Information Literacy in the Design Thinking Process - A Preliminary Research

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Abstract. The main problem of research study was to explore and capture the relationship between Information Literacy and Design Thinking processes in the didactic context. The study was carried out in two groups of students who participated in classes where Design Thinking was used. The first group was represented by people studying at the first-cycle studies in the field of electronic information processing (humanities and information technology studies); the second group consisted of students from second-cycle studies in the field of information management (studies in the field of social sciences). In both groups, the author of the paper conducted classes and moderated the Design Thinking process. The study was conducted using a quantitative method, supplementing survey research by a critical analysis of the literature, comparative analysis, and statistical methods.

Keywords: Design thinking · information literacy · higher education · collective intelligence · didactic process

1 Introduction

The process of design thinking is widely used in various areas of human activity, including information activities. According to Rak [1], there are three areas where Design Thinking (DT) processes can take place. The first, the most general and universal, applies to entities whose activities are related to broadly understood information activities and information management (IM) (institutional area). The next refers to individual and group IM and includes tools supporting activities among participants of the DT process (operational area). The last, third area is related to the use of DT in the implementation of practical subjects in the field of IM and related fields (didactic area). The aim of the paper was to explore and capture the relationship between DT and Information Literacy (IL) in the context of the didactic process. The main research questions were: What information competences should students have in order to actively participate in the DT process? What IM tools did they use in the DT process? The expected outcomes of the research were to show what information skills are needed and preferred in the process of DT and what differences in IL existed among students in information-related fields of study. By examining two groups of students, my research provided insights into the impact of IL education on the DT process. It allowed for a comparative analysis of the knowledge, skills, and perspectives gained by students who have a background in IL

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versus those who do not. The study shed light on the potential advantages and disadvantages of incorporating IL in DT education. The study was preliminary in nature. Its local character was driven by the intention to explore the research problem and assess the potential for further investigation on a representative group of respondents.

In the adopted perspective, DT was understood as a manifestation of collective intelligence [2] of great importance for didactic processes [3], in which students undertook both practical activities of designers [4] and users of innovations [5]. It is innovation design [6] that was the main core of activities undertaken by students in the didactic area, where specific information competences were also needed. IL was understood as undertaking information behaviors that allowed obtaining information tailored to information needs and their ethical use [7].

Review of publications in databases registering scientific literature, conducted from April 29–30, 2023, showed that the topic related to the relationship between DT and IL was of interest to researchers. For the search phrase 'design thinking AND information literacy' Scopus returned nine results, Web of Science returned ten, while Google Scholar returned 3,030 results. The databases registered more publications for the following thematic areas:

- "design thinking" - Scopus: 7,099, Web of Science: 4,720, Google Scholar: 208,000;
- "design thinking AND students" - Scopus: 2,019, Web of Science: 1,372, Google Scholar: 87,500;
- "information literacy" - Scopus: 10,122, Web of Science: 7,850, Google Scholar: 268,000;
- "information literacy AND students" - Scopus: 5,408, Web of Science: 4,280, Google Scholar: 213,000.

The above analysis demonstrated that embedding the DT process within the context of IL could contribute to the development of a new research perspective. Moreover, the relationship between DT and information behavior concepts in the context of teaching and the student environment was very strong. To gain a better understanding of the relationships between DT and IL, it is worthwhile to examine how these concepts are currently discussed in scientific literature.

2 Design Thinking and Information Literacy

Strengthening the relationship between DT and IL is particularly evident in libraries. As Ingwe and Sulyman indicated, there was a belief that the benefits resulting from implementing changes in practices and services contributed to this state of affairs. Libraries recognized the value of integrating DT and IL, that led to the improvement of library services and the enhancement of users' information competencies [8]. What is more, as emphasized by Mercer et al., DT could be a driver of information behavior because design work required the use of specialized sources of information [9]. Students who are involved in the design process must diagnose their information needs, gather resources, evaluate quality, and use resources to guide the decision-making process for adopting potential solutions needed to solve the problem [10]. On the other hand, the research conducted by Johnson and Tawfik showed that teachers used a variety of design approaches to improve the teaching of students' IL [11].

DT, acknowledged as a problem-solving methodology in literature, possesses the remarkable capacity to harmonize creativity and analytical thinking processes [12]. It is an intuitive approach that fosters collaboration among multidisciplinary teams from engineering, business, design, and social sciences, with the common goal of generating innovative solutions [13].

The origins of DT can be traced back to the late 1960s and early 1970s, when Simon emphasized the integration of analytical and intuitive thinking, along with the pursuit of changes in the business landscape. Papanek also underscored the significance of design knowledge in addressing social problems (Papanek [25]). Initially, DT was viewed as a structured design process encompassing elements such as inspiration, ideation, and implementation [14].

The contemporary understanding of DT can be attributed to Kelley, a professor at Stanford University and co-founder of the design firm, IDEO. Kelley emphasized the imperative of deeply understanding customer needs and expectations. He described empathy as the willingness to challenge preconceived assumptions and suspend the belief that what one thinks is true, in order to discover what is genuinely true [4].

DT does not possess a single definitive definition. When considering various theoretical perspectives, it is recognized as: 1) a methodology [15], 2) a mindset [16] and 3) a problem-solving philosophy [17]. DT serves as a potent approach to drive innovation, tackle complex problems, and meet customer demands [18, 19]. It is characterized as a comprehensive framework encompassing diverse mindsets, methods, and practices, all aimed at enhancing productivity, fostering creativity, and cultivating innovative solutions [9].

Irrespective of the diverse definitions, DT exhibits certain inherent characteristics. It is universally applicable, transcending disciplinary boundaries and catering to individuals with different areas of expertise. At its core, DT is centered on the needs of customers, emphasizing the thorough understanding and recognition of their requirements. Organizations that employ DT gain a competitive advantage, as the solutions derived through this approach serve the betterment of humanity [20].

The DT process comprises five distinct stages. The first stage, empathy, revolves around the identification and empathetic understanding of customer needs. Following this, the subsequent stage centers on defining both the design challenge at hand and the underlying motivations behind tackling it. In the idea generation stage, the emphasis lies on fostering a mindset that values quantity, encouraging the generation of as many ideas as possible. The fourth stage centers on prototyping, where the ideas generated in the previous stage are translated into tangible visual representations. Lastly, the fifth stage involves testing the prototypes, refining the most promising ideas, and discarding those that prove unsuitable [21].

In contrast to DT, IL remains much more “tangible” and “concrete” in research. Since the 1980s, extensive research and education on IL has been enriched by a wide array of theories. The existence of diverse theories and definitions of IL gave rise to different approaches in IL education. Each theory offers unique insights and perspectives, influencing the instructional methods and strategies employed by educators in promoting IL skills among learners. As a result, IL education has become a dynamic field that

encompasses a range of approaches, tailored to meet the diverse needs and goals of learners in different contexts [22].

IL is a valuable competency for nurturing social capital [23]. An examination of the data reveals specific areas within IL that necessitate improvement. These areas encompass the effective processing of information, the critical evaluation of information resources, the proper utilization of information sources in compliance with legal frameworks, and the proficient utilization of information technologies. Strengthening these skills is imperative to enhance the overall development of IL.

3 Methodology

The study primarily utilized a quantitative method with a survey questionnaire as the tool. It was supplemented by a critical analysis of the literature, along with descriptive statistics. The survey was carried out in two groups of students who participated in classes where DT was used. The first group was represented by people studying at the first-cycle studies in the field of electronic information processing (EIP) (humanities and information technology studies). Their curriculum does not include subjects directly related to IL. The second group consists of students from second-cycle studies in the field of IM (studies in the field of social sciences). The study program provided for participation in many subjects related to IL. In both groups, I conducted classes and moderated the DT process. The study was anonymous and voluntary. The survey questionnaire was completed only by willing students who had completed the specified courses and chose to participate in the study.

The International Federation of Library Associations and Institutions (IFLA) standards for IL competencies were used in the survey questionnaire [2]. The questionnaire consisted of twenty-one closed-ended questions organized into four thematic areas. The first area related to information about the respondents and their knowledge of basic concepts. The second area focused on access to information. The third area centered around information evaluation, and the final area addressed the utilization of information. Incorporating IFLA's standards that cover three main areas related to IL competencies such as access to information, evaluation of information, and use of information, allowed for the assessment of respondents' IL in DT based on indicated key areas.

4 Results

4.1 Respondents and Knowledge of Basic Terms (DT and IL)

In the study, fifty-two students participated, representing 74.28% of the total seventy students in the classes. Among the participants, forty-one students were from the IM field of study, accounting for 78.85%, while eleven students belonged to the EIP program, making up 21.15%.

Breaking down the respondents by gender, thirty-eight were women (73.08%), with thirty-two from IM and six from EIP. There were also fourteen men (26.92%), with ten from IM and four from EIP.

The survey included questions about IL and DT. When asked about their familiarity with the term "Information Literacy", forty-six participants (88.45%) answered positively, with forty-two from IM and four from EIP.

To gauge agreement with the definition of IL "To what extent do you identify with the statement: "Information literacy is the adoption of appropriate information behavior to obtain, through whatever channel or medium, information well fitted to information needs, together with critical awareness of the importance of wise and ethical use of information in society" (Johnston & Webber, 2003), respondents used a five-point rating scale. The majority (53.85%) indicated the highest level of agreement (rating 5), with twenty-seven IM students and one EIP student aligning with this view. A substantial portion (30.77%) expressed a high level of agreement (rating 4), with nine IM students and seven EIP students in this category. Furthermore, eight participants (15.38%) showed a moderate level of agreement (rating 3), including five IM students and three EIP students.

Regarding familiarity with "Design Thinking", all respondents reported being familiar with the concept (100%), including both IM and EIP students. When asked about previous experiences related to innovation design using the DT method, responses varied. More than half of the participants (51.92%) indicated having previous experience, with twenty-four from IM and three from EIP. On the other hand, eighteen respondents (34.62%) reported having no prior experience, including nine IM students and seven EIP students. Additionally, seven students (13.46%) were unable to answer the question, comprising six IM students and one EIP student.

4.2 Access to Information

When asked about their ability to define information needs in everyday life, a majority of respondents answered affirmatively. Among them, thirty-five IM students (73.68%) and three EIP students (6.32%) acknowledged their capability to define information needs.

In terms of the level of difficulty in defining information needs at different stages of the DT process, there were some variations between the two groups (Fig. 1). In the empathy stage, sixteen IM students (33.68%) found it very easy, while five EIP students (10.53%) shared the same opinion. Additionally, six IM students (12.63%) and three EIP students (6.32%) found it easy, while eleven IM students (23.16%) and one EIP student (2.11%) found it very difficult.

Moving to the diagnosis of needs stage, eight IM students (16.84%) and five EIP students (10.53%) found defining information needs to be easy. Eleven IM students (23.16%) and one EIP student (2.11%) found it difficult, and eight IM students (16.84%) found it very difficult.

In the ideation stage, the majority of IM students faced moderate to high difficulty in defining information needs. Sixteen IM students (33.68%) found it difficult, and two IM students (4.21%) found it very difficult. On the other hand, eight EIP students (16.84%) found it moderately difficult, while one EIP student (2.11%) found it easy.

When it came to the prototyping stage, IM students generally had an easier time defining their information needs compared to EIP students. Fifteen IM students (31.58%) found it easy, while only two EIP students (4.21%) had the same opinion. However, three IM students (6.32%) and two EIP students (4.21%) found it very difficult.

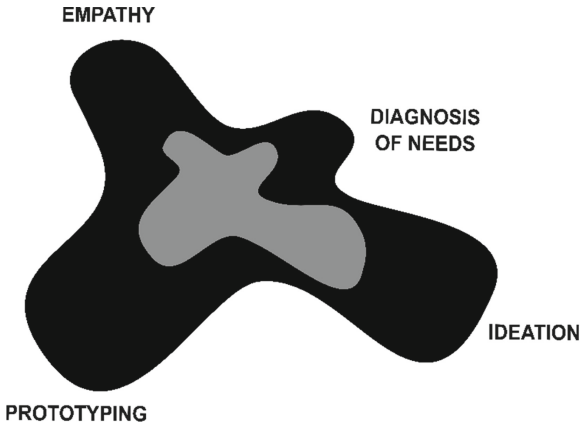

Fig. 1. Level of difficulty in defining information needs at different stages of the DT process: the color black refers to IM students, while the color gray represents EIP students (Source: own research)

In summary, IM students generally reported higher levels of ease in defining information needs across different stages of the DT process compared to EIP students. Both groups faced varying degrees of difficulty in different stages, highlighting the challenges associated with accessing information in the DT process.

4.3 Evaluation of Information

When it came to evaluating the relevance and usefulness of retrieved information at each stage of the DT process, the majority of respondents (71.15%) acknowledged assessing the information's relevance and usefulness. Out of these, thirty-four IM students (64.15%) and three EIP students (5.66%) declared that they assessed the information's relevance and usefulness. Eight individuals (15.38%) responded negatively, indicating that they did not evaluate the information, while seven respondents (13.46%) found it difficult to answer the question.

Regarding the usefulness of obtained information at different stages of the DT process, there were variations between the two groups (Fig. 2). During the empathy stage, nineteen students (36.54%) found the obtained information very useful, with twelve IM students (22.64%) and seven EIP students (13.21%) sharing this opinion. On the other hand, twenty-one students (40.38%) found the information not useful, with nineteen IM students (35.85%) and two EIP students (3.77%) expressing this sentiment. Moving to the need's diagnosis stage, half of the respondents (twenty-six individuals; 49.05%) found the information very useful, with twenty-two IM students (41.51%) and four EIP students (7.55%) supporting this view. Additionally, twenty-one respondents (40.38%) found it moderately useful, while five respondents (9.62%) considered it useless. In the ideation stage, the majority of students found the information obtained to be very useful. Thirty-two students (60.38%) perceived the information as highly useful, with twenty-eight IM students (52.83%) and four EIP students (7.55%) sharing this perspective. Eight students (15.38%) found the information useless, with seven IM students

(13.21%) and one EIP student (1.89%) expressing this opinion. During the prototyping stage, the percentage of respondents who considered the information useless was slightly higher at 19.23%, with ten students (18.87%) sharing this view. On the other hand, twenty-nine students (54.72%) found the information very useful, with twenty-six IM students (49.05%) and three EIP students (5.66%) indicating high usefulness. Additionally, thirteen individuals (24.53%) found the information moderately useful. In the testing stage, twenty-one respondents (39.62%) indicated the high usefulness of the information, with fifteen IM students (28.3%) and six EIP students (11.32%) supporting this view. Fifteen students (28.3%) found the information moderately useful, while sixteen students (30.19%) considered it useless, with twelve IM students (22.64%) and four EIP students (7.55%) expressing this sentiment.

In the study, the frequency of organizing information at each stage of the DT process was examined too.

During the empathy stage, it was found that 44.23% of the respondents did not organize the information. Among them, the majority (91.3%) belonged to the IM group, while a smaller portion (8.7%) were from the EIP group. Additionally, a small percentage of the IM group (7.69%) organized the information very rarely, whereas an equal percentage of both groups (7.69%) organized it rarely. Interestingly, a higher percentage of the IM group (32.69%) organized the information very often compared to the EIP group (13.04%).

Moving on to the need's diagnosis stage, 13.46% of the respondents did not organize the information. Within the IM group, (17.31%) organized the information very often, while the majority organized it often (38.46%) or rarely (17.31%). In the EIP group, the distribution was similar, with 17.31% organizing the information very often, 38.46% organizing it often, and 17.31% organizing it rarely.

During the third stage of the DT process, which is idea generation, it was observed that 15.38% of the respondents organized the information very often, 21.15% organized it often, 42.30% organized it rarely, 15.38% organized it very rarely, and a small percentage (3.85%) did not organize it at all. In terms of the group breakdown, more students from the IM group organized the information very often (15.38%) compared to the EIP group (5.77%).

Lastly, during the testing stage, 38.46% of the respondents did not organize the information. Within the IM group, a larger portion (30.77%) organized the information very often, while 13.46% organized it rarely and 5.77% organized it often. In contrast, within the EIP group, 13.46% organized the information rarely and 5.77% organized it very often.

In another question about the use of tools other than Canva for information development, it was found that the majority of respondents (96.16%) answered affirmatively. Among those who used additional tools, a large percentage (69.23%) utilized a text editor. Similarly, more than half of the individuals (63.46%) relied on folders on their computer or university cloud storage for information organization. Additionally, 36.54% of the respondents used email for IM and a small percentage (3.85%) utilized other tools.

While both IM students and EIP students evaluated the relevance and usefulness of information in the DT process, there were some variations in their perceptions. IM students generally found the obtained information to be more useful across different stages

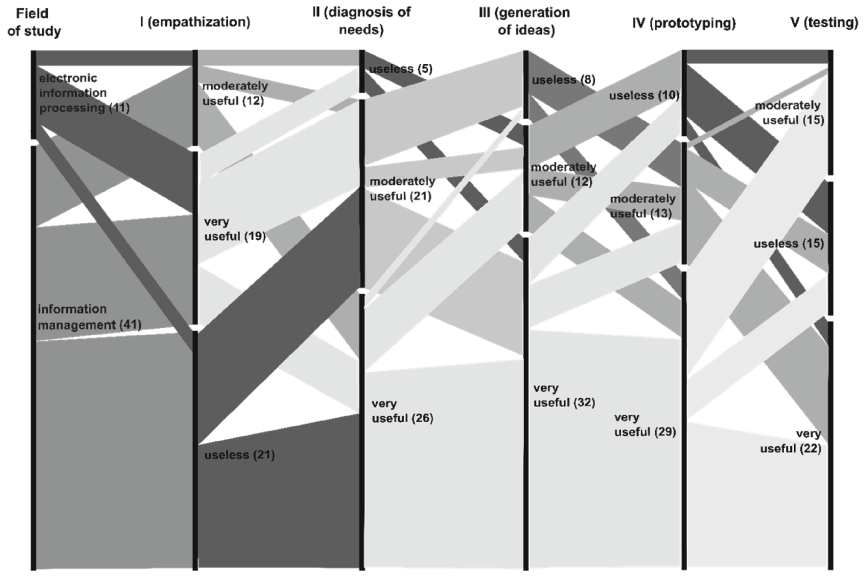

Fig. 2. Usefulness of information (Source: own research)

compared to EIP students. Both groups encountered instances where the information was perceived as less useful or even useless, highlighting the importance of effective evaluation and utilization of information throughout the DT process. The comparison between IM and EIP students revealed some differences in the frequency of organizing information at each stage of the DT process. IM students generally reported higher rates of not organizing or organizing information very rarely, while EIP students showed a smaller proportion in these categories. Both IM and EIP students demonstrated a high presence in organizing the information often and very often during different stages of the DT process. These findings highlight the variations in the frequency of organizing information at each stage of the DT process between the IM and EIP groups. Furthermore, they shed light on the extensive use of different tools for information development, with text editors, computer folders, and university cloud storage being the most common choices among the respondents.

4.4 Information Use

The last part of the questionnaire pertained to the utilization of information. In response to the question, "During the DT process, did you assimilate the information obtained so that you can now define it as your own knowledge resource?" a total of forty-eight respondents (92.31%; forty IM and eight EIP) answered affirmatively. Three persons (5.77%; two EIP and one IM) responded negatively, and one (1.92%; exclusively EIP) was unable to answer the question. Similarly, a majority of respondents, forty-seven of them (90.38%; forty IM and eight EIP), answered affirmatively to the question "Have you used the information obtained in the DT process in an ethical manner?" Four students

(7.69%; exclusively EIP) were unable to answer the question, and one (1.92%; only IM) responded negatively.

To the question regarding difficulties in communicating about the innovations developed through the DT process, forty-three students (82.69%; thirty-six IM and seven EIP) responded that they did not encounter any difficulties, three (5.77%; IM only) confirmed facing difficulties, and six (11.54%; four EIP and two IM) were unable to answer the question. Slightly greater diversity in responses were observed in the last question, which pertained to clear and unambiguous indication of authorship in the developed information product (report/presentation). Forty-one individuals (78.85%; thirty-five IM and six EIP) answered affirmatively, ten (19.23%; six IM and four EIP) stated that they do not remember, and one person (1.92%; IM only) responded negatively.

These findings demonstrate variations between the IM and EIP groups in terms of assimilating information, ethical use of information, difficulties in communication, and clear indication of authorship. The majority of respondents from both groups were able to assimilate the information and use it ethically. Some differences emerged, particularly in terms of facing communication difficulties and indicating authorship clearly.

5 Discussion

In the study conducted, a group of students participated, representing two distinct fields of study: IM and EIP. The IM students constituted a majority of the participants, while the EIP students formed a smaller group. Regarding the division by gender, both male and female students were included. The number of female participants was higher overall, with a larger representation from the IM program. Conversely, the number of male participants was relatively smaller, with a slightly higher representation from the IM program.

The survey administered to the students that covered various aspects related to IL and DT. Students should have a solid understanding of IL, including the ability to identify information needs, access and evaluate relevant information, and ethically use and communicate information. Based on the findings of the research, it can be noticed that the majority of the respondents, particularly those from the IM field of study, demonstrated a good understanding of basic terms such as “Information Literacy” and “Design Thinking”. There was a high level of agreement among the participants regarding the definition of IL, indicating a strong awareness of the importance of appropriate information behavior and ethical use of information in society.

In terms of access to information during the DT process, a greater proportion of the respondents reported being able to define their information needs in everyday life. The level of difficulty in defining information needs varied across different stages of the DT process. While some stages were easier for the majority of the participants, such as the empathy stage, other stages presented more challenges, indicating the need for further support and guidance in those areas. What is more, when individuals possess a strong belief in their ability to acquire, evaluate, and utilize information effectively, they are more likely to demonstrate higher levels of IL competence [24].

The study also revealed that the respondents showed a high level of engagement in searching for information once their information needs were identified. The sources used

during the DT process included official websites, social media, random websites related to innovation, and personal resources. Most of the respondents considered the sources used to be reliable, emphasizing the importance of accessing credible information during the DT process. Regarding the evaluation of information, a considerable number of respondents reported assessing the relevance and usefulness of the retrieved information at each stage of the DT process. There were also individuals who found it difficult to evaluate the information or did not consider it relevant or useful. This highlights the need for enhancing information evaluation skills and providing clearer guidelines on evaluating information during the DT process.

In terms of organizing information, the respondents displayed varying levels of organization across different stages of the DT process. While some participants organized the information very often or often, others did so rarely or very rarely. This suggests the importance of promoting effective information organization strategies to support the DT process and enhance information management skills. The use of tools other than Canva was prevalent among the respondents, with the majority utilizing text editors, folders on their computers, and university cloud storage for organizing and managing information. These findings indicate the need for providing diverse and user-friendly digital tools that can facilitate IM and enhance the DT process. Overall, the research findings provide valuable insights into the respondents' knowledge of basic terms, their access to information, evaluation and organization of information, and utilization of information as a knowledge resource during the DT process. These conclusions can inform educational institutions and professionals in the field of IM and EIP to develop targeted interventions and support mechanisms that foster information literacy and effective information management skills within the context of the DT process.

6 Conclusion

Lessons learned from this research include the importance of incorporating IL skills into educational programs for DT practitioners. It highlighted the need to cultivate effective IL skills to optimize DT processes and outcomes. Additionally, the research emphasized the value of fostering a culture of responsible information behavior and critical thinking within the DT community and society. Developing a course focused on IL within the context of DT presented several challenges. One challenge was designing a curriculum that effectively integrated information management principles while aligning with the dynamic and iterative nature of DT. Another challenge was identifying appropriate teaching methodologies and resources to engage learners and facilitate practical application of IL skills within the DT process. Additionally, addressing the evolving nature of information technologies and their impact on DT required ongoing updates and adaptability of the course content.

This work opens up perspectives for the future. The research contributes to fostering a culture of responsible information behavior and critical thinking, benefiting not only the DT community but also society at large. The perspectives gained can refine and optimize information-related practices within the DT process, leading to more informed and impactful outcomes. The design of educational programs to enhance IL skills within the context of DT can guide the development of training initiatives to cultivate effective

IM competencies among DT practitioners. By considering these perspectives, educators, practitioners, researchers, technologists, and policymakers can collectively advance the integration of IM principles in the realm of DT. The insights can drive the creation of innovative tools and technologies that support IM in DT, enabling more efficient and effective problem-solving.

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