 2020 published by the Association for Library and Information Science Education (ALISE) and found that inter-disciplinary research became common in the library and information science curriculum and has shown that 'Information Technology' as an area that has recently received more attention.

Choi Sang-gi, Ahn In-ja, Noh Young-hee, and Kim Jun-seop (2013) compared and analyzed the teaching methods in the syllabus of library and information science courses within Korea and abroad, and identified their characteristics and differences. In Korea, lectures and presentations were commonly used, but in other countries, team projects such as project case studies were actively used. However, Han Seung-Hee (2008) also discussed the effectiveness of such project based classes. The study that was conducted in Korea shared how when the lectures were developed by applying the project-based learning method within the library and information science education environment, it had a great effect on improving the learning ability and problem-solving ability of undergraduate students majoring in the field. Similarly, in Korea, Kang Ji-hei (2017) designed a problem-based learning model within library and information science classes, and it was found

that students' critical thinking and creativity were enhanced through this. As a result of an analysis of preceding studies, professors and librarians were all aware of the need to teach subjects that respond to the use of various new digital media and technology in accordance with the Fourth Industrial Revolution. However studies showed the need in exploring more ways of teaching such subjects.

2.3 Design Thinking in Library and Information Science

A significant number of tasks performed by libraries are related to design thinking (Bell, 2008; Clarke, 2018b). Design thinking, or thinking by design, is creating something to solve a problem. The process of design starts with defining a problem and then finding various solutions to it, and for this purpose, various attempts and approaches are used. Design thinking has five steps: the first is to empathize with and understand the problem the user is facing, the second is to accurately define the problem, the third is to come up with an idea, and the fourth is to develop a prototype for that idea. Lastly, developing and creating something with empathy and understanding about another problem through verification (Brown & Wyatt, 2010). Within the space of creating digital learning spaces, to meet the different needs of the patrons, librarians often implicitly use design thinking strategies to come up with solutions.

The term Design Thinking emerged from the design methods movement of an approach of understanding the thought process when design happens (Buchanan, 1992). The approach has grown across different industries from engineering to business. In the field of Library and Information Science, design thinking has a longer history in Information Science of information systems (Gleasure, 2013; Hevner et al., 2004). Comparatively less work has been done in fewer applications for understanding issues in academic librarianship. However, Bell (2008) by introducing the term Blended Librarianship has emphasized how professionals need to blend skills of academic librarianship with instructional design (Bell & Shank, 2007). Similarly, to the statements Bell & Shank (2007) made Howard & Davis (2011) included how design thinking may be combined with evidence based librarianship. Understanding the emphasis of the need for librarians to engage in design thinking, in 2016 at Simmons SLIS opened a course called 'Library Test Kitchen' in the goal to teach library students how to apply design thinking. The course originated at Harvard's Graduate School of design to teach architecture students about libraries. The idea came in why not offer it reverse: library students about design. Razzouk & Shute (2012) stated that design thinking has a positive influence on 21st century education across disciplines because it involves creative

thinking in generating solutions for problems.

In the United States, Clarke, Amonkar, & Rosenblad (2020) conducted an online survey to understand the interest and awareness of design thinking among librarians in the United States and the need for design thinking in library education. The findings showed how the librarians thought that design thinking and library work had many connections. However, the application method of design thinking was different depending on the task in charge, and design thinking was more active in tasks that required understanding and empathy for users, such as library space design and library programs such as for technology usage. In Korea, there were zero results found for the keyword search "Design Thinking" in December 2022 in the major Korean journals of library and information science (Korean Bibilia Society for Library and Information Science, Journal of the Korean Society for Library and Information Science, Journal of the Korean Society for Library and Information Management). However, in 2016, Lee, Byeong-Ki (2016) introduced a similar concept which is 'service design'. Service design is a methodology of a process to improve services or create new services. Lee, Byeong-Ki (2016) analyzed overseas cases in public libraries of using service design. It showed how the library, as a service institution, used service design methodologies to meet the constantly changing needs of the users. But it has been difficult to find cases of libraries that have applied this in Korea. Therefore, this study aims to analyze the case of applying specifically design thinking methods in a Library and Information science class using case study methods. Through analyzing the data, this study intends to understand ways and opportunities for opening classes that use design thinking for creativity and innovation in order to respond to changes in information technology.

3. Method

This study is a single case study. The unit of analysis is a course titled "Participatory Design and Libraries". This study examines the course over the period of four years from 2017 to 2020. According to Yin (2003), a single case study can be used when there are embedded units of analysis within the case. In this single case study, the sub unit of analysis was the interview data of the participants that engaged in the class throughout the years. A total of 29 people who were part of the course (3 librarians and 26 students) was interviewed. The interviews were conducted in the following quarter after the course was completed. This was part of a larger study (Yip, Lee, & Lee, 2019) of understanding the digital use in the library. The inclusion

factor of the participants were students and librarians who either had a degree in the library and information program or were currently enrolled in the program at the point of the interview. An inductive approach of the interview data is first done and afterward is followed by a deductive approach by mapping out what design opportunities emerged from the interview data.

Research Questions:

1) How was the design thinking method applied in the library and information course?
2) What are the perceived values by librarians and library and information science students of learning design thinking in a library related course?

3.1 Design Thinking Library Course: Participatory Design and Libraries

The course that was analyzed for this study is titled "Participatory Design and Libraries" which was a course opened in a Library and Information Science graduate program. The class was a part of a service learning course which provided services to public institutions. The professor with a research background in Human Computer Interaction (HCI) applied the design thinking methodology to the local library. The class was held twice a week for 10 weeks as the university was in a quarter system and not a semester system. The class had a dual learning model where on weekly Mondays the students gathered in the classroom in the university to learn about theory of libraries and design thinking methods and for every Wednesdays the students gathered in the local library to conduct design thinking workshops with patrons and librarians in the library. In this case study, the patrons were specifically children between the age of 7 to 11. The objective of the class was to analyze how library users (children) wanted to use and learn about certain technologies.

The digital devices used by students continued to change each year. In 2017, how to apply storytelling to game design, in 2018, designing hardware products using Arduino, in 2019 3D printing, and in 2020, electronic paper circuits were explored. Although the medium continued to change, the critical mind on how to introduce and use cutting-edge equipment to patrons and how to create library services using the medium remained the same. In addition, students discussed whether to recommend each medium to librarians who did not know the device and gave recommendations on how to run related programs if recommended as an assignment. The allocation of public libraries for design practice was carried out by librarians in the Central Building.

During the 10-week period, a total of 8 design workshops were actually held with the patrons

of the library. The first week introduced the class, and the 10th week ended with a party for the participants. In the first class of each week, professors and students met at universities to read papers and study design methodologies and library-related theories. The class started with a discussion about the good and bad points and areas for improvement during the previous week's visit to the library. Students talked about their experiences with patrons they met. In addition, all design workshops were filmed with a camera, and students watched the recordings and observed what was happening as a researcher as part of the class.

3.2 Context of the Partnering Library: The Seattle Public Library

The partnering library where the design thinking workshop was held was the Seattle Public Library. The Seattle Public Library operates 27 branch libraries, and the central building is the largest library in the state of Washington. Seattle is an area where computers and technology are very important for employment, and the main branch had a goal of creating more makerspaces and technology programs in public libraries for equitable use. In the main branch, there is a librarian dedicated to technology and programming, the job title is Digital Media and Learning Manager. The Digital Media and Learning manager decided to collaborate with their local university in order to understand the needs of users about what technology to use and what content the patrons wanted to have in order to run programs that each user group wants, such as children, teenagers, and adults. In this case study focuses on the case specifically of the children group.

3.3 Interview

In the following quarter after the class ended, all students and librarians from class were sent an invitation to participate in a 30 to 60 minute interview asking their experience with the class, and participating in the design thinking workshop. A total of 26 students and 3 librarians were interviewed from the year of 2017 to 2020 class and at least five students from each year. Table 1 shares the themes and questionnaires of the interview. The goals of the interviews were to first understand the library and information science students' perception on engaging and learning about design thinking methods in the library with patrons and second, to understand the librarians' experience of applying and learning about design thinking methods with the partner of LIS students from the local university. The interviews were concluded by asking participants about their takeaways and future application of the design thinking method.

〈Table 1〉 Table of Interview Questions

Interviewee	Themes	Specific Quiestions
Students	Prior Relationships with libraries and librarians	• What relationship did you have with libraries in general? • What relationship did you have with librarians? • What is the best example of an ideal librarian? • Why did you choose the LIS program?
	Experience with the class	• What are the reasons you took this class? • How does this course relate to or can you compare it to other courses you have taken?
Librarians	Roles in the library	• What is your role in the library? • What are the struggles you face in the library?
Librarian and Students	Experience with the design thinking workshop	• Can you tell me about your experience participating in design thinking workshops? • Can you tell me your thoughts on design thinking in relation to libraries after participating in the workshops?
	Application with design thinking methods	• Do you see yourself using design thinking in libraries or other information organizations? • What is a limitation of doing design thinking in libraries? • What is the biggest takeaway?

3.4 Data Analysis

All 29 interview transcripts (26 graduate students, 3 librarians) were open coded (Kolb, 2012; Corbin & Strauss, 2014). A qualitative analysis software named Quirkos was used in which it provides a visual way to manage and analyze the transcripts. A codebook was developed by grouping themes generated from each of the stakeholders and afterward analyzed the data if there were any difference of themes based on year. Next, based on the codebook that was created through the interview data, the codes were further iterated by making connections to the nature of design thinking characteristics that was stated in prior literature (Clarke, 2018).

4. Finding

• **Research Question 1:** How were design thinking methods applied in a library and information science course.

The first finding section states how design thinking methods were applied in a library and information science course.

1) Identifying the design challenge of the library

Before engaging in the design thinking workshops it was crucial for the instructor of the course to identify the challenge the local library was facing. In this case study, the main central library had two issues. First, it was about how to develop and improve programs for the patrons to experience and learn about new digital technology by questioning what digital technology would be suitable for purchase and what kind of content to use. Many startups were migrating from Silicon Valley to this local area and there was a growing need of people who could effectively code or have skill sets of working with different technologies. However, the challenge the librarian faced was which media to invest in, such as 3D printers, Arduino kits and electronic circuits, ect. and how patrons in the library could use and learn them meaningfully. Overall, there were concerns about what efforts the librarians needed to make to provide users with a learning space that is more than just a maker space equipped with state-of-the-art equipment.

The second issue the central library had was understanding how more librarians in the local branches would be interested in creating a library that incorporates cutting-edge digital technology for patrons to interact with. The technical service of the Seattle Public Library was carried out in the form of a librarian in the central library holding a workshop on a certain technology, and the branch librarians who were interested in the subject would participate for learning purposes to later execute them in their own library. However, many librarians, while understanding the importance of implementing such technologies, were skeptical. Many librarians questioned whether workshops that teach coding fit the role of libraries, and there were librarians who wanted to spend more time on homework helpers and storytelling, which libraries already do. Therefore, the librarian in the central library had a challenge, of looking for ways for branch librarians to participate in the creation of a library that incorporates cutting-edge digital technology for learning. In order to work on these design challenges the instructor of the course structured the course in following a framework for engaging in design thinking activities.

2) The weekly structure of the design thinking workshops

This section shares my findings of how the weekly structure was made out of implementing spaces for design thinking to occur with different stakeholders of the library. In the first 4 sessions of the 8 design thinking workshops in the library, the professor composed the program, but from the 5th session, the students made the design program following the previous composition as group assignments. The composition of the program is as follows: First week session was a time for students, patrons, and librarians to meet and build relationships. Different ice-breaking games

were played to help them get to know each other better and to build a design team. Session 2, in the exploration stage, the theme of the year was explored, that is, the digital medium in this case. Session 3 was the evaluation stage, the opportunities, limitations and design ideas were evaluated about the medium. Session 4 was the application stage, where the groups discussed how to use the medium. From session 5 to 8, in the activation stage different groups tested out each other's recommendations and artifacts to test the utilization of the idea.

〈Table 2〉 Weekly Program Breakdown

Week	Topic	Goal	Examples
1	Icebreaking Activity	The goal is for the group members (students, librarians and patrons-children in this case) to get to know each other.	Sharing out one's name and affiliation. Engaging in design related activities.
2	Exploration	The goal is for the group to explore the digital medium (3D printer, Arduino, electronic paper circuits) being used.	• Group members explore the parts of the 3D printer, the software and hardware parts. • Group members explore the functions of the paper circuits.
3	Evaluation	The goal is for the group to evaluate the digital medium.	• Group members list out the opportunities and limitations of the 3D printer. • Group members give design ideas based on the limitations and opportunities of how the technology can be used in the library.
4	Applications	The goal is to brainstorm a manual about the digital medium.	• Group members brainstorm learning activities for the 3D printers in the library • Group members brainstorm projects that libraries can use with other children using Arduino kits.
5~8	Activation	The goal is to test the utilization of digital media activity from various angles.	Groups exchange the different projects and try it out. • Example: Group 3 and Group 2 tried out the mini activity of using the Arduino kit to engage in a game that Group 1 created.

3) The structure of a design thinking session of a day

Within a design thinking session of a day that was usually 90 minutes it typically followed four stages. The first stage is the 'Question of the Day' related to design, in which all students, patrons, and librarians replied to a short-answer question led by the professor. For example, when designing a game that incorporates storytelling, people took turns talking about their favorite game or fictional character in a story. In the second stage, the people were divided into groups

and participated in design activities. Each group was configured with a student-patron ratio of 2:1 or 1:1. At this time, depending on the workload, the librarian either participated in the session to rotate around to look at the different group's activities or joined the reflection session after doing other library work. In the third stage, each group presented their designs and received questions. At this time, the professor or librarian arranged the common themes on the whiteboard. In the fourth stage, after the patrons left, the professor, students, and librarians stayed to reflect on the entire design session of the day, and had time to talk about their feelings and evaluations for future improvements.

〈Table 3〉 Breakdown of the design thinking workshop

Order	Activity	Participants	Goal	Time Spent
1	Question of the day	Patron (Children), Students, Librarian, Professor	Everyone sits in a circle, the facilitator (professor) of the design thinking workshop asks one short-answer question that everyone can participate in, and everyone takes turns answering the question of the day to get to know each other and to think about the design topic.	15 min
2	Design Activity	Patron (Children), Students, Librarian	A group is formed of a mix of students from the LIS program, children from the community and the librarian. The small group engages in different design thinking techniques. The purpose is to exchange ideas.	45 min
3	Presentation and Discussion	Patron (Children), Students, Librarian	During this time each group goes around presenting their design ideas. After a short presentation there is a Q and A session from other groups.	15 min
4	Reflection	Students, Librarian, Professor	After the patrons (children) leave, the adults (students, professor and the librarian) reflect on the overall design workshop and discuss what more efforts are needed to encourage participation from the patrons and discuss any interesting design ideas or findings that came out during that day.	15 min

4) Techniques used for the design thinking activities

There are various techniques for the design activities. This study uses the term technique which is a term used in HCI to indicate specific design activities for collaborative design (Walsh et al., 2013). Technique is also a methodology to creatively communicate with users. In the design session of this class, four main techniques were used. The contents are shown in the following table.

〈Table 4〉 The techniques used from the design thinking workshop

Name of the technique	The name used to introduce to the patrons	Materials	Roles
Sketching	Big Paper	25x30 inch size (64.5x76.6cm) paper, markers and colored pencils.	In the process of coming up with ideas, the facilitator (professor) asked each group to write a picture or a text that fits a topic on a fairly large piece of paper to help come up with a group idea.
Prototyping	Bags of Stuff	Different objects such as colored paper, feathers, blocks, cards, glue, thread, and ect. to design with.	This technique allows groups to put together an artifact that is a model of their design idea through prototyping using various items that can be easily encountered in daily life.
Storyboard	Comic Boarding	Comics with blank spaces, Scenario print outs and drawing material.	This technique is used for brainstorming about problem solving in the idea stage. It aims to create ideas by filling in the blanks by giving a fictional scenario as a cartoon to users who have difficulty recognizing abstract problems.
Affinity Diagram	Likes, Dislikes, Design Ideas	Sticky notes and markers	In the evaluation stage, if one opinion is written on a post-it note, then a professor or librarian groups them by theme and finds a relationship between the groups by theme.

Through analysis, it shows how the syllabus incorporated the design thinking methods weekly, daily and what design technique was utilized within the daily sessions. The findings show that while there is a structure by following the stages, it also shows that there was enough flexibility to allow different ideas and brainstorming to occur within a group and also a space to share each other's ideas and to finally test out the ideas by also providing feedback. The method also shows how the professor played a role in being the facilitator of the design thinking workshops.

• **Research question 2**: What are the perceived values by librarians and library and information science students of learning design thinking in a library related course?

This section reports on what aspects of the design thinking process was mentioned as a value of applying it in a Library and Information Science course by librarians and students.

1) The value of collaboration: empathy and inviting multiple perspectives

The first perceived value was the opportunity of being able to invite multiple perspectives through the design thinking process and having empathy toward the different stakeholders. The

first stage in the design thinking process is empathy of understanding how the users are feeling. Through the small group activities where the librarian, students and the patrons gathered they were able to grow empathy toward each other. Many students in the class expressed how this was one of the only classes that partnered directly with the library despite the fact that many of the students hoped to build relationships with the local librarians. This was because after graduation many hoped to become librarians. The students expressed a lack of opportunities to directly meet the librarians prior to this class. Students also mentioned how they perceived the designing thinking as a method that had many connections to librarianship and how they felt that the younger generation liked the space of expressing oneself and liked collaborative thinking spaces. For instance, in the quote below by a student who took the course states the following:

> *The collaborative nature that comes into play in design thinking, I think, is something that already exists in librarianship. Like, I think, especially now, the people who are graduating in the last like 5 to 10 years of library school, when I talk to them versus when I talk to kind of older people in the profession, they're like, the younger folks are like really interested in collaborative cooperative thinking spaces in general, and so I think that design thinking play into that really well and like can tap into something that people are already comfortable and familiar with and like interested and excited about.* (P12)

This class was themed on a design workshop to find out what kind of technology-related programs would be desired by patrons who will visit the library in the future. Students collaborated with child patrons of public libraries to collect opinions through a design methodology that exchanged opinions with each other. At first, students thought that the patrons in our case the young children would not have good ideas, but when design tools, that is, tools to express their opinions, such as making or drawing, were provided, they were able to hear various opinions of children.

> *"I was very surprised at design thinking, like the actual process is more like you know, working with people and coming up with ideas together. Like building on each other's feedback and building on each other's ideas. I think that reciprocal feedback and the creation cycle would be really cool to replicate, and I can see it having applications like in pretty much any field I think but especially in librarianship."* (P22) and also made statements about the importance of directly working with the end-user. *"I appreciate that a lot about design thinking, is that it focuses on the people who are going to be using the process or the space or whatever it is and finds out what's important to them.*

Ask the people who need it, who you're working for, who you're designing for what they need and what they want." (P5)

The following quote shows the students perceived value in the human-centered design thinking process of focusing on the end-user as opposed to focusing on the creation of the technology itself. Students also expressed that the success of a session was dependent on the relationships that they built with children and librarians throughout the quarter. When asked about what should be changed or improved about the course, the majority of students advocated for more sessions at the library to strengthen connection with the children as well as each other. P2 commented on the importance of building trust from the beginning, stating that *"the kids that knew me and felt comfortable talking to me about things, their feedback they were giving me was just like more transparent."* By understanding the children better, the graduate students were able to utilize everyone's skills effectively. P11 recognized that some children "just wanted to talk" and some *"needed drawing out."* Understanding this distinction allowed the groups to work more efficiently together as a team. The librarian also commented on the importance of the relationship component stating: *I don't think kids come for the technology. I think they come because they like having relationships with adults where they feel like they get to talk about what they want to talk about.* The following quote shows the librarian's perception of what role the design thinking process was playing in empowering the patrons of the library to provide an opportunity to share their thoughts.

2) The value of the problem-solving mindset: engaging in problems of practice

Within the library, there exists multiple design problems and in other words "problems of practice" which can be broad or common, complex but still actionable that exist in a professional's sphere of work. The problems of practice are usually navigated by a knowledgeable practitioner. Public librarians discussed the opportunities of working on a problem with LIS students as they were not hesitant to try new things out. When students were asked about their experience of this class, their answers focused on the pride of working on a real world problem. Especially for the students, they stated how they had higher motivation of working on a problem that the library actually had for change.

By visiting the physical libraries the students stated how they had a chance to be exposed to design problems in practice that the librarian was confronting. Many students made a comment about the opportunity to go to the library as part of the class as an incentive and further be exposed to real world problems. For example, P7 stated *"Yeah, like that added value of just physically*

being in a library, and like getting to talk to ⋯ like actual librarians and to understanding the problems they were facing." P4 also made similar comments stating, *"I liked the fact that you actually got to interact with the stakeholders and like to meet people from the libraries to understand the holistic problems the current library was facing such as problems of spaces or resources."* The interest of students in getting to meet the librarians and library patrons as part of the class shows the interest of being situated in the real world setting.

The design thinking workshops were conducted through lively discussions with patrons and librarians in advance about what theme the design workshop would be held on. The assignments that the students had to work on were actual design problems that the current library dealt with and through the assignments students presented their opinions in various ways on how to solve them. This was stated as different from the existing teaching methods compared to other classes the students were taking. For instance, on the question on the perceived relationship between design thinking and libraries the following statement was made by a student:

> *Design thinking feels more involved, more engaged, and with libraries one of the issues that always seems to come up in conversations is you know, what does the community want, and how does the librarian find out what the community wants, and how does the librarian interpret what the community wants and of course deal with our limited resources and stuff like that.* (P10)

The following quote shows the characteristic of the design thinking mindset of first viewing it as a problem that can be solved and the multiple attempts being made in identifying and articulating the problems to later actively find solutions for it. In comparing the class to other classes students also stated how in other classes students had to search for a research topic on their own and had to suggest solutions. Students also stated how when they select a specific topic for a project, how they were not exactly aware of how their project affects society. However, in discussing the experience of this class, in the interview students stated the value of how they were able to directly view how their ideas can be utilized in the library through the testing and activation of the ideas in the design thinking sessions.

3) The value of iteration: flexibility within the design thinking sessions

Librarians stated how they were able to learn about the new devices by participating in the design thinking workshops with the students and the patrons of the library. Prior to the design thinking workshop a struggle many librarians stated in the interview was compared to the work

that had to be accomplished there was lack of time and resources which is a common problem in public libraries. In order to meet the changing needs of the patrons many librarians also expressed the importance but difficulties of learning new technology for programming especially for youth. However, regarding thoughts on the design thinking process the librarians stated how unlike the existing method of educating users after becoming media experts, learning how to use digital devices together with users was a great help in reducing the burden on librarians.

Different from social science, an aspect within design is flexibility. When working on a problem the students did not have a solution for, before the expectation would be in asking the professor of the class or a librarian. However, in this class many students stated about the flexibility the design session allowed in experimenting with new directions. This was the same to the public librarians, where if there was something that did not go as planned the public librarians appreciated the opportunity to change directions. Iteration for improvement is one of the attributes of the design thinking process, it is different from going sequential and stepwise, and improvement is made through modification based on failed experience. In interviews, librarians talked about the burden of trying something new. The reasons were about the fear that patrons may not come when operating a new program, and the burden of programming without being completely familiar with the numerous newly emerging technologies (Augmented Reality, Virtual Reality, 3D printers and ect.). However, through the design workshop, they said that their fear of new attempts was reduced by recognizing failure as a data point by engaging in the iteration process of design thinking.

This study found that students also focused on the structure of the design thinking class course. In particular, they described their experiences regarding the structure of dual learning: spending half of the class time in a classroom and half interacting face to face in a public library. At the beginning of the course, they were confused due to the unexpected situation in a dynamic public setting but they stated how they could learn how to overcome through reflection in the classroom or from the reflection time with the librarian after the design thinking workshop ended. Students emphasized that the course structure provided the necessary opportunity for reflection so that they could share their experiences with peers and learn how to get familiar with dynamic settings. P18 said, *"We had in class time to discuss what worked, what didn't work, how did you feel about this last week, and then you know, anticipating the next week. […] They're like, oh, I hadn't thought of that so, you had kind of that safe space in class where, you know, you didn't have to worry."*

Many students expressed new confidence about how they might engage design thinking principles in their future professional careers through the course, though not every student intended to utilize

design thinking in the same capacity after the course. This stood in stark contrast to the anxiety they felt at the beginning of the course about engaging with real world problems. Moreover, some students were able to conceive ways to utilize the skills in the future which were learned in class, such as leading design thinking activities themselves or just incorporating some of the ideas into workshops or discussion.

5. Implication & Conclusion

This study analyzed a case of a class from 2017 to 2020 at a North American university that applied design thinking methods and a total of 29 interview data of people who participated in the design thinking workshop. The findings showed what were the perceived values of design thinking. From the class, students shared how they were accumulating library experience through user-centered research methodology in HCI, problem-solving methods, experimenting with various attempts and learning from their failures by engaging in the design thinking process. Librarians were able to get help by sharing the challenges they faced in the actual library setting with the resource and time support from the universities and library patrons. Based on the analysis results, below considerations and implications on how universities can apply design thinking for library and information courses is shared.

First, identifying a library where there is a space for the different stakeholders to gather was a crucial indicator in conducting the course. From the interviews, it was apparent that the librarians and the students all appreciated a shared space in the local library to meet with the patrons to develop new service programs using the methods of design thinking. Regarding space, it was not just the physical space where it was close enough for the university students to visit the library but also a space where the students were able to apply their knowledge. The dual nature of the course of half theory learning and reflection in the classroom, half active engagement in design challenges with library patrons gave a balance of both learning theory but also to engaging in practice. The classroom portion of the curriculum created ample room for reflection while the design thinking workshops challenged the students to become more versatile in their application of different engagement methods. I believe that with the right amount of structure and flexibility spaces, students are willing to take more risks and try different tactics.

Second, it was important for the instructor of the course to actively communicate with the current librarians to understand the issues the library was facing in the library and to create

assignments where students were able to engage with the current problems. From the interview we learn that the two groups both found values in the design thinking methods of clearly articulating the design challenge they were facing. By articulating the problem and breaking down the problem where different stakeholders (LIS students, professor and patrons) can work on, students were able to actively engage with the patrons and librarians to solve social problems from different perspectives. When classes incorporate design thinking methods and are conducted with local libraries, universities can not only realize the educational goal of enhancing students' competencies, but also think about the problems the library is facing and therefore benefiting in both directions.

Third, creating structure within the course where students and librarians are able to engage in the iterative process of going through trial and error was crucial. Understanding when and how new digital media will be incorporated for the patrons in the library is not a problem that can be solved in the short term. Through countless trials and errors, librarians and students were able to think about the various considerations when placing new media in a public library. By incorporating design thinking methodology in the process such as engaging in the testing and the application stage we notice how librarians and students had less anxiety in trying new methods out.

Fourth, based on the value of collaboration, it is necessary to recognize that not only professors and current librarians but also students and patrons can participate in solving the problems in public libraries. From the findings of this study, the students and the librarians appreciated the space in exchanging ideas with the library patrons and stated how they were building upon each other's ideas by engaging in the empathizing stage and overall gaining multiple perspectives. In order to create a space where patrons, students, and librarians can design together, it is necessary to think about how to incorporate different design techniques within the design thinking workshops. In the interview, many students said that they learned how to cooperate, and that they could see that the theories learned at school were 'not everyone's language'. Through collaboration the students were able to learn the communication skills necessary for being librarians.

For future studies, students also stated about the opportunities of applying design thinking methods to other patron groups of the library such as the people with special needs, the elderly, and multicultural families. In this way, by connecting with various patron groups, it will be possible to have classes in universities in which the voices of patrons can be heard more actively. In addition, the findings show how the professors and librarians did not have a one-sided relationship to teach students and patrons, but that all four groups were able to learn together and have a role as being design partners who can solve problems together. This helps to break away from the existing methods and helps in better identifying the changing needs in the library.

In addition, this study was conducted in the United States. South Korea has different policies in school such as the number of credits students need to earn for a LIS degree and rules on what it means for the instructor to ask students to work alongside patrons in the library. The library may also have a different relationship with the university in Korea. Despite the differences, this study suggests many opportunities of applying design thinking methods in a Library and Information Science course. Future studies may look into what opportunities and limitations there are in applying design thinking methods for students in Korea.

Overall, this study investigates the perceptions of students and librarians who participated in the class that applied design thinking methods, and suggested implications for future methods that can be applied in the library and information science curriculum. This case study can be used as an example for educators seeking different pedagogy in fostering librarians who are able to gain adequate skills in the evolving information environment in public libraries. The contribution of this paper is that it first shows how design thinking can be implemented in the LIS course by examining the curriculum in the case study and next the findings reveal the perceived opportunity of applying design thinking methods in the course from the interview of students and librarians. Even though as stated in prior literature that many librarians unintentionally, gradually, or naturally employed such design thinking methods in their workforce, this study shows the value of how it can be manifested in the LIS curriculum for the students to learn and work with the community.

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