Conceptualizing Context and Its Relationship to the Information Behavior in Dissertation Research Process

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【Abstract】
Context has been addressed as an influential factor of human information behavior. However, there is no consensus on what constitutes a context, or what the relationship between context and information behavior is. In this paper we explore the notions of context and describe the relationship between context and information behavior based on empirical findings, and reviews of current literature. Our finding suggests that context is stratified and dynamic. A context is consisted of several situations, and each situation is defined by a set of related contextual factors. In this way, we propose a new approach to represent the context and situation. At different levels of context, multiple relationships between context and information behavior are identified, including the association relationship, the interaction relationship, and the one-directional relationship. These findings substantiate the concept of situation in Dervin's Sense-making approach, the concept of information horizon proposed by Sonnenwald, and Ingwersen's cognitive model of IR interaction. The multiple relationships between context and information behavior imply that information behavior is related to, but not equal to the process of problem solving. In contrast, information behavior can be viewed as a response of certain situation in the context.
1. BACKGROUND

Context is influential to information behavior. It has been suggested that context might be a better predictor of needs and uses of information than socioeconomic status [1, 2]. However, what is meant by context in relation to human information behavior is usually not stated explicitly [3]. The confusion arises in terms of (a) the label and meaning of context; (b) the dimensions included in the context; and (c) the role of context or its influence on information behavior.

1.1 The label and meaning of context

The meaning of context is usually vague. To some, context is the situation in which the person finds himself or herself [3, 4]. To others, the “IUE” (Information Use Environment) [5] and “Small World”[1, 7] are used to indicate the context of different groups of people. Sometimes context and situation are used interchangeably in the literature, while situation often indicates some specific conditions in a definite time-space movement [8], and is characterized as a set of related activities that occur over time [9].

1.2 The dimensions of context

The notion of context held by the scholars is diverse. Table 1 summarizes the dimensions of context that are proposed in different studies. The most frequently mentioned dimensions of context are setting, resources, problem & resolution, cognition, task, rules. As Table 1 illustrated, there is no consensus on what constitutes the underlying dimensions of context. Context or situation could be referred to all or some of these factors.

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<td>People</td>
<td>Task at hand</td>
<td>Task environment</td>
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</table>
1.3 The role of context or its influence on information behavior

In spite of this long list of contextual factors, the relationship between context and information behavior is unclear and this is due to the lack of systematic research. Taylor [5] has suggested that context affects the flow and use of information, and determines the criteria by which the value of information are judged. Rosenbaum [12] also suggested that bi-directional relationship between the IUE and information behavior when the structure of IUE changes. These narrative findings help us understand the influence of context, but are not able to serve as a tool for describing the way that the contextual factors affect information behavior or vice versa.

The implications from previous research [3, 4, 9, 12], call for a conceptual framework of context that can: (a) represent its multi-dimensional and dynamic nature; (b) demonstrate the relationship between context and information behavior in a systematic way; (c) generate theoretical contribution based on present theories of information seeking and use. Our research is a step toward this direction.

2. RESEARCH QUESTION

Based on the issues discussed above, we designed a study to explore the following questions within the process of dissertation research in plant systematics. Specific questions addressed by this study are:

1. What constitutes the context of dissertation research?
2. What kinds of information behavior occur in dissertation research?
3. What is the relationship between context and information behavior?

The dissertation research process is chosen for three reasons: First, there are intensive information-related activities in dissertation research. It is suggested that the situation of thesis constructing may determine how individual acquires information and what information is looked for [15]. Second, it has been suggested that information behavior should be understood as a process rather than an one-shot deal [16]. Third, the researchers of plant systematics use not only textual but also pictorial information that is emphasized by the studies of digital library [17].

This paper reports partial findings of our study on the dissertation research in plant systematics. In this paper we explore and construct the elements of context and its relationship with doctoral student’s information behavior. We also provide an analytical language to describe and represent the context.

3. METHOD

3.1 Research approach

This study is exploratory in nature, with the objective to explore and describe the context and its relationship to information behavior. This research is a case study with the naturalistic inquiry approach, investigating six doctoral students and two Ph. D. in plant systematics.

3.2 Data collection & analysis

There were about twelve to fifteen doctoral students doing plant systematics research in Taiwan when we conducted this research. The eight participants came from various graduate schools and were at different stages in their graduate studies. The participants were chosen purposively to maximize the diversity of the situation. This strategy was fruitful for identifying the whole spectrum of a meaningful context within the same domain and for
revealing various features of possible relationships.

The data was collected from multiple sources as the participants progressed in their dissertation research. The deep interview served as the major source of data supplemented with informants' working journals, their personal documents, and questionnaires of their preference of used information.

The deep interview, combined with Dervin's Time-line Interview technique [8] and the Critical Incident Technique [18], was used to collect the informants' events, reactions, and resources within their experience. Each participant was interviewed twice. The second interview was conducted four or five months after the first one. Five informants agreed to keep a four-months working journal, which was used to capture the action, thinking, feeling, and resources contacted during this period. The personal documents, such as e-mails and notes, were provided by six participants, and were used to discover personal thinking and communication traces.

The data was then analyzed based on the Grounded Theory [19]. Specific steps taken were as follows: First, developing coding scheme, and identifying main themes. Second, identifying and naming the dimensions and types of information behaviors. Third, identifying and labeling contextual factors and situation. Fourth, identifying and describing the relationship between context and information behavior within each case and cross cases.

To improve our understanding of the field and science of plant systematics, we consulted textbooks, informants' master theses, and other literature on this subject. We also used several methods to strengthen the quality of this research, such as data triangulation, peer debriefing, and member checking.

4. RESULT

4.1 The stratified and dynamic context of dissertation research

The process of the dissertation research can be analyzed at three different levels, as shown in Figure.1. At the macro level, a dissertation research can be viewed as a voyage of knowledge discovery, in which the student has a clear destination to reach with limited resources. At the semi-micro level, the student encounters various situations as proceeding the research process. At the micro level, four contextual factors characterize the context, which are task, type of problem, accessibility, and the research community.

![Figure 1. Context of dissertation research](image-url)
4.1.1 Contextual factors

Task constitutes the main theme of the context, which determinates destinations to reach and products to create. The tasks of a dissertation research include question formulation, research material collection, data collection, data analysis, writing and publishing. These tasks appear to be nearly cyclic, and determine the key intentions and activities of the information behavior.

While the task sets the main theme, the problem complicates the situation and forces students to engage in some information behaviors to solve the problem. There are various types of problems that may be encountered in one task, including topical problems, technical problems, resources-insufficient problems, and no problems. When the problems vary, the information behaviors change accordingly.

The third contextual factor is accessibility, which is related to the degree of the risk and cost when the doctoral student contacts certain source of information. The degree of accessibility is dependent on both the type of source and the student himself. For example, some students can access the Genebank database easily on their local networks; in contrast, other students have to go to another academic center in order to conduct a search.

In the background of task, problem, and accessibility is the research community, which represents the social aspect of the academic world. It includes (a) research tradition and trends, e.g. the emphasis on historical evidences; (b) the social norms, e.g. the customs and conventions concerning doing experiment in other labs; and (c) relationships with advisors and the peers.

4.1.2 The situation

Although each contextual factor has certain influence on information behavior, taken together they provide us a better understanding on the relationship between context and information behavior. We call this semi-macro context as “situation”, by which we mean the condition of the dissertation research at a specific time-space moment.

The situation could be viewed as a slice of the dissertation research, illustrated as the big circle in Figure 1. Each situation is characterized by three contextual factors, which are the task at hand, the type of problem encountered, and the accessibility of specific information. The community, as a part of the contextual factors, is not always present in a given situation, and thus not applied to describe the characteristics of a situation. As these contextual factors change, the situation varies. In the context of doctoral research process, two or more different situations may happen at the same time, especially when the doctoral student involves in two tasks simultaneously.

The following example illustrates one multidimensional situation. When asked why he felt troublesome to go plant collecting again, the doctoral student explained his situation as below:

G: "Because of the heavy rains in this season, it is difficult to find someone to go with me, ...unless I want to go mountain climbing alone. But usually we don't go there alone. It's dangerous.

Interviewer: So, should your companion be someone from your department?

G: No, this is not necessary. It's just that he has to be available now. This time, I found a hiking club. I'd already checked their schedule of the program on the Web, but they might change their schedule because of the rain. (G: 125-158)
The characteristics of this situation can be described with three contextual factors. To gather needed plants reveals that the doctoral student was in the task of “research material gathering”. The description of difficulty in finding a partner indicates encountering a resource problem. When looking for partners, he used the web to search local hiking clubs and schedules, which implies he had high accessibility to this information in this situation.

In summary, our findings indicate that the context could be viewed from three levels. At the macro level, the nature of dissertation research can be analoged to a voyage of knowledge discovery. In contrast, at the micro level of this voyage, a limited set of contextual factors plot out the context. Between the macro and micro level of context, that is the semi-macro level, various situations occur as the doctoral student proceeds the dissertation research. Based on the empirical data, we found that the notion of context is stratified and dynamic in nature.

4.2 The information behaviors in dissertation research

Embedded in this context, wide-ranging information behaviors are identified. Five salient types of information behavior is presented in Table 2. As it shows, each information behavior is characterized by four dimensions, which are the intention to interact, the activity conducted, the information object of that activity, and the sources of the information consulted and used.

<table>
<thead>
<tr>
<th>Information behavior</th>
<th>Intention</th>
<th>Activity</th>
<th>Source of information</th>
<th>Objects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Seeking</td>
<td>To obtain</td>
<td>Searching Scanning Chaining Information exchanging Locating</td>
<td>Social network in the lab Information system Published material Plant specimen</td>
<td>Physical object Reference</td>
</tr>
<tr>
<td>2. Uncertainty-reducing</td>
<td>To evaluate</td>
<td>Information exchanging Examining Testing Comparing</td>
<td>Social network in the lab Plant specimen Published material</td>
<td>Facts Knowledge</td>
</tr>
<tr>
<td>3. Learning</td>
<td>To learn</td>
<td>Organizing Examining Information exchanging</td>
<td>Published material Social network in the lab Plant specimen</td>
<td>Facts Knowledge</td>
</tr>
<tr>
<td>4. Value-adding</td>
<td>To corroborate</td>
<td>Examining Organizing</td>
<td>Published material</td>
<td>Facts Knowledge</td>
</tr>
<tr>
<td>5. Disseminating</td>
<td>To disseminate</td>
<td>Creating Information exchanging</td>
<td>Published material Social network in the lab</td>
<td>Facts Knowledge</td>
</tr>
</tbody>
</table>
Using these dimensions and attributes, we are able to describe and distinguish five types of information behavior from empirical data.

Here is an example of uncertainty-reducing behavior in Table 2. When doctoral student H explained her strategies to avoid redundant effort, she expressed:

"Before doing an experiment, I used to check and study the experiments of similar studies. By doing so, I can know the first step, second step, and so on. ... I will compare the papers. ... I will double-check the procedure. If there are more steps in the procedure in the paper than what I was told, or vice versa, I will ask my advisor, 'Can I skip that step?' "

(H : 188-200)

In this example, the uncertainty-reducing behavior can be characterized with the 4 dimensions mentioned in Table 2. The student’s intention was to verify, because she wanted to know if she could skip any steps in the procedure. With this intention, she looked for the facts. Her activity was comparing, and information exchanging. The source of information used in this behavior included both published material and social network in the lab.

4.3 The Multiple relationships between context and information behavior

There are different sorts of relationship between context and information behavior, depending on the level of context we look at. At the semi-macro level, given a situation, we identify the associated information behavior, whereas both at the semi-micro and micro level of context, we find the interaction relationship. Finally, at the micro-level of context, the one-directional relationship between contextual factors and information behavior is identified.

4.3.1 The association relationship

Viewing at the semi-micro level, in a given situation, we found that certain types of information behavior tend to occur together. Here is an example of the association relationship between the situation and the information behavior. One informant was completing the writing & publishing task. He faced a topical problem, discovering that his research findings were not quite compatible with his expectation, but he did not know why this happened, and how he could explain it:

C: “The pattern [of the phylogenetic tree] came out. It was somewhat different from my expectation, and different from the pattern that was already discovered since 100 years ago. Thus I was wondering why?”

At that moment, he desired for the information of previous research results and had the literature at hand. Thus, his accessibility of information was high. In response to this situation, the doctoral student engaged in the following behaviors: (a) uncertainty-reducing behavior, to confirm the accuracy of the experimental results: “First step, I examined if there is any typo on the species name. Second, I examined whether my results had strong or weak support statistically.” (b) seeking behavior, to look for solutions from other sources: “I dug out my old papers...to see if I had missed any anatomic features that can be used...” (c) learning behavior, to acquire new knowledge: “I re-read the book, ...carefully examined some tables in the book.” (d) value-adding behavior, to apply the new knowledge for corroborating arguments and findings: “[Then] I cited the data from this book...as an supporting evidence.” (C : 161-174) These four types of information behavior also appear in other doctoral students’ experience when they encountered the same situation.
Another association relationship is identified in the situation when the doctoral student faces the technical problem when "doing an experiment" for this data collection task. All students who encountered this situation, in response, conducted the following three types of information behaviors: (a) seeking behavior, to find out the problem and the solution by discussing with the peers or the advisors. (b) learning behavior, to obtain new knowledge of certain method by discussing with others or reading some literature. (c) uncertainty-reducing behavior, to evaluate the feasibility of the modified method by doing a preliminary test.

4.3.2 The interaction relationship

At both semi-micro and micro level of context, we found the interaction relationship. Not only is the information behavior influenced by the contextual factors, but information behavior could also alter the attributes of specific contextual factors. In this way the outcome of the information behavior changes the situation. In the following example, the doctoral student explained how he obtained an essay originally, despite its low accessibility, which reveals this interaction relationship:

G: "I remembered that I had retrieved from a CD-ROM database. So, I found this [abstract]. ...However, the volume of this journal was absent in Taiwan. So I wrote the author a letter, [but] ...there was no response. Then, I asked others and knew that there was a guy who wanted to study this subject. I asked him, 'Do you have any papers? Do you have this one?' and he said 'yes.' [So I asked,] 'Can I borrow it from you?' [The guy nodded.]" (G: 80)

The interaction relationship between contextual factors and information behavior took place in this process in two steps, as illustrated in Figure 2. In the first place, the accessibility to desired information was low, which evoked the first seeking behavior. After the first search, the doctoral student still could not get the essay. Thus he remained in the situation of low accessibility, and conducted another seeking behavior. Because of the result of the second sought, he finally got the essay and thus raised the accessibility by the second behavior, and changed that situation.

![Diagram of the interaction relationship]

**Figure 2. The interaction relationship**
4.3.3 The one-directional relationship

Another relationship happened between the micro level of context and the information behavior is the one-directional relationship. By one-directional relationship, we mean the contextual factors encourage, affect, determine, or prevent certain types of information behavior.

An apparent example of one-directional relationship is identified when we analyzed how the research community influences the dissertation research process and information behavior within it. In the research tradition of plant systematics, they place high value on historical findings and evidences, i.e., type specimen. This tradition encourages the students to visit the herbarium, to discover the research history of the species, and to compare and contrast their field observation, specimen information, experiment results, with the prior findings in literature. Here is one example:

E: I went to Japan to examine specimen. One thing is important, that is, to see the type specimen. Most discoveries of native species in Taiwan were published by Japanese, so, many type specimen are stored there. So I went to Japan to verify some suspicious species, to make sure if that is the same one [as what I’ve seen here] or something else. [In order to judge this], I have to see the type specimen. (E2: 13)

Among other factors of the community, social norms also tend to affect information behavior in one-directional way. A doctoral student learned the tacit knowledge about the rules and regulations from their social network and experience. He/She internalized those as his/her own values, which evokes certain information behavior or serves as the criteria when he/she evaluates information. For example, one doctoral student expressed that in order to formulate a proper research question he examined scientific comments in the flora and collected the opinion of his colleagues. In this uncertainty-reducing behavior, the idea of ‘proper research question’ is an example of the influence from social norms, which imply the shared understanding of current issues, and the requirements for the levels of doctoral research.

5. DISCUSSION

In this paper, we present a stratified framework of context, as illustrated in Figure. 1. This stratified representation is used for describing the context of dissertation research in plant systematics. Within this framework, the context is represented by a series of situations. Each situation is multi-dimensional, and is defined further by the task at hand, the problem encountered, and accessibility of certain information. All of these dimensions are related to the research community. Based on this stratified framework, the association relationship, the interaction relationship, and the one-directional relationship are identified at different level of context.

In this section, we first discuss the difference between our approach and other perspectives on the notion of context. Second, we elaborate how this new framework clarifies the related concepts in the literature. Third, we explain how our findings can expand Ingwersen’s Cognitive IR Theory [20]. Fourth, we introduce the implication of multiple relationships between context and information behavior.

5.1 The perspectives on context

Generally, there have been three perspectives to studying context (see Table 3). The representations of context in each perspective are different, depending on the scope of research object, that is, the information-related phenomenon.
Table 3. Perspectives on context

<table>
<thead>
<tr>
<th>Scope of study</th>
<th>Representation of context</th>
<th>Examples</th>
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<tbody>
<tr>
<td>Communication within a community</td>
<td>Context as cultural / social feature</td>
<td>Chatman [1, 7]</td>
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<td>Information behaviors within a process of a project</td>
<td>Context as independent contextual factors</td>
<td>Fletcher [21]</td>
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<td>Brystrom &amp; Jarvelin [22]</td>
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<td>Rosenbaum [12]</td>
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<td>Algon [23]</td>
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<td>Interaction with information systems</td>
<td>Context as interaction situation</td>
<td>Cool [14]</td>
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<td>Xie [24]</td>
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<td>Hert [25]</td>
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<td>Park [26]</td>
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The most macro perspective focuses on individuals’ communication within a community. This perspective characterizes context with cultural and social features, and views information behavior as a social phenomenon that is influenced by social factors, such as the social network. An example of this approach is Chatman’s “impoverished life-world of outsiders”[1]. The value of this approach lies in its explanatory power based on the theories from communication science, sociology, and social psychology.

The second perspective focuses on individual’s information behavior within a group in an organizational setting. This approach mainly emphasizes the contextual factors, such as task complexity [22, 23], problem dimensions [21], rule, resources, resolutions [12]. Research in this vein deepens our understanding of the spectrum of contextual factors. However, most studies in this vein tend to assume the context as an independent variable, and information behavior as a dependent variable.

The third perspective focuses on individual’s interaction situation with information systems. In this approach, the individual is assumed to be an independent character apart from his social world. Therefore, the social and societal factors are not taken into account. The concept of situation is emphasized in terms of its influence on user’s searching goals, searching strategies, and relevance judgement at the moment of interaction [14, 24, 25, 26, 27, 28, 29] However, these researchers have no attempt to capture the characteristics, elements, and variety of interaction situation per se.

Our framework integrates these above perspectives. We take the first perspective by viewing the doctoral student as living in a social world, and identifying the influence of the research community. We incorporate the second perspective by identifying the spectrum of the contextual factors in dissertation research process. We consider the third perspective by identifying and describing various situations. However, our framework differs from these existing perspectives in several ways.

First, our representation of context is stratified. At the macro level, we use a metaphor of voyage to characterize the theme of the dissertation research process. In this process, we identify various
situations and link the changes of situations to reflect the dynamics of this context. At the micro level, we discover several contextual factors. In this way, we solidify the multidimensional feature of the context.

Secondly, we conceptualize the notion of context from a holistic view. Our finding suggests that the understanding of the context is more meaningful when the contextual factors are viewed in combination. Any single contextual factor, either task or problem, alone is unable to describe the situation of a context, and is insufficient to explain why and how certain information behavior occurs in that context.

Thirdly, we found that contextual factors are not necessarily independent of each other. Our study shows the type of task and problem might be related. For example, the technical problem occurred when the student was conducting experiments in the task of data collection. Similarly, the factors of the community, such as the lack of certain social network, may cause the difficulty of finding the needed experimental equipment, which forced the student to face the resource problem.

5.2 The clarification of context and situation

In Dervin’s Sense-making approach [8], context serves as the background of human behavior, and situation is defined as the time-space moment at which meaning is constructed. Although Dervin recognizes the importance of context, her definition does not explain explicitly what constitutes a situation or the differences between context and situation.

Intuitively, context is broader than situation. More recently, in Sonnenwald’s notion of "information horizon" [9], context is defined as "the quintessence of a set (or group) of past, present
and future situations. Within each context, a flow of situation arises," and situation is "characterized as a set of related activities, or a set of related stories, that occur over time." Sonnenwald's conception defines the scope and the relationship between context and situation. However, Sonnenwald's statement defines the situation based on the factors concerned with the action rather than with the context per se. These definitions lack the descriptive power in terms of how to delineate a situation and are not explicit enough to show its relationship with a context.

From the macro to the micro perspectives, our study represents context, situation, and contextual factors in a stratified manner. The context of dissertation research is constituted of both dynamic situations and multiple contextual factors. The situation, which is encountered by the doctoral student, is not defined by the actions or stories but by a set of contextual factors. These contextual factors, including type of tasks, problems, and accessibility to information, not only serve as the backbone of context, but also characterize the condition of each situation. Thus our conceptualization substantiates the Dervin's [8] and Sonnenwald's [9] construct by providing an analytical language to describe the boundary of context and situation and clarifying the connotations of these two terms.

5.3 The stratified concept of context and Cognitive IR theory

Our conception corresponds to Ingwersen’s polyrepresentation of cognitive IR theory [20]. Ingwersen’s model delineates the concept and elements of polyrepresentation as applied to the users’ cognitive space and the information space of IR systems. On the user’s side, Ingwersen’s model represents the user’s cognitive space by identifying not only the topical variables, such as the dominant
work domain(s), but also contextual factors, such as users' underlying problem space, and actual work task or interest. Outside user's cognitive space, those contextual factors outline the social /organizational environment in terms of domains, strategies /goals, and task & preferences.

Although outlining these contextual factors, Ingwersen argues that information need is emerging from users' cognition, and mainly focuses on representing users' cognition space rather than the context itself. However, our study suggests that before information needs are shaped up in the individual's cognitive space, it is the individual's perception of certain situation in the context that evokes the need for information. For example, to all doctoral students with various cognitive structure, the task of question formulation brings forth straight-forwardly a need for certain information that will help the evaluation of potential research topics. The context does have structures, dimensions, and patterns, as the contextual factors and various situations identified in this study illustrate. Thus, to certain extent, the basic characteristics of a context may be described prior to concerning individual's cognition.

Based on this understanding, we could reconstruct Ingwersen's polyrepresentation model in relation to our findings as illustrated in Figure 3.

![Figure 3. Expanded model based on Ingwersen’s Polyrepresentation of Cognitive Space](image-url)
5.4 The implication of multiple relationships between context and information behavior

The multiple relationships between context and information behavior imply that information behavior is related to, but not equal to the process of problem solving. In contrast, it may be more realistic to view the information behavior as a response of certain situation in the context.

The association relationship at the semi-micro level of context suggests that whether the situation is problematic or not, the information behavior occurs responsively to the situation as a whole. Similarly, the one-directional relationship at micro level of context also indicates that certain information behavior happens or disappears as long as certain contextual factors “occur”, which do not necessarily relate to any problem. In the meanwhile, at both semi-micro and micro level of context, the interaction between context and information behavior corresponds with the process of problem solving. Therefore the underlying pattern of individual’s information behavior may not be static but dynamically shifts from problem solving to interest-fulfilling\(^1\) according to the situation-encountered.

6. CONCLUSION

This study explores the concept of context and its relationship to information behavior based on the empirical data collected from doctoral student’s experience of dissertation research in plant systematics. We identify the elements of context, the information behavior, and the relationship between context and information behavior. An integrated conceptual framework that is capable of describing the stratified and dynamic context of dissertation research is proposed. The multiple relationships between context and information behavior is identified and described in a systematic way.

Methodologically, this study demonstrates the way that qualitative approach of data collection and analysis contributes to exploratory research and theory building.

Theoretically, we provide empirical data that clarify the vagueness of context and develop an analytical language to represent context. While opening to other contextual factors, we suggest that the stratified framework of context can be used as a tool for describing and representing the context. This framework is also helpful for describing and explaining the multiple relationships between context and human information behavior.

For future research, it will be fruitful to investigate dissertation research in other discipline with the same approach and methods, and compare the result with the findings of this study. It is also necessary to explore other contextual factors, and to investigate the possible association between contextual factors. The multiple relationships between context and information behavior indicate that human information behavior is a combination of problem-solving and interest-fulfilling actions that are interwoven in an individual’s responses to his context. This insight calls for the development of an integrated framework for understanding complex human information behavior in relation to his context.

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\(^1\) The term ‘interest’ here refers broadly to the things concerned.
References


