Electron Commer Res
https://doi.org/10.1007/s10660-018-9304-0

The process of solving problems with self-service technologies: a study from the user's perspective

Alireza Nili[1] · **Mary Tate**[1] · **David Johnstone**[2]

Abstract Even the most reliable self-service technologies (SSTs) sometimes fail to meet the user's expectations. This can occur due to technical errors, user service support staff or the user's own mistakes. Although extensive research has been done on topics such as user complaining behaviors and the role of businesses in solving SST problems, little research has focused on the user's own role in solving these problems. In this study, we review the extant studies of SST problems and resolution in the wider business literature; review the prominent theories of problem-solving from multiple disciplines; explain the limitations of existing studies and theories in the context of self-service and SSTs; and develop a process theory specifically for this context.

Keywords Self-service technology · SST · SST problem · Problem-solving process · Process theory

✉ Alireza Nili
a.nili@qut.edu.au

Mary Tate
mary.tate@qut.edu.au

David Johnstone
david.johnstone@vuw.ac.nz

[1] School of Information Systems, Queensland University of Technology, Brisbane, Australia

[2] School of Information Management, Victoria University of Wellington, Wellington, New Zealand

Published online: 17 April 2018

1 Introduction

Self-service technologies (SSTs) are increasingly being provided by service providers in diverse environments [15, 99]. SSTs are now prevalent in diverse spheres of life including supermarket check-outs, banks, car parking, official documents such as passport and visa applications and renewals, public transport, libraries, and many others. A Gartner report [31] noted that "[customers] can go further down the customer journey without human engagement than ever before", and customer service blog Fonolo [29] suggested that 50% of customers want to be able to solve product issues themselves; 70% expect a self-service section on a company website; and predicted that within 1–2 years, 80% of interactions with an organization will not involve a person. In addition to customer benefits, there are many motivations for organizations to facilitate customer self-service. On a comparative basis, a self-service transaction has been estimated to cost only 6% of the cost of delivering an equivalent service via a telephone channel, and a mere 0.025% of the cost of a face-to-face transaction [17].

However, more self-service means that service users are increasingly expected to solve their own self-service problems when they occur [43, 45, 46, 66]. Problems arise from technical errors, user service support staff or user's own mistakes [107]. When SST problems occur, it is typically the user who identifies their perceived SST problem, solves it with their own efforts or collaborates on its solution, and checks whether a solution has solved the problem [43, 46, 55, 65]. For example, a user who is experiencing a problem with an online welfare benefit application system may initially repeat what they have done several times in case they made a typing error. They may restart their device, or the application they are using, check their internet connectivity, or mobile phone data service credit balance. If their problem persists, they may start by using the available self-help information, frequently-asked questions, or the trouble shooting features on the interface of the SST. If the result is still not satisfactory, and the user still wants to continue solving the problem, they may ask for help from another user (e.g., a colleague) or electronically through an online discussion forum. If the problem is still unsolved, the user may decide to ask for help by contacting user support service staff, even if they expect this will require a long wait time. The process of solving this problem ends when the user either achieves a satisfactory result or gives up trying to solve it.[1]

In taking a user perspective, we look back in broad terms to studies of *user perceptions* of services based on expectation–disconfirmation theory (e.g., [71, 72, 76, 77, 99]). This research stream is based on the classic perceptions minus expectations ('P–E') definition of service quality [76], which defines user-perceived service quality as the gap between user expectations of a service, and user perceptions of the service they have actually received. In a SST context, we recognize that many perceived service failures may not be due to any observable failure at a technical level, but may originate from unmet user expectations, misunderstandings, and user

[1] In the course of gathering data for another research project, the authors observed this process on multiple occasions from a range of customers of a large public welfare agency.

errors. We therefore define a SST problem as any gap between user perceptions and expectations with the SST which motivates the user to take corrective action. To our knowledge, this is the first study to investigate and theorize the processes followed by *users* to solve their SST problems.

Although much research has been done on the role of businesses, and in particular, the role of their customer service staff, in solving SST problems (e.g., [30, 33, 42]), there have been fewer studies that focus on the user's role in solving these problems [46, 107]. In this study, we review the extant literature on SST problems and problem-solving, and using Situated Cognition Theory as the point of departure, we carry out a rich qualitative study to develop a process theory for this context. In addition, we identify the tools for SST problem-solving that service providers can provide for their users at relevant stages of their problem-solving process. Developing this process theory responds to recent calls from within the Information Systems (IS) discipline to develop native theories [37, 98, 105]. Specifically, several scholars have discussed the need for 'meso' or 'mid-range' theories in IS [57, 103–106]. These are theories that are sufficiently specialized as to include characteristics of IT-specific phenomena explicitly in their nomological net [98]. Meso-level theories link the micro-level world and macro-level world in a discipline, and should constitute the primary theories in a discipline [57, 105, 106]. This level of theorizing avoids 'narrow empiricism', but also avoids being so general in coverage that it is difficult, if not impossible, to test empirically [57, 103–106]. We answer the question: "what is the process that users go through to solve their own SST problems?"

Our study aims to build a *process theory*, rather than a *variance theory*. In other words, we examine the process needed to present the sequence of SST problem-solving steps. In the rest of this paper, we review process theories of problem-solving, and clarify what the purpose of a process theory is; we describe the data collection and analysis methods; then we present our process theory; and this is followed by a discussion, research limitations, and suggestions for future research. We finish with concluding remarks.

2 Literature review

This section describes SST problems specifically; introduces 'classical' theories of problem-solving; introduces conceptualizations of problem-solving as a process; and provides a precis of Situated Cognition Theory, which provided the best theoretical explanation for the results of our study.

2.1 Problem-solving and the nature of solving SST problems

Experiencing or perceiving a problem with a SST can be considered to be a subset of individual problem-solving as a general phenomenon. A problem in general is defined as "[a situation] that demands a response for adaptive functioning but no effective response is immediately apparent or available to the person or people confronted with the situation because of the presence of one or more obstacles", such

as ambiguity of the problem or a lack of the required knowledge to solve it [12, p. 12]. On the other hand, problem-solving in general can also be conceptualized as a process consisting of several sequential steps of identifying and implementing a satisfactory solution for a problem [12, 26, 27, 50, 61]. A satisfactory solution may be 'satisficing' (good enough) or 'acceptable', rather than optimal. The outcome of this process can be either achieving a satisfactory result or giving up solving the problem [26, 27, 50, 61].

In the context of self-services and SST, a SST problem is a user's *perception* of such a problem, which can also be expressed as a gap between the service the user expected and the service they perceive they received [82, 99], even though a real technical problem may not have occurred. A user may misunderstand the SST because of their lack of knowledge or skills. Users often experience SST problems as 'wicked' problems, for which there is frequently no immediately available and clear description to work with, no immediately available and specific way of solving them, and there may be a lack of understanding as to what an effective solution can be [15, 65, 82, 99].

Previous studies [20, 107] have found that the process of solving an SST problem, as in our example above, frequently involves one or more methods of problem resolution, including: the user's own efforts and/or asking for help from other users (referred to as customer-recovery), where no problem-solving activity is done by service support personnel; seeking support from user support service personnel (joint-recovery); and situations where all activities of problem-solving are done by the organization, where the user has a minimal role in solving the problem (firm-recovery). However, these studies concentrated on: (1) clarifying understandings of the locus of recovery (LOR, or who contributes to the recovery, based on the concept of locus of control [9]) and the customer's preferences and satisfaction with the service recovery depending on the LOR [82]; and (2) the notion of customer participation and its consequences for future intention, using a variance, not a process, model [19–22, 82].

The outcome of the SST problem-solving process is often unpredictable and uncertain at the beginning. Sometimes users achieve a satisfactory result (i.e., the problem is solved), sometimes they give up solving it, and sometimes they find a work-around (the problem is still unsolved, but the user may solve the problem later or give up trying to solve it) [107]. We turn first to classical theories of problem-solving to examine their explanatory power.

2.2 'Classical' theories of problem-solving

Classical theories of problem-solving typically view problem-solving as a set of cognitive strategies involving mental operations and drawing on internal representations including memories and past experience.

Sternberg [95] and Davidson and Sternberg [16] describe an individual's problem-solving as a cognitive chain of problem recognition (the individual becomes aware of the occurrence of the problem), problem definition and mental representation, solution/strategy development, knowledge organization (the problem solver organizes his/

her knowledge about the problem), mental and physical resource allocation, progress checking (checking the extent of progress towards the goals), and testing the adjustment of the solution to the problem. Later, Polya [79] described problem-solving as: formulating objectives, defining the situation, planning, generating ideas, choosing a solution alternative, executing the chosen alternative, and testing the results.

Other scholars, for example [14, 44, 72], posited that some types of problems and situations require creative ways to solve them. Several descriptions of creative problem-solving (CPS) can be found in the literature (e.g., [11, 14, 39, 44, 72, 92, 101]). These also typically describe problem-solving as a process. The main point of difference in these studies is their level of comprehensiveness; whether they have been specifically developed for a particular domain or for a broad field. In general, CPS can be summarized as: defining the problem, generating possible solutions (or creative ideas of how to solve the problem) and ranking them, choosing the best possible solution (i.e., the most applicable and appropriate solution/idea), and implementing it [11, 14].

Newell and Simon [60] state that behavior is a function of memory operations. According to their theory of human problem-solving, an individual solves a problem through a heuristic search through a problem space. They explain this search as the series of: choosing tentatively among alternative solutions, anticipating the outcomes of the chosen solutions, evaluating the outcomes, and backing up and changing their solution if the outcome of the evaluation is unfavourable. Newell and Simon's research has dominated the psychology studies of problem-solving for almost three decades. However, it has been suggested that the theory is incomplete [70], since it assumes that a full range of strategies and solutions are available to the problem solver and the solver's responsibility is just going through the heuristic search for those solutions.

In another study of memory and complex cognition by Heppner and Krauskopf [41] and similar studies such as [36, 74, 75, 78, 102], the authors describe problem-solving as an individual's retrieval and compilation of information from their memory, and proposed the information-processing model. Their study explains that an individual gathers information about a problem, the information is stored in their memory, and this information is then used in relation to the information in their working memory to solve the problem. The study also suggests that an individual may use their prior knowledge or experiences while solving a problem, and at the same time the solver stores the information related to what they are learning while solving the problem [26, 27].

The disadvantage of these theories is that they assume that problem-solving is largely cognitive. However, we take forward from these theories the conceptualization of problem-solving as a *process,* where the process steps may be a combination of both internal cognition and actions.

2.3 Problem-solving as a process

Continuing with this theme, Tallman et al. [97] offer a generic theory of problem-solving as a process, rather than concentrating on the effectiveness of the outcomes: "problem-solving is a behavioral process involving several stages" [97, p. 160]. Tallman et al.'s [97] flow-chart of a generic problem-solving process moves through acknowledging a problem, determining if there is motivation to solve it, searching

for alternatives, selecting alternatives, taking an action, evaluating the action, and determining whether or not to continue. Another important aspect of this generic process is that it is conceived as a series of decisions: "in each stage, key decisions are made about whether to continue activities in the present stage, to take actions to move to the next stage, to return to a previous stage, or to conclude the problem-solving activity" [97, p. 160]. The notion of problem-solving involving ongoing decision-making is also carried forward into our study.

2.4 Situated problem-solving

However, the applicability of studying and using these general theories have been subject to implicit and explicit criticism, in particular that they are too closed, are not representative of real-world situations, and do not take sufficient account of the user's interactions with the environment [12, 26, 27, 51, 97]. As a result, Kirsh developed the theory of Situated Cognition [50]. This proved to be the best fit with our study, as the rich, and relatively unstructured interaction between the person with a perceived problem, and the problem context and environment described by Kirsh, is much closer to the phenomenon of SST problem-solving than the more constrained problems studied by classical problem-solving theorists. Some key components of Situated Cognition theory, for our purposes, include a recognition that many problems: are ill-defined; have ongoing and rich interactions with the context in which they occur; may have many competing and potentially relevant frames by which they can be understood; and can draw on 'scaffolds' for problem-solving. Scaffolding is a notion taken from educational theory, and refers to support of various types given to a student (or problem-solver) during the problem-solving process which is tailored to the needs of the user with the intention of helping the user achieve their goals [48].

Kirsh's [50] view of problems as ill-defined resonates with our view of SST problems. While it is the case that the user often has a clear picture of what constitutes an adequate answer to their problem, a SST problem is frequently ill-defined in another sense of the word, as it often "has no fixed set of choice points, fixed consequence function…or well-defined constraints on feasible actions" [50, p. 268]. The notion of ongoing interaction with the environment is also a good fit with the process of SST problem-solving, which includes: "the back-and-forth process of acting, observing the result, then thinking about the next move" [50, p. 269]. Framing involves applying knowledge, judgement and experience to the problem to determine what is relevant to solving it. Information technologies are usually layered with (at least) hardware, software, and network components, and users will have varying degrees of knowledge and experience with these layers from which they can usefully frame their problems. Kirsh also observes that problem-solving does not occur in mental isolation. People 'scaffold' their problem-solving using tools, techniques, hints and other resources in the environment. These might include (for example) lists of FAQs (Frequently Asked Questions), and talking to other people: "a final source of resources and scaffolds is found in our neighbours or colleagues…offering hints, suggestions, tools, and so on" [50, p. 285].

This conceptualization of problem-solving as Situated Cognition is a more open and iterative process, with a greater degree of interaction with the problem context, than those proposed by classical problem-solving theorists, but still fits generally with the conceptualization of problem-solving as a process.

2.5 The need for a process theory for SST problem-solving

Most theory building research in the IS discipline has had either a variance or a process view[2] [10, 37, 59, 81]. With a process theory, entities are "no more than temporary instantiations of ongoing processes, continually in a state of becoming" [52, p. 5]. Process theories focus on the 'how' by providing "explanations as narratives or stories about how a sequence of events (or steps or activities) unfolds to produce a given outcome" [73, p. 3]. "Variance approaches emphasize the 'what' or the changes that independent variables infringe in a dependent one" [73, p. 2]. Unlike a variance approach, for which time ordering of variables is not of any importance,[3] time ordering can be important for process theories [58, 92]. In terms of methodology, often a qualitative method with a longitudinal orientation is employed to develop a process theory [65, 73, 94].

A high level, conceptual framework is shown in Fig. 1. We use the P–E conceptualization [76], defining a SST problem as something that does not perform as expected [99]. We conceptualize SST problem-solving as a process, consisting of cognition and actions [50, 97]. We view the process as a series of decisions [50, 97], and draw on previous SST problem-solving research that suggests it may involve a number of methods including individual or joint recovery activities [107]. Importantly, we use Situated Cognition Theory [50] as our major point of departure. We see SST problems as ill-defined, open, and presenting challenges for users in selecting an appropriate frame. We recognize that SST problem-solving involves continuous interaction with the environment, and the environment offers many resources and scaffolds to assist the user.

3 Method

In order to develop the theory, we needed to capture the process of problem-solving as it occurred. We initially considered observation, but it was not possible to know in advance when a participant would experience a SST problem. It also became apparent that many SST problem-solving strategies extend over periods of hours or days. We therefore selected the diary method followed by individual interviews. Each participant self-reported their SST problem-solving activities, and the sequence of

[2] We note that a hybrid approach, which combines the characteristics of variance theories and the characteristics of process theories, has also been suggested [73].

[3] However a recent IS study by Ortiz de Guinea [73] suggests that time ordering can be important for variance theories, too.

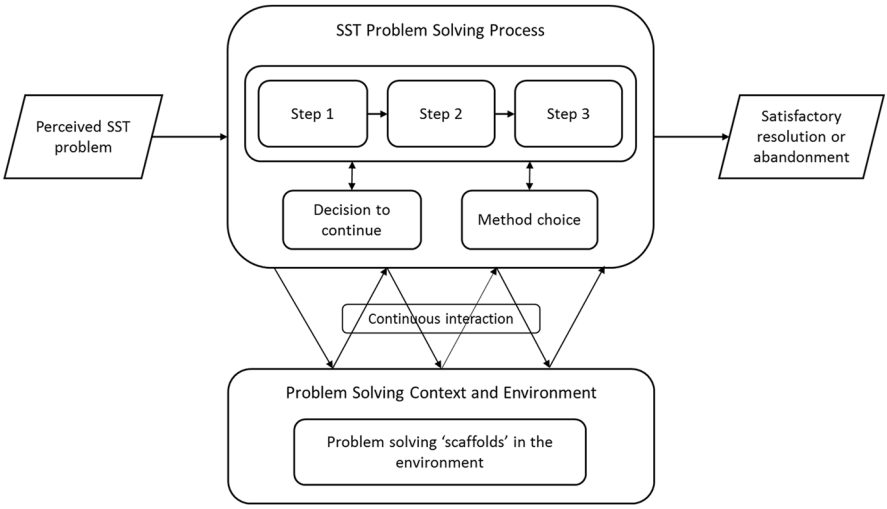

Fig. 1 A high level conceptual framework for the process of solving SST problems

those activities, while going through the process, in a diary [6, 53]. This was followed by individual interviews to ensure our correct interpretation of the diary data.

The diary method is a popular method of data collection for studying people's behavioral processes and patterns within psychology studies and organizational behavior research [53]. It is a reliable method of obtaining data about real people's behavior, for two reasons. First, each participant self-reports information on their own activities as soon as possible, thus minimizing the risk of recall problems [64, 80, 90]. Second, compared with other methods of data collection that rely on participants' self-reporting, and compared with experimental methods and observation method, there is far less concern about the diary data being influenced by social desirability and hindsight bias, which are two factors that affect people's willingness to respond truthfully after the event [64, 85, 86]. However, as the researcher is not present in the data collection environment, ensuring the completeness of reported customer data (e.g. completeness of the activities of solving a SST over a lengthy period of time) can be challenging. Therefore, we followed the recommendations of previous research on the diary method [53, 64, 80, 85, 86, 96], who suggest engaging participants through sending reminders via email or any other suitable communication media during the time participants are completing their diaries. Sending these reminders have not shown a considerable effect on social desirability ('truthfulness' of responses), even with more serious and sensitive research, such as studies of marital and family processes [53, 85, 86].

3.1 Data collection procedure

We chose work and study related SSTs, since they cover a broad range of SST problems that occur in daily life. We chose user participants from the students, teaching

staff, and administrators at a large New Zealand university. Users at the university extensively use various work and study related SSTs, and the university provides first-level phone and second-level face-to-face user support. These three groups of participants represent the vast majority of all users, are diverse (age, background, level of education, gender, and ethnicity) and all have equivalent levels of access to both organization-provided service support resources and peer support.

The data collection phase was widely advertized on the notice boards at all departments of the university and at all branches of the university library, and through notifications and announcements via the University's learning management system. We also employed snowball sampling to reach further potential participants. We had provided our email address as the primary way to communicate, asked participants to send an email to us if they were interested in this research, and replied to any email we received from them. We restricted the study to unobserved user problem-solving behavior; for example, we excluded problems that a lecturer experiences with classroom technology while teaching in order to eliminate social environmental factors [5, 24] which might affect the user's problem-solving process.

The diary form that we designed starts with instructions and an example showing how the information on solving a SST problem can be captured. The rest of the diary includes three sections, each of which is dedicated to one event of a SST problem. Each section asks the participant to describe the problem, explain why they believe that it is a problem, and complete a table outlining the time each decision was made to perform a step, the reason for this decision, what was done, and the outcome of that step. An anonymized example of a completed diary is included as "Appendix 1". After a pilot test of the diary with several participants, in order to check clarity, comprehensiveness and the appropriateness of its structure, the diary was emailed to all participants.

We explained to the participants that the information on solving one SST problem is the minimum required input, the form should be completed up to 2 weeks after receiving it, and that this time may be extended if no SST problem occurs during this period of time or if the participant is willing to provide information on more possible SST problem events. Participants were asked to provide us with their diary during and after completion of their problem-solving in the form of a hard copy or via email. We also sent a reminder to each participant once a week via email to ensure participants' compliance with completing their diary forms. To maximize participants' compliance, we followed the recommendations of the literature on the diary method (e.g., [80, 86, 96]), which suggest designing a semi-structured diary form ("Appendix 1"), providing instructions on how to complete the diary, and maintaining contact with participants. In addition, we emphasized to the participants the importance of including all SST problem events they experienced and details on how they attempted to solve them in their diary. Therefore, although we tried to minimize any risk related to participants' commitment to completing their diaries, we cannot claim that each participant has perfectly complied with completing their diary.

We stopped data collection when we achieved theoretical saturation within each of the three participants groups and among all participants. Theoretical saturation is a consequence of sampling to the point of redundancy, that is, when collecting

data from more participants does not lead to any new insight, idea, theme or the sequence/relationship between categories. This is achieved by concurrent data gathering and analysis, and is operationalized through the process of constant comparison [8, 67, 68]. Our process of constant comparison involved constantly checking and rechecking the codes (e.g. a problem-solving activity represented by a label, such as 'information search'), themes and categories (e.g. problem-solving activities in the category of self-recovery method), and the sequence or relationship between them (e.g. the sequence of using different problem-solving methods) [8, 67] during our data analysis that we were conducting at the same time with data collection.

3.2 Data analysis procedure

All participants sent us their diary forms via email. In total, 33 users participated in the study, and we identified 60 events of SST problems from their diary forms. We drew detailed process diagrams of the problem-solving activities for each of these problem events. Each process was drawn and illustrated through a flowchart diagram that shows the sequential problem-solving activities and the inputs/outputs of the activities (the output of each activity becomes the input of the next activity in the process). We note that at this stage, we used text (words and sentences) close to the participants' own text/wording mentioned in their diaries. Next, we reviewed all processes we had drawn and condensed the description of each activity within its activity box by summarizing the description of the text of each activity using representative words or a short sentence in the activity box and with caution to avoid losing the meaning of the original activity description [18, 58, 88]. These representative words were revised several times while we were reviewing all drawn processes. An example of these processes, which is based on the participant's diary data in "Appendix 1", is presented in "Appendix 2".

In the next step, we invited each participant to a follow-up individual interview to ensure our correct understanding of their diary data and the reliability of the processes we drew. Every participant attended their individual interview session. The individual process representation for each SST problem was confirmed with the problem solver of that problem. Each interview was audio recorded, and took from 20 to 45 min, dependent on the number of SST problems the participant had reported in their diary. Overall, none of the participants' comments showed different or contradictory data about the processes we had drawn, and no need for any major revision or change in any of the processes was identified. This made us confident about the accuracy and reliability of the problem-solving processes we had drawn.

We then examined each of the detailed process maps, and found that users had used from one to three methods to solve their own SST problems (we explain these in the next section). Having these three methods in mind, we found that 77% of the time, users employed the three methods in a similar sequence to solve their SST problems. Also, for a further 8% of problems, where only two methods were used, the same first two methods were used in the same sequence. Based on these findings, we then developed a unified process diagram to show the process users go through

to solve their SST problems, including the sequence of methods, and the percentage of users that followed each sequence.

Lastly, we note that the users' diaries also provided us with information on the tools that users employed to solve their own SST problems (these are further discussed in the next section). To add richness and relevance for practice to our study, when we categorized each user problem-solving process into three high-level categories, we also captured the tools that users employed to solve their problems. We associated these tools with the method(s) of solving SST problems they relate to (see Fig. 3).

Finally, we asked 10 industry experts in the fields of e-commerce and service management to provide their opinions on the technologies that participants employed, in order to add, remove or revise the technologies in Fig. 3. The purpose was to improve our findings on the tools and to provide a comprehensive list of tools that can support users in their efforts of SST problem-solving. Each of these experts has at least 5 years of industry experience, has a post-graduate business degree and has done, or is currently doing, academic research in the area of e-commerce and service management. We received similar comments from all 10 experts, such as this comment: "there can be detailed technical aspects behind the scene for these technologies… [However] you've covered the tools that businesses can provide for their users to solve their SST problems". Overall, at the level of analysis we were seeking, no new categories emerged, supporting our comprehensive coverage of the tools.

4 Findings

Table 1 presents information on the frequent types of SST problems that the three groups of users experienced during our data collection. Also, the diary data shows that only 4 events of SST problems were unsolved. These 4 problems were reported by 3 participants: an administrator, a student and a teaching staff member.

4.1 Process of solving SST problems

We first found that a user often needs to employ a combination of methods to solve their SST problem. We identified three methods of solving SST problems from the user perspective, including:

1. *Self-recovery method* we define this as the situation where the user only employs their own efforts (without asking for help from anybody else, including other users and service staff). The user may use one or more of the available tools that support self-recovery of the SST problem (we explain these in Sect. 4.2), such as a Help icon, troubleshooting features, messages and directions provided on the SST interface, and online how-to and self-help information (e.g., FAQs and various online instructions, such as video tutorials) provided by the business.

2. *Community-recovery method* we define this as the situation where the user asks for help from other users (e.g., a friend, a colleague or any other user) in person (e.g., through a face-to-face interaction in their office) or through an interactive technology (e.g., via an online community of users, such as an online discussion forum on the service provider's website or any other site). The method applies to the situation where problem-solving interactions are only between users, and service staff are not involved. The electronic means of communication (support tools) users use can vary dependant on their preferences or availability and suitability of these tools for their interaction.
3. *Joint-recovery method* we define this as the situation where both the user and user support staff interact with each other and try to solve the problem collaboratively. This includes the joint-problem-solving interaction between service support staff and users either in a face-to-face (offline) environment or through any technology-mediated synchronous or asynchronous 'interaction' (e.g. by telephone and online remote support). In other words, a joint-recovery method involves more activities on the customer side than just contacting service staff to resolve a SST problem (we consider the act of contacting service staff and the associated problem-solving efforts by the service staff, as firm-recovery, which is not the focus of this study). Dependant on the problem, joint-recovery activities may include, for example, contacting service staff and solving the problem together at the same time, or service staff may send instructions to be used by the user after elaborating on what the problem could be.

From the results, we found that each of the participants started solving their SST problem through the self-recovery method. There were no exceptions to this. However, some users demonstrated a low level of persistence with their self-recovery efforts (e.g., they had a short information search, tried to restart or reboot their SST and then use it in the same way again). Among the three user groups, the student SST users showed a lower level of continuance with their self-recovery efforts and started the community-recovery method quickly. Community-recovery was the most frequently-used second method, though similar to the self-recovery method, some participants showed a low persistence with the method (e.g., some participants only asked for help from a friend or a colleague nearby and without providing them with a description of what they did or learnt from their prior efforts). Finally, joint-recovery was the third most frequently-used method.

"Appendix 3" presents the detailed findings based on the users' diaries, and Table 2 presents a summary of the findings, including an overview of the methods and the sequence of those methods the users employed to solve their SST problems. As shown in Table 2, users employed all three methods and employed those methods in the same sequence 77% of the time.

Using this sequence of methods, and the associated activities of each method, we drew a unified, comprehensive, process theory (Fig. 2) for the process a typical user goes through to solve their SST problem. We have illustrated this process with a flowchart that presents the sequential use of the three methods of solving SST problems a user typically employs. The activities within each of the methods and the inputs/outputs of each activity have also been presented.

Table 1 The frequent types of SST problems for the three groups of users

Participant group	Number of participants	Frequent types of SST problems
Teaching Staff	9	Problems with downloading, uploading, and sharing teaching and research materials through the University's learning management system and similar systems, mostly due to temporary network issues
School Administrator	6	Problems with retrieving or storing information on workforce management, research management, and online booking systems, mainly because of limited storage issues
Student	18	Problems with uploading, downloading or retrieving information from the learning management system and library applications via mobile devices, mostly due to system/technical problems, and sometimes because of user's own mistakes

As shown in Fig. 2, the process starts with four activities of the self-recovery method. These activities include: (1) using one's own knowledge and/or available self-help information to know the type and nature of the problem; (2) using available self-help information (provided by the business for their users) and searching for external information (e.g. information available on other websites) to identify and evaluate the possible strategies (possible solutions) for solving the problem; (3) using the strategy from the pool of possible strategies that is perceived to most likely to succeed; and (4) using the next strategy perceived to most likely to succeed, if the previous strategy was unsuccessful. If the user does not achieve a satisfactory result from using the self-recovery method, and they want to continue solving the problem, the user moves on to the four activities of the community-recovery method. These activities include: (1) sharing information (e.g. via social media or in a physical environment) about the results of the previous steps with other users; (2) identifying and evaluating possible strategies for solving the problem; (3) using the strategy from the pool of possible strategies that is perceived to most likely to succeed; and (4) using the next strategy perceived to most likely to succeed, if the previous strategy was unsuccessful. If the problem is still unsolved and the user does not want to give up, the user continues the process of problem-solving through the joint-recovery method, which includes four activities: (1) sharing updated information about the previous steps with support staff; (2) jointly identifying and evaluating possible strategies; (3) using the strategy perceived by service staff to most likely to succeed (e.g., where the user follows the instructions/directions provided by service staff); and (4) using the next strategy perceived to most likely to succeed, if the previous strategy was unsuccessful. Finally, if no satisfactory outcome has been achieved yet, the user either gives up completely, finding some other way to cope with the problem, or outsources the problem completely to someone else (e.g. the service staff).

4.2 Tools to support solving SST problems

The users' diaries also provided us with information on the tools that were found to be most useful to support the various steps in the SST problem-solving processes. These included technologies and technology-supported solutions such as using self-help information (e.g. online instructions), video tutorials (available on the service provider's website or on a different online site), Q&A sites, and social media. As mentioned earlier, we refer to these as "support tools for solving SST problems", which service providers can offer to their users. Figure 3 illustrates a categorization of these tools based on the methods of solving SST problems they relate to in the generalized process, such as online tutorial videos and automated messages as part of the self-recovery method, and customer community pages and discussion forums as part of the community-recovery method.

As demonstrated in Fig. 3, the tools that can support users in their use of the self-recovery method are of an 'informational' nature, and the tools that can support users in the other methods, which require contacting and/or interaction between at least two persons, are 'interactive' communication technologies. As a result, some tools, particularly social media, can be employed for more than one method

Table 2 A summary of the findings based on the users' diaries

The sequence of using the methods			Percentage of SST problems	Percentage of solved SST problems	Users
Self-recovery	Community-recovery	Joint-recovery	77% (46/60 problems)	96% (2 unsolved problems out of the 46 problems)	25 users among the 3 groups of users
Self-recovery	Community-recovery	–	8% (5/60 problems)	100% (no user needed to continue problem-solving)	3 students
Self-recovery	Joint-recovery	–	5% (3/60 problems)	33% (2 unsolved problems out of the 3 problems)	1 administrator and 1 teaching staff
Self-recovery	–	–	10% (6/60 problems)	100% (no user needed to continue problem-solving)	1 student and 2 teaching staff
Any other sequence			0	–	–

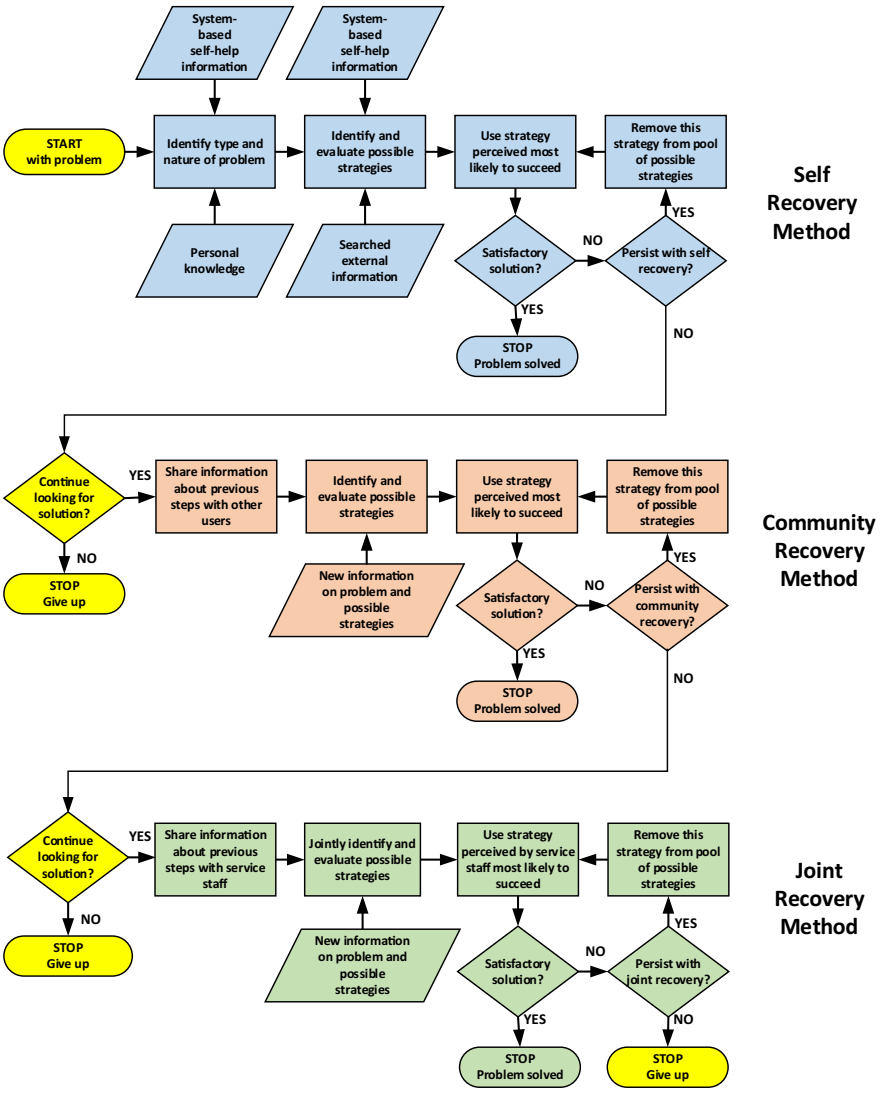

Fig. 2 The process of solving SST problems from the user's perspective

of solving SST problems (e.g. community-recovery and joint-recovery methods), showing their high importance for solving SST problems. One interesting finding is that there did not appear to be any tools that were used consistently by a broad range of users for SST problem-solving. A wide range of tools were used, and each tool was used by only 1–5 participants. There appeared to be a very wide range of individual preferences for tool use and/or different levels of usefulness.

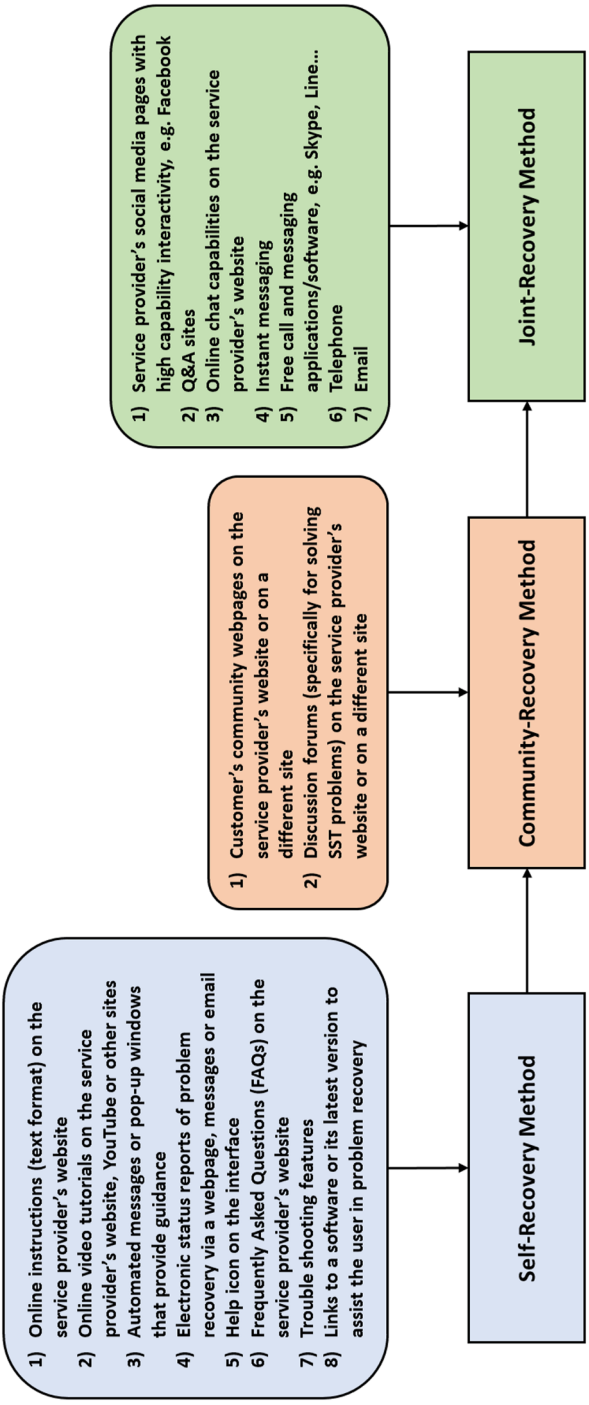

Fig. 3 Tools that can support users in their process of solving SST problems

5 Discussion

Overall, our theory confirms previous theories of problem-solving and, most importantly, provides a detailed, usable and IS-specific, 'meso-level' theory, based on Situated Cognition Theory [50], that includes technology phenomena [38, 104, 105]. We conceptualize SST problems as typically poorly defined, 'wicked' problems that cannot be approached by evaluating a single, pre-determined, linear and closed set of alternatives. SST problems need to be 'framed' by the user, by applying knowledge, judgement and experience to the problem. Users also need to engage in continual interaction with their environment to obtain more information and revise their problem-solving strategy. The degree to which the user possesses attributes of relevant knowledge, judgement and experience will vary greatly. Despite this, the users in our study followed a consistent process of, first, attempting to solve the problem on their own, then turning to peers and their community, and finally seeking help from the organization. As this proceeds, the user obtains fresh insights from interaction with the environment. To support users to solve their problems, organizations and communities need to leverage these interactions in order to 'scaffold' users—to provide tailored information that will help frame and resolve their problems. If we consider this in the broader context of 'trends' in SSTs, and user interactions with SSTs, several interesting points emerge. First, the best 'approach' to user problem-solving is prevention. Error prevention, and appropriate help are included among the ten basic interface design heuristics [62, 63, 69]. Our study assumes that despite careful attention to usability design, there will still be situations where the service does not meet the user's expectations. We also note that while attention to user interface design for usability has become mainstream in the last 20 years, it is not ubiquitous (the authors will attest to this based on their experiences with some of the internal systems used in their workplace). It also appears to be the case that many organizations do not devote the same attention to the usability of help and service recovery systems that they devote to the main service process. Greater attention to these issues is likely to prevent many instances of perceived SST failure, or make it more likely that 'self-recovery' will be effective.

Another interesting area for consideration is the likely impact of increasingly intelligent and autonomous services.[4] Learning and self-repairing systems should reduce the need for SST problem-solving in the first place, diagnosing and repairing problems *before* the user is aware that the problem exists [65, 66]. An avatar or robot assistant might fill the place of community-recovery in scaffolding the user to solve their problem.

We assume that despite these advances, there will still be situations that SST users experience as problems. While we feel confident that our theory captures an accurate snapshot of SST users' problem-solving processes at present, it will be fascinating to see if this changes as increasingly intelligent and autonomous digital services become more mainstream.

[4] We thank an anonymous reviewer for this contribution.

We further note that our findings resonate with observed behaviors of millennials in other contexts. For example, millennials engage in multi-tasking and task switching, and have been observed to switch tasks an average of every 6 min in a detailed study by Rosen et al. [87]. In this case, supporting switching that is as seamless as possible (for example being able to carry a summary of what has already been tried forward into the next problem-solving method) could be a valuable area for future research.

The diary data shows that the student and younger SST users quickly switch to the community-recovery method after some self-recovery efforts, showing the high importance of facilitating interactions between these groups of users. One possible explanation is that in the 'sharing economy', an increasing range of online sharing sites, providing services ranging from travel recommendations to ride shares and technical help, are more widely used by millennials than by older generations [4]. Increasing the willingness of older customers to engage with community problem-solving may be an area for further investigation.

5.1 Contribution to theory

Considering 'classical' theories of problem-solving, it is clear that there are important cognitive aspects to the process we observed. For example, according to Heppner and Krauskopf's [41] study of cognition, an individual gathers information about a problem, stores this information in their memory, and uses it in relation to the information in their working memory to solve the problem (this also means that an individual may use their prior knowledge or experiences while solving a problem). At a high-level, this is congruent with our finding that users in our study started their process of solving their SST problems with the self-recovery method, as this both draws on their own experiences and 'working memory', and helps to reduce the level of uncertainty. Following Sternberg [95] and Davidson and Sternberg [16], we can see evidence of similar cognitive processes in our participants' observed behaviors. The individual becomes aware of what they perceive as an SST problem. The individual's mental representation may not have been entirely clear or accurate but, nevertheless, it guides their first choice of strategy and knowledge organization. Resources are then applied and the result evaluated. The result will likely provide a clearer problem definition and additional knowledge, which informs either continuation with the same approach, or starting a new approach.

Our results are commensurate with [50, 97], who emphasized the 'decision-making' components of the problem-solving process. Each step may be considered as a choice to continue (overall) rather than giving up, and the availability of a community and joint-recovery methods means the user must also make a choice as to whether to continue with their current method or to switch to another.

The 'unstructured' and 'open' nature of the problem-solving process was also clearly evident. Many users reported a change in their understanding of the nature of their problem and possible solutions as they moved through the process. Continual interaction with the environment [50] was evident. It was also clear that users accessed 'scaffolds' of different types [50]. These were frequently digital tools,

which included a wide range of resources including video, help systems, and FAQs. These scaffolds had a major influence on their behavior, suggesting new strategies, and making it more likely that a user would continue with a problem-solving method. With regard to the interactions between users and service support (joint-recovery), these interactions can also offer an opportunity for scaffolding and educating users by providing them with step by step guidance on how relevant self-help information can be found and be used to solve a certain type of SST problem. This knowledge can also improve their self-efficacy in solving similar and even other types of SST problems that may occur in the future [13].

We clarified that the theory we developed in this paper is a *process theory* of users' SST problem-solving. As we noted earlier, process theories provide explanations as narratives or stories about how a sequence of steps or activities unfolds to produce a given outcome [73]. Time ordering is important [7, 59, 94], and longitudinal data collection is often employed to develop a process theory [59, 73, 100].

Clearly, our use of the diary method (which is longitudinal, non-experimental, and not limited to time and place) supports the development of a process theory. In this regard, we also note that the diary method has been widely used in psychology studies of an individual's decision making and behavior, but rarely in information systems research. Therefore, this study can serve as an example for the practical use of the method in IS research.

In the literature review section we briefly reviewed Dong et al.'s [20] and Zhu et al.'s [107] three categories of user participation in solving their SST problem, comprising customer-recovery, joint-recovery, and firm-recovery (these are the only existing categories in SST problem-solving literature). In this study we offer a deeper view of user behavior in solving their SST problems, and identified slightly different categories, including self-recovery, community-recovery, and joint-recovery. In other words, we have effectively partitioned the customer-recovery method into the self-recovery and community-recovery methods, while joint-recovery has remained the same. The firm-recovery method was not used by any of the study's participants, as this study, and its data collection procedure, is from the user's perspective (the user behavioral process of solving SST problems). Thus, any situation where a user is not even aware of the organization's internal operations related to solving the problem falls outside the scope of this research.

Our paper, which is the first study to investigate and theorize the processes followed by *users* to solve their SST problems, responds to recent calls [37, 98, 103–106] from within the Information Systems discipline to develop 'meso', 'mid-range' native theories that specialize by explicitly including characteristics of IT-specific phenomena. Commensurate with this level of theorizing, we avoided 'narrow empiricism', but also avoided being so general in coverage that it is difficult to test the theory empirically [57, 103–106]. We also clarify that the high-level convergence between our findings and previous cognitive and behavioral studies (e.g. [1–3, 16, 23, 25, 28, 32, 35, 40, 41, 50, 95, 97]) increases our confidence about our results.

5.2 Contributions to practice

Knowing the process users go through to solve their SST problems has implications for service management in practice. Once a business knows this process, they can provide appropriate tools to scaffold their users' attempts, at various stages, to solve their own SST problems. The tools presented in Fig. 3 can serve as useful guidelines for other organizations that aim to provide tools for SST problem-solving for their users. We note that most of these tools are inexpensive, even for businesses with a small budget for user support. However, the diversity of tools employed by users poses challenges for organizations who may be wondering which tools and electronic channels to support. It seems that users expect to be able to find help via the tool or channel of *their* choice, which can increase the organizational effort devoted to maintaining multiple information and communication platforms. Some of these channels, such as social media pages, require dedicated staff for responding to help requests from users. This also emphasizes the importance of careful content management, to make sure that multiple sources of information maintained by the organization are updated consistently and in a timely manner. Industry commentators suggest that successful organizations are increasingly taking strategic, integrated, and automated approaches to managing their social media presence for marketing and service delivery [56], and an increasing array of tools is emerging to support organizations with the task [91]. We suggest that supporting SST problem-solving needs to be included as an integral part of an organization's social media strategy. Supporting SST problem-solving should be seen as part of a wider strategic landscape for customer relationship management and support. Organizations that are struggling with strategic management of their social media presence overall, may also struggle with using social media effectively to support SST problem-solving.

Our study emphasizes the importance of providing high-quality tools to scaffold both the self-recovery method (e.g., various self-help information and how-to contents in Fig. 3) and the community-recovery method (e.g., user community pages and discussion forums). Tools of this nature offer efficient solutions for small businesses, start-ups or any business with a small budget and/or lack of required resources, enabling direct interactions with users and increasing user satisfaction by meeting the users' needs as early as possible in their problem-solving process. An efficient management of SST problem-solving can also support any SST service provider in maintaining their overall user satisfaction and retention rate [15, 47, 49, 83, 84, 89, 93].

The findings also show that some interactive communication technology channels, particularly social media pages, can be employed for more than one method of solving SST problems. This shows the high importance of these tools/channels, when compared with other approaches, for assisting users when solving SST problems. Many of these tools/channels can facilitate both the interactions among users (in the community-recovery method) and the interactions between a user and service support staff in the joint-recovery method.

Organizations that are able to scaffold more effective 'self-recovery' will reduce the pressure on online communities and their own customer support resources. However, this also means that it is likely that only more complex problems will be solved using these methods. Expert users in online communities may expect to be compensated for their time and expertise. We imagine a possible future where 'community-recovery' could be crowd-sourced using micro-payments and micro-tasking platforms. Following this line of argument, joint-recovery with firm employees often acts as the final point of escalation for problems. An increasing number of problems are resolved by self-recovery or community-recovery methods. Therefore, support for self- and community-recovery should not be seen as a 'poor relation' in the organization. Finally, if problems are escalated to firm employees, they should possess genuine expertise and added value beyond what is available to support self-help.

5.3 Limitations and suggestions for future research

In this study we focused on the process (sequential activities/steps of problem-solving, like the process theories we reviewed in Sect. 2) from an individual SST user's perspective, and positioned our study and our research question as a theory building study that aims to build a 'process theory', rather than a 'variance theory'. As a result, we did not include any determinants (e.g. user characteristics), as these are outside the *aim and scope* of the current study. We identified that the process users go through to solve their SST problems is largely consistent. Interestingly, although, there may be some factors which may affect the users' progress through the process they don't appear to change the process overall. These factors may be, for example, computer self-efficacy (the user's perception of their own ability to use computer technology; [13]), locus of recovery (who should contribute to the recovery; [9, 21, 82]), ease of use (the user's perception of how effortless using a computer technology is) and interactivity of SST (how easily and efficiently a system responds to commands; [107]). These factors might contribute to how long a user persists with a specific method, or with SST problem recovery overall. Future research may consider exploring the motivation factors that contribute to a user's decision to *choose* which of the three methods to use to solve a SST problem, the factors that contribute to the user's decision to *continue* using (persist with) that method, and the factors that contribute to the user's decision to continue the overall process of solving SST problems, since the motivation factors related to the overall process may be different to those related to each method.

The participants of this study are well-educated or are studying for a university degree, have a medium to high level of IT literacy, have access to a variety of tools for SST problem-solving, are able to have direct interactions with user support service staff, and are able to interact with peers and other SST users. However, given the very broad variety of our participants' demographics (age, gender, level of education, etc.) and given the fact that work and study related SSTs cover a broad range of SSTs that many people use in their daily life, we believe that it is highly possible that our findings are generalizable to other SST contexts. We suggest future

IS research to consider different types of users, such as users with a low level of education, or users with special circumstances, such as the elderly or users with some types of disabilities that may prohibit them from being able to use one or more of the three methods of solving SST problems effectively. We also suggest future research to consider users in a different situation, such as where a business does not provide full service support for their users or when there is no organizational service support at all.

As explained, we asked the participants of this study to report their SST problem solving activities in an unobserved environment, where they may feel more comfortable with problem-solving, in order to eliminate factors (e.g., environmental factors) that might influence their activities. However, asking users to report their activities of solving SST problems in the presence of others may result in new insights about the process users go through to solve these problems.

There is little evidence to suggest that using the diary method can lead to a significant change in a participant's decision-making or behavior while participating in a study (referred to as the participant's 'reactance') or a similar negative effect on the validity of diary data [6, 34, 54]. In this study, only four SST problems were unsolved. Although we believe that this does not diminish the development of a theory of solving SST problems (and it can even be perceived as a positive factor for this research), this low number of unsolved problems may show some participant reactance.

Our study concentrated on the user perspective. Informed by these insights, it would be very valuable to conduct a further study from an organizational perspective; to relate our findings to organizational value and success metrics for user support, and to evaluate the success of various organizational interventions.[5]

Another rich area for further research is to examine the evolution of user problem-solving processes as technologies become more autonomous. Previous research examining omni-channel users of services suggest that users like to feel in control and have a choice as to when they select self-service or joint service options [64, 96]. Similar issues are likely to arise in service recovery. How can we find an appropriate balance between user-directed problem-solving and system self-repair or autonomous behavior? Will users be willing to relinquish their authority to autonomous SSTs in the problem-solving processes?[6]

6 Conclusion

From a customer perspective, self-service technologies are increasingly ubiquitous, and increasingly essential for many aspects of our daily life. From an organizational perspective, in a competitive or severely resource-constrained environment, encouraging users to solve their own problems wherever possible represents opportunities for considerable cost savings in customer support. However, this needs to be

[5] We thank an anonymous reviewer for this contribution.

[6] We thank an anonymous reviewer for this contribution.

carefully balanced with providing customers with a satisfactory overall experience of SST problem-solving, in order to support customer retention.

We note that many customer actions in SST problem-solving are not observable by the organization—for example use of a discussion forum, off-line consultations with friends and colleagues, and other actions. Our study is the first, to our knowledge, to capture detailed insights about user SST problem-solving from a user perspective *as it happens* rather than being recalled after the event, thus avoiding the risk of selective recall and hindsight bias.

Our study offers two important insights. The first is that while the overall process people use is fairly consistent, they use a very wide variety of tools. This means that for organizations trying to decide between (for example) YouTube videos, online help, assistants and prompts, and FAQs, the answer may be 'all of the above'. Careful content management is required to ensure that timely and consistent information is available in the wide range of places that users look for it.

The other is that the overall process of SST problem-solving is very consistent across a wide range of users, technologies, and problems; the vast majority of users attempt a sequence of their own efforts, followed by community help, followed by service support staff help. This means that, provided organizations invest appropriately in scaffolding self-help and community-recovery methods, they can likely position themselves as an expert source of last-resort for SST problem-solving, without necessarily adversely affecting user satisfaction.

Compliance with ethical standards

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

Appendix 1: A completed participant's diary form (an anonymized example)

Please describe the problem briefly:
The system [removed the name] that I use to produce audio and video content does not work today. I need it for my research and study.

Why do you believe this is a problem?
I use it to produce content myself without asking from AV production staff, but it does not work today. Currently I do not know how to solve it.

Please provide as specific information about your problem-solving steps as possible while you are solving the problem or as soon as you finish a step.

Start date and time	Finish date and time	What intended (what did you decide to do), and why?	Did you perform this decision? If no, why? If yes, what did you do?	Outcome of this step?
11 Nov. 9:20 am	11 Nov. 9:27 am	I decided to visit their website and its Help section to see whether there is any information about such a problem	I searched Google, found their website and read the Help and FAQ sections	I did not find any relevant and helpful information
11 Nov. 9:28 am	11 Nov. 9:38 am	I've already heard and seen that sometimes sellers or service providers provide some video instructions. They are usually very simple. Any relevant information may help	I wrote some initial keywords in the search box of YouTube and clicked on any video that seemed relevant to the problem on the first page of the results	I feel I know the problem. I know what sort of problem it is
11 Nov. 9:38 am	11 Nov. 09:47 am	I decided to search Google again. I know that I know the problem, but I don't know what the reason of it is and don't know how to solve it yet	I wrote some other keywords in the search box of Google and clicked on most of the links on the first page and on a link on the second page	There should be three possible reasons and two ways. Not sure which one
11 Nov. 09:48 am	11 Nov. 09:48 am	Decided to use the way that seems better, though the steps are unclear	Started and stopped quickly. It's not a right way	This doesn't work
11 Nov. 09:48 am	11 Nov. 09:48 am	Decided to use the other way though the steps are a bit unclear	Started and stopped quickly. It's not a right way	It doesn't work either
11 Nov. 09:48 am	11 Nov. 09:54 am	I still feel unconfident about this and I do not know how to solve it yet. I decided to ask some of my colleagues in my department who probably have some relevant knowledge	I went to two colleagues who have already used this system and have a good knowledge of it, and shared what I know with them	I became sure it is because of a design flaw. But I don't know any solution yet. Need to work on other jobs

Start date and time	Finish date and time	What intended (what did you decide to do), and why?	Did you perform this decision? If no, why? If yes, what did you do?	Outcome of this step?
11 Nov. 11:30 am	11 Nov. 11:38 am	I decided to participate in a discussion forum. I found it online. I guess it can help because there are already some good information there. I hope someone knows how to solve it	I explained my problem and wrote whatever I know so far. I tried to write it clearly and avoid any extra information that confuses people	I received three responses. The possibilities are: the network and its protocol, and the driver of the system
11 Nov. 15:20 pm	11 Nov. 15:22 pm	I decided to try all available networks. It seems to be a good and logical solution. I do not know much about network protocols though	I went to the page which shows all available networks and their details. I tried to do whatever that user told me as best as I can	This doesn't work
11 Nov. 15:23 pm	11 Nov. 15:35 pm	I decided to install the driver because the first solution did not work. Also, at this stage, I think this new solution makes sense	I installed the driver. At first I did not know much about how to do it, but it was not difficult really	Unsuccessful again
11 Nov. 16:00 pm	11 Nov. 16:19 pm	I decided to contact service staff and ask for help. I thought if I solve the problem myself, it can be solved fast, but now I feel I'm losing time	I contacted them. It was taking too long. I have to wait more but I don't have enough time	I gave up. I think email should be a better option
11 Nov. 16:19 pm	11 Nov. 16:21 pm	I decided to send them an email. It doesn't take much time, I can do my other tasks and also I can explain things more clearly when I write	I sent an email to the service staff. I tried to provide as much details as possible and whatever I know and I've done so far	They replied and sent step by step instructions. The good thing is that I can understand it easily

Start date and time	Finish date and time	What intended (what did you decide to do), and why?	Did you perform this decision? If no, why? If yes, what did you do?	Outcome of this step?
11 Nov. 16:49 pm	11 Nov. 16:57 pm	I decided to follow the instructions. There are six clear steps	I followed all the steps exactly	Problem solved. I also saved the instructions. I may need them in future again

Appendix 2: An example of the process of solving a SST problem

See Fig. 4.

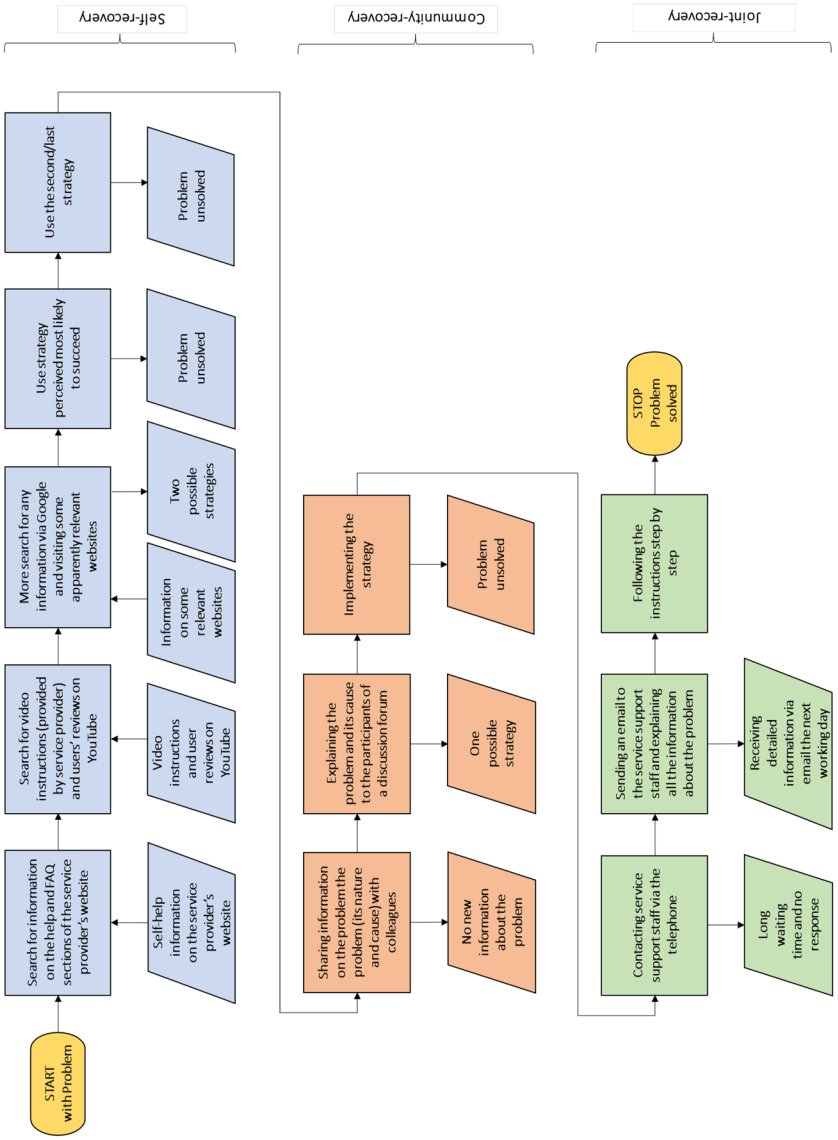

Fig. 4 An example of the process of solving a SST problem (based on the diary data in "Appendix 1")

Appendix 3: Diary data

User#, SST problem#	Used self-recovery as the first method?	Used community-recovery as the second method?	Used joint-recovery as the third method?	Used any method after the third method?	User					Mandatory SST use?	User support service is available?	Problem solved?
					Group	Age	Gender	Education background	Experience of prior use of the SST?			
1,1	Yes	Yes	Yes	No	S	24	M	IS	Yes	No	Yes	Yes
2,1	Yes	Yes	Yes	No	S	20	F	OSS	Yes	No	Yes	Yes
2,2	Yes	Yes	Yes	No	S	20	F	OSS	Yes	Yes	Yes	Yes
3,1	Yes	Yes	Yes	No	S	21	F	OSS	Yes	Yes	Yes	Yes
4,1	Yes	Yes	Yes	No	S	23	M	OBusM	No	Yes	Yes	Yes
5,1	Yes	Yes	Yes	No	S	25	M	OBusM	No	Yes	Yes	Yes
6,1	Yes	No	No	No	S	21	M	ComS	Yes	No	Yes	Yes
6,2	Yes	Yes	Yes	No	S	21	M	ComS	No	Yes	Yes	Yes
6,3	Yes	No	No	No	S	21	M	ComS	Yes	Yes	Yes	Yes
7,1	Yes	Yes	Yes	No	S	21	M	ComS	Yes	Yes	Yes	Yes
8,1	Yes	Yes	Yes	No	A	41	F	OBusM	Yes	Yes	Yes	Yes
8,2	Yes	No	Yes	No	A	41	F	OBusM	No	No	Yes	No
9,1	Yes	Yes	Yes	No	S	27	M	IS	Yes	Yes	Yes	Yes
10,1	Yes	Yes	Yes	No	S	22	M	ComS	Yes	Yes	Yes	Yes
10,2	Yes	Yes	Yes	No	S	22	M	ComS	No	No	Yes	Yes
11,1	Yes	Yes	Yes	No	T	61	M	OBusM	No	Yes	Yes	Yes
12,1	Yes	Yes	Yes	No	S	28	F	OSS	Yes	Yes	Yes	Yes
13,1	Yes	Yes	No	No	S	24	F	OSS	No	No	Yes	Yes
13,2	Yes	Yes	No	No	S	24	F	OSS	Yes	Yes	Yes	Yes
14,1	Yes	Yes	Yes	No	S	19	F	OSS	Yes	Yes	Yes	Yes

User#, SST problem#	Used self-recovery as the first method?	Used community-recovery as the second method?	Used joint-recovery as the third method?	Used any method after the third method?	User					Mandatory SST use?	User support service is available?	Problem solved?
					Group	Age	Gender	Education background	Experience of prior use of the SST?			
15,1	Yes	Yes	Yes	No	A	39	F	OBusM	Yes	Yes	Yes	Yes
15,2	Yes	Yes	Yes	No	A	39	F	OBusM	Yes	No	Yes	Yes
16,1	Yes	Yes	Yes	No	A	35	F	OBusM	Yes	Yes	Yes	Yes
17,1	Yes	Yes	Yes	No	S	43	M	IS	Yes	No	Yes	Yes
17,2	Yes	Yes	Yes	No	S	43	M	IS	No	Yes	Yes	Yes
18,1	Yes	Yes	Yes	No	T	44	M	IS	Yes	Yes	Yes	Yes
19,1	Yes	Yes	Yes	No	T	27	M	IS	No	Yes	Yes	Yes
20,1	Yes	No	No	No	S	25	M	OBusM	Yes	Yes	Yes	Yes
20,2	Yes	No	No	No	S	25	M	OBusM	Yes	Yes	Yes	Yes
20,3	Yes	Yes	Yes	No	S	25	M	OBusM	Yes	No	Yes	Yes
20,4	Yes	Yes	Yes	No	S	25	M	OBusM	No	Yes	Yes	Yes
20,5	Yes	Yes	Yes	No	S	25	M	OBusM	No	No	Yes	Yes
21,1	Yes	Yes	Yes	No	S	26	M	OBusM	Yes	Yes	Yes	Yes
21,2	Yes	Yes	Yes	No	S	26	M	OBusM	Yes	Yes	Yes	Yes
21,3	Yes	Yes	Yes	No	S	26	M	OBusM	No	No	Yes	Yes
22,1	Yes	Yes	No	No	S	42	M	IS	Yes	No	Yes	Yes
22,2	Yes	Yes	No	No	S	42	M	IS	Yes	Yes	Yes	Yes
23,1	Yes	Yes	Yes	No	T	65	M	IS	Yes	Yes	Yes	Yes
23,2	Yes	Yes	Yes	No	T	65	M	IS	Yes	No	Yes	Yes
23,3	Yes	No	Yes	No	T	65	F	OSS	No	No	Yes	No
23,4	Yes	No	Yes	No	T	65	F	OSS	Yes	Yes	Yes	Yes
23,5	Yes	Yes	Yes	No	T	65	M	IS	Yes	Yes	Yes	Yes

User#, SST problem#	Used self-recovery as the first method?	Used community-recovery as the second method?	Used joint-recovery as the third method?	Used any method after the third method?	User					Mandatory SST use?	User support service is available?	Problem solved?
					Group	Age	Gender	Education background	Experience of prior use of the SST?			
24,1	Yes	Yes	Yes	No	T	35	M	OBusM	Yes	Yes	Yes	Yes
25,1	Yes	Yes	Yes	No	S	29	M	OBusM	No	No	Yes	Yes
25,2	Yes	Yes	Yes	No	S	29	M	OBusM	Yes	Yes	Yes	Yes
25,3	Yes	Yes	Yes	No	T	35	F	IS	Yes	No	Yes	Yes
26,1	Yes	Yes	Yes	No	T	36	F	IS	Yes	Yes	Yes	Yes
27,1	Yes	Yes	No	No	S	25	M	OBusM	Yes	Yes	Yes	Yes
28,1	Yes	Yes	Yes	No	T	32	M	IS	Yes	Yes	Yes	Yes
29,1	Yes	Yes	Yes	No	S	19	F	OEng	Yes	Yes	Yes	Yes
30,1	Yes	Yes	Yes	No	S	20	M	OEng	No	No	Yes	Yes
31,1	Yes	Yes	Yes	No	A	38	F	ComS	No	Yes	Yes	Yes
31,2	Yes	Yes	Yes	No	A	38	F	ComS	Yes	No	Yes	Yes
31,3	Yes	Yes	Yes	No	A	38	F	ComS	No	Yes	Yes	Yes
32,1	Yes	Yes	Yes	No	A	45	M	OSS	Yes	No	Yes	No
32,2	Yes	Yes	Yes	No	A	45	M	OSS	No	Yes	Yes	Yes
32,3	Yes	Yes	Yes	No	A	45	M	OSS	Yes	Yes	Yes	No
33,1	Yes	No	No	No	T	36	F	OEng	Yes	No	Yes	Yes
33,2	Yes	No	No	No	T	36	F	OEng	Yes	Yes	Yes	Yes
33,3	Yes	Yes	Yes	No	T	36	F	OEng	No	Yes	Yes	Yes

S student, *A* administrator, *T* teaching staff, *M* male, *F* female

IS, information systems (as a business/commerce field); OBusM, other business and management related fields (e.g. marketing, finance, and human resources management); OSS, other social sciences; ComS, computer science and engineering; OEng, other engineering fields

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