Designing a peer-based support system to support shakedown

Short Paper

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Abstract

Many problems of software implementations appear after roll-out during the shakedown phase. Research have shown that peer advice ties are more effective and preferred by users than traditional IT support structures. However, large organizations are often shrouded in anonymity and individuals often don't know which peer to ask for advice, resorting to help desks as a last resort. The paper addresses the challenges of peer advice ties as support structure by presenting a peer-based support system (PBSS) design to address emerging problems of individuals during shakedown. By applying design science research and theory of interaction as explanatory theory for peer advice to derive design requirements. Based on the informational, timeliness and contextual advantages of peer advice ties, we develop tentative design principles, which aids in identifying and creating interaction among peers. The contribution lies in prescriptive knowledge on how systems should be designed to support peer advice as support structures.

Keywords: design science research, shakedown , peer advice ties , IT support

Introduction

Software implementations in organizations are both a promising and risky undertaking (Markus 2004). They are often managed as technical IT-projects (Highsmith and Cockburn 2001; Markus 2004; Mueller, Thoring 2012), yet are inherently accompanied by challenges of organizational change (Zmud and Cox 1979). Its failure rates are estimated to be as high as 60% (Devadoss and Pan 2007). Undertakings of IT-projects accompanied by and resulting in organizational change are called technochange projects (Markus 2004). From an individual perspective it is imperative that users acquire the necessary knowledge about the software (Gnewuch et al. 2016; Davison et al 2013). This missing knowledge is most apparent after rollout when users begin to use the software in their day-to-day business and start encountering problems (Markus 2004). Technochange defines the phase as *shakedown* and characterizes a period when employees need help to adapt and cope with the newly introduced software and processes (Markus and Tanis 2000). Shakedown includes formal user-trainings and other IT-support initiatives, which are crucial for closing the knowledge gaps of most users. Only then do users truly learn how to integrate their new software into their day-to-day work (Sykes 2015). Learning how to use the software is therefore essential to overcome the challenges of shakedown and to reduce the duration of shakedown to attain benefits realization more quickly (Markus 2004).

Currently, different forms of traditional support structures are deployed to support the shakedown phase. Users need knowledge on how to use the software. Traditionally, these learning services, such as formal training, online support, help desk support, change management support are provided by established support structures (Puhukainen and Siponen 2010; Ragunathan et al. 2008; Sykes et al. 2009; Venkatesh et al. 2011). Conceptually, the emerging problems represent existing knowledge gaps among users that hinder day-to-day use. Sykes (2015) states that the above-mentioned support structures provide "the necessary information to allow employees to work effectively" (p.476). In other words, IT-support provides users learning services, which ideally "teaches" the user to solve emerging problems during shakedown by applying newly acquired knowledge. However, certain limitations apply to traditional IT-support structures (Sykes 2015): The support structures are limited in regards to providing the right information, at the right time and with sufficient contextual information (Sykes 2015). Training are often conducted before the roll-out and are usually not as viable during shakedown due to financial constraints (Markus 2004). Furthermore, online support and help desk support often lack the necessary domain knowledge to fully understand the problems users face day-to-day, resulting in "lacking contextual elements" [...] not understanding necessary "downstream actions" (Sykes 2015, p. 476). Even online support are often software specific, which means that users need to contact different online support in order to address their information needs. However, recent research suggests that non-traditional peer advice ties play an important role in IT-support, being the more preferred and effective support structure during shakedown (Davis et al. 2009; He 2005; Sykes 2009, 2015). The more effective form of support is peer advice ties (PAT). Peer advice ties form when users seek advice with their peers and their peers decide to give advice.

The most common peer advice scenario is that people tend to ask their colleagues through face-to-face interaction whether they can help them or know someone who can (Sykes 2015). This type of learning via social interaction is especially important for shakedown (Gnewuch et al. 2016) since peers have the advantage of highly domain-specific knowledge and understanding of social structures of their organization. Thus, users play both the role of service producer and service consumer, resulting not only in a better understanding of emerging problems but also enhanced judgement on how solutions to respective problems should look like. This type of learning is restricted by vicinity and whether the user knows who and where potential experts are.

Yet, peer advice ties are highly dependent on the individual and the people they know, therefore making it hard for organisations to engineer the necessary conditions and make it scalable (Sykes 2015). Hence, the research goal of this short paper is to propose a design of a peer-based support system (PBSS) to make use of the advantages provided by peer advice ties.

Since it is vital for individuals to learn how to use the software correctly during shakedown (Gnewuch et al. 2016; Markus 2004) to realize its benefits for both the individual and the organization. This results in following research question:

RQ: How should a peer-based support system function to support users?

This research follows the design science research principles of Hevner et al. (2004) and applies a design science research approach (Vaishnavi and Kuechler 2007). The foundation chapter presents a discussion and justification for the problem space, from which the design requirements are derived. A concept in form of design principles is then suggested. Based on those principles an initial prototype with two core design features is developed. Finally, a short discussion on the expected contribution and future work concludes this paper.

Foundation

Traditional IT-support structures

Sykes (2015) has recently made a review of support structures in MISQ and ISR publications. The author identified four traditional support structures to benefit individuals directly: training, change management support, online support, help desk support and peer advice ties.

Training involves classical, on the premise frontal education, such as common in classroom settings. They are condensed into either several hours or even days with most information that users need to use the new software effectively (Sharma and Yetton 2007; Sykes et al. 2009). Due to the amount and the fixed time of the trainings, individuals usually only understand or retain the basic information (Sykes 2015). *Online support* is usually only limited to single software, even though it can provide timely and remote help for users, while also providing some software specific learning contents (Beaudry and Pinsonneault 2010). *Help desk support* are support resources provided by the own organizations who have a vast technical solutions knowledge on emerging problems based on their access to up-to-date manuals and reference contents. However, domain specific knowledge is often the missing problem (Gray and Drucikova 2006). *Change management support* is provided by change consultants, who can provide the necessary information in most contexts, however they are an expensive resource with limited capacity and only staffed for a finite time (Strong and Volkoff 2010). Each traditional support structure has limits in either getting the right information to the user or getting it at the right time or understanding the business context (Sykes 2015). However,

The importance of peer advice ties in IT-support

The concept of peer advice ties (PAT) originates from social networks research studying communication and advices in work settings (Ibarra and Andrews 1993; Kilduff 1992; Rogers and Kincaid 1981). The networks that focus on the allocation of resources and information are called advice networks (Zagenczyk and Murrel 2009). In social networks, network embeddedness describes how connected one node is in relation to other nodes and how all nodes are connected to each other (Granovetter 1992; Nahapiet and Ghoshal 1998). PAT are the most widespread source of information for employees in organizations (Davis et al. 2009; He 2005; Sykes et al. 2009), due to its high *ease of access* and high *contextual understanding* of the problem.

Peer advice ties can be a type of social support, such as understanding and encouragement from colleagues (Beaudry and Pinsonneault 2010). Other organizations chose to train power users to become on-the-field experts for their colleagues to turn to (Sykes 2009). Similarly, Strong and Volkoff (2010) observed that power users were picked from their usual work environment and integrated into the technochange team as testers and even function as IT support. Afterwards, they were reintegrated into their former position. Sykes' (2015) findings suggest that the investment into traditional support structures are wasteful, if peer advice ties are present. Organizations should redirect their spending into fostering an organizational culture in which PAT are encouraged or even incentivized. Therefore, PAT act as conduits for getting necessary knowledge to the right place and to the right people to solve emerging problems during shakedown. Relating to ITCon, peer advice is identified as being superior over traditional support structures. Peer advice ties performs significantly better in terms of getting the right information (I) at the right time (T) with the right context (Con) (ITCon) to the advice seeking user (Sykes 2015).

Theory of Interaction and importance of peer learning

Theory of Interaction stems from the disciplines of sociology, psychology and education. The term interaction encompasses the communicative actions and interrelations between humans (Bryant and Heath 2000; Jäckel 1995). In this case, specifically Moore's (1989) differentiation of three types of interaction: *1. learner-learner interaction; 2. learner-content interaction; 3. learner-lecturer interaction* is adopted.

Learner or a lecturer are dynamic roles that peers can take on during interaction. They are dynamic, since peers only act as learner/lecturer once they interact with each other. The learner is the person facing the problem and thus is on the receiving end of knowledge transferral. For this system, interaction is defined as all learning activities between learners, lecturers and content (Moore 1989; Schrum and Berge 1997).

Contents aid learners learn either with the most traditional form being a textbook but can also include a variety of reference material (Sykes 2015).

Furthermore, learning changes the human state and therefore its behaviour based on experiences (Gagne 1984). Team members share knowledge on how to use a system informally (Wagner and Newell 2007). Introducing peer learning in organizations is comparable to a community of practice (Wenger 1998) on a "special topic, distributing knowledge in a 'living' way" (Wegener and Leimeister 2012, p.384). This form of informal learning differs from classical learning, since it lacks a dedicated teacher and is unstructured (Eraut 2004). Managers thus must create an environment of active feedback culture regarding change (Tennant et al. 2015). An environment to leverage peer advice ties is hence crucial for a successful PBSS. Furthermore, recent research in peer learning show that learner preference is diverse and even a seemingly homogeneous group prefer different types of learning modes (Raymond et al. 2016). Therefore, different forms of content are required, such as video clips, how-to presentations or plain text (Kogga et al. 2016).

Research on peer-advice ties and learning literature is complimentary. In Peer-advice ties literature, peers can seek missing information by creating links to other peers (Hollingshead 1998; Rulke and Galaskiewcz 2000), which coincides with the learning perspective of *learners* seeking advice from *lecturers* or from *content*. The missing information is thus conveyed by the learner-lecturer or interaction with content (Moore 1989). The content can be text books (classic learning scenario), as well as reference materials or handbooks (traditional support structures), thus we also argue that we introduce the concept of the interaction with content into leveraging peer-advice-ties.

Overall Design Science Research Approach

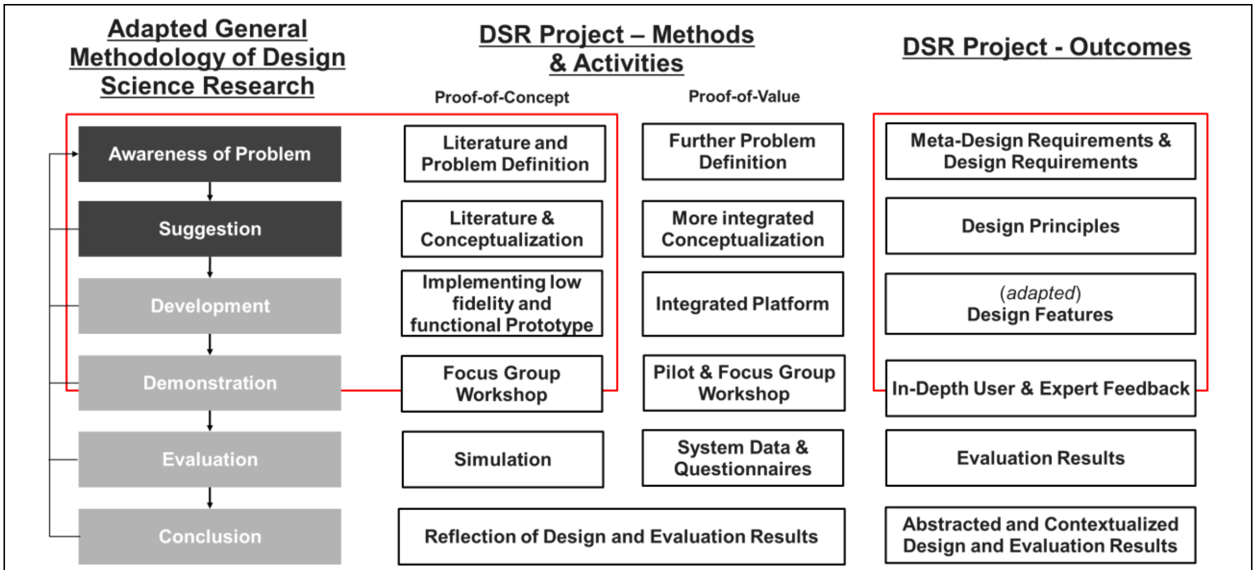

Figure 1 - Adapted DSR approach – red boxes symbolizes status-quo (Vaishnavi and Kuechler 2007)

This research follows the design science research approach (Hevner et al. 2004) to develop design requirements and design principles through the iterative design of the artefact. This enables a richer understanding and continuous reflection on the PBSS design. Figure 1 illustrates our complete design science research approach for our research project adapted from the general design science research methodology (Vaishnavi and Kuechler 2007) and its adaptation following Meth et al. (2015). Also, Peffers et al.'s (2008) approach of theory-driven design is followed, starting by defining problem awareness through a review and addressing the need for peer advice ties (Sykes 2015) and theory of interaction (Moore 1989; Schrum and Berge 1997) for traditional support structures. Subsequently, we suggest design principles and develop a recommender and multimedia learning tool prototype. To integrate literature and expert opinion for increased relevance (Hevner et al. 2004), we participated at a kick-off workshop for a customer relationship management system project held by our research partner, a mid-sized company from the energy sector, with all six heads of their business unit present. We attended a 6-hour long training session to gain a deeper understanding how change managers work and trainings are held. While being present we gained insights and took research notes (Yin 2013). The resulting requirements were tested after developing a low-fidelity prototype during the demonstration phase (Meth et al. 2015). To increase rigor, focus group workshops as a method were chosen to gain additional ideas in a moderated discussion with stakeholders (Smithson 2000). This enabled both to test initial assumptions and to move towards a proof-of-concept by presenting the two main functionalities, the recommender and the multimedia messaging tool (Nunamaker et al. 2015).

Both workshops were held with members of our research partner, consisting of three employees from organisational development, IT support and the project management office and two researchers. The problem understanding was refined with a focus group discussion (Smithson 2000) and elicit additional requirements based on our presentation and arising discussion. At the second workshop, we presented the use case of people searching for advice, giving advice and creating content with our low-fidelity prototype. Each workshop took 3,5 hours. The discussions were recorded and we followed the qualitative approaches to derive further insights (Greenbaum 1998). We then co-authored a joint report for the board of directors and gained their top-level support by officially sanctioning our research project endeavour. The initial results for our proof-of-concept are presented in this short paper. To complete our proof-of-concept, we have planned another focus group workshop with five additional users from one single business unit with our functioning prototype to gain additional insights and feedback after simulating several use cases as advice seeker and giver in a concluding demonstration and evaluation phase.

Next, proof-of-value is addressed and whether peer advice ties have improved over time and whether the users are more inclined to use our PBSS compared to the existing traditional IT-support structures. To do so, we launch our second iteration by integrating our prototype into the organization's Confluence system as a plugin with approximately 50 users. To measure the impact of our PBSS on advice ties we refer to Kilduff and Tsai's (2003) measurement of network centrality via system data to see whether users can overcome the face-to-face barrier. The peer-advice ties *ease of access* can be measured by proxy of perceived ease of use. The PAT *contextual understanding* of peer-based support will be measured by perceived usefulness, its *perceived prescriptiveness* and to accommodate the shakedown context, adapted *perceived life cycle applicability* (Wallace and Sheetz 2014). To complement self-reported use-behaviour, system data is collected. The baseline for both usefulness and ease of use will be the evaluation of other existing support structures to determine whether our PBSS indeed leverages the benefits of peer-advice ties (Sykes 2015).

Awareness of Problem: Developing Design Requirements

The current research results are illustrated in figure 2, which depicts the mappings of all DSR outcomes from design requirements to design principles and the two core design features. Design requirements are developed from both theory as well as from interactions with our research partner. Following sections will show our rationale in developing the relationships of figure 2. Furthermore. design requirement 2-4 and design requirements 6-7 have also been directly elicited from the experts during our focus group workshop.

For the first two design requirements, a theory-driven approach was employed, by drawing upon the discussion on theory of interaction (Moore 1989). A PBSS in organizations connects peers without formal definitions of learners and lecturers (Sykes 2015). It creates dynamic relationships through configuring suitable peers with either role. Each peer can therefore take on the role of a learner or that of a lecturer. The overall notion is to construct a realm, in which all peers can learn from each other for peer support and sharing of knowledge (Faraj et al. 2016). Davison et al. (2013), showing that informal sharing of knowledge increases team performance. The learner must be in an environment in which the idea of seeking knowledge from peers is encouraged (Tennant 2015). Therefore, a rigid form of dedicated one-to-many lecturer is not ideal in organizations, but should rather rely on informal 1-1 interactions among peers (Eraut, 2004). Informal interactions among peers applies to learner-to-lecturer constellation (Moore 1989). A lecturer is therefore a role who is responsible for conveying their knowledge to the learner. Additionally, studies have shown that learners who interact with their lecturers are more actively involved, resulting in a more effective learning process (Liu et al. 2003; Wang et al. 1990). Since learner and lecturer are roles undertaken by peers, we adapt learner-to-lecturer interaction into the following design requirement:

DR 1: *A peer-based support system needs to increase peer-to-peer interaction.*

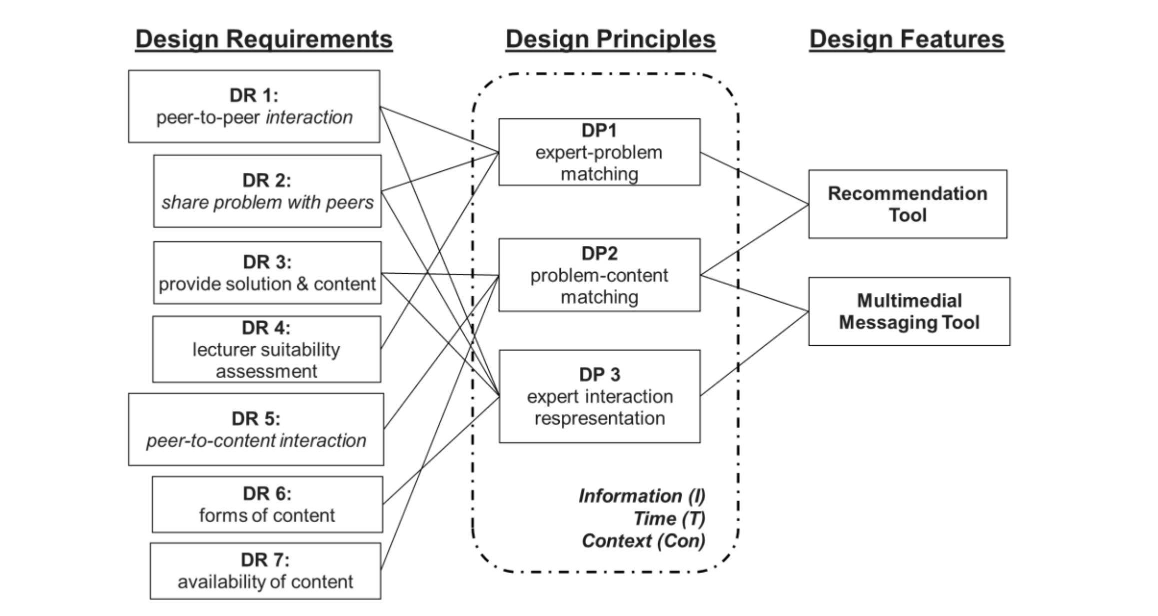

Figure 2 - Overview of all DSR outcomes and corresponding relationships

Furthermore, shakedown is characterized by emerging problems on an individual level (Markus 2004; Li and Peters 2016). On the one hand, peers have to be enabled to share the problems they encounter and on the other hand, other peers have to solve the encountered problem. Drawing upon online support, textual data are suited for posting problems (Beaudry and Pinsonneault 2010).

DR2: *In order to increase peer-to-peer interaction, users need to be able to share emerging problems with peers.*

DR3: *In order to increase peer-to-peer interaction, users need to be able to provide solutions and content with their fellow peers.*

A lecturer traditionally teaches by letting learners solve tasks. These tasks are important elements for learning. However, in This case, the learner brings tasks in form of emerging problems (see DR2). Other peers need to be able to solve that problem, to be able to teach. Peers therefore first must analyze the stated problem and assess whether they have the necessary skills to help their fellow peer. If they deem themselves competent enough, he takes on the role of lecturer, leading to following requirements:

DR4: *In order to increase peer-to-peer interaction, peers need to be able to assess whether they are suitable to be instructors based on comparing the shared problem with their own skills.*

Furthermore, tasks are but a part of the learning content, describing what it is used for. Using different forms of communication and media forms, to support learners with their task, one address different learner preferences (Meehan-Andrews 2009; Raymond et al. 2016). Hence, it is important to increase learner-to-content interaction.

DR5: *A peer learning support system needs to increase peer-to-content interaction.*

The documented results of the peer-to-peer interaction defines the respective content. This includes messages, videos, texts, screenshots and links etc. (Rolando et al. 2014). The content can then be shared among future peers, facing similar problems. However, correct content (documentation) has to be matched to the correct context (problem description) to create value-in-use (learner successfully solving problem). The information, which is created for peers should therefore be externalized and made available as content for future reference (Faraj et al. 2016).

DR6: *In order to increase learner-to-content interaction, multiple forms of communication based on learner preferences have to be employed by the lecturer.*

DR7: *In order to increase learner-to-content interaction, transferred knowledge has to be externalized and made accessible for future problems.*

Suggestion: Developing Design Principles

Sykes (2015) stresses the important role of PAT for shakedown. However, PAT relies on face-to-face contact or second order relational contacts (Davison et al. 2013). Due to both time and spatial differences, finding the right person in large organizations is a difficult task (Watson-Manheim et al. 2002). Although recent research on comparing traditional support structure with peer-advice ties guides our PBSS, learning literature mostly guide these design requirements, especially overarching DR1 & DR5. The following chapter presents the development of design principles based on the design requirements. The development is guided by ITCon: getting the right *information*, at the right *time* in the right *context* (Sykes 2015). The suggestions further draw upon design knowledge of expert recommender systems (Cosley et al. 2007; Balog et al. 2012).

The design principles are developed based on the design requirements to address identified problems (see figure 2). How can learners find lecturers to solve their problem (DR2)? A similar issues has been addressed by recommender systems: How to engage suitable editors for Wikipedia (Cosley et al. 2007). It matches tasks with people through intelligent task routing. To increases motivation to contribute, Latané and Harkins (1979) study the phenomena of social loafing and show that reducing costs of participation is needed. Individuals already perceive high costs for contributing voluntarily (peer support), due to their busy day-to-day work activities (Iivari and Igbaria 1997). Intelligent task routing "reduces the cost of finding work and matches people with tasks they are likely to care about" (Cosley et al. 2007, p. 33). This principle is applicable to our context: To match potential lecturers with open tasks they can solve. Once a learner posts problems, a recommender system should match suitable lecturers from the pool of peers (DR4). These experts are measured by both content of the problem description and each peer's skills (DR2, DR4). If someone knows how to solve the tasks, the lecturer will more likely provide better information (I), as well as have better domain knowledge (Con). The interaction between two peers will thus result in better learning results. A match between potential lecturers (DR 4) and the accessible problem description (DR2) should result in potential experts being recommended by the backend system to increase peer-to-peer interaction (DR1).

DP1: A peer-based support system should match problem descriptions with potential experts based on skill profiles and domain-specific experience.

To accommodate DP1 in regards to time *(T)* and since the problem description (DR2) will undergo a text mining and keyword extractor tool that identifies and then extracts two types of keywords: The first keyword type represents the applied domain and problem context *(Con)* (Sykes 2015). For example: the domain is *customer care. The information* required *(I) are* software system types, such as a customer relationship management system. Another keyword type ideally includes technical skills required, such as *java* . Ideally, someone with customer care and CRM experience skills in java would get an alert. It is probable that users will have the same problems, independently from each other. For the purposes of how to implement a prototype, expertise retrieval approaches (Balog 2012), following a query-dependent approach, by comparing candidate experts (Petkova and Croft 2006) with similar but solved problems were referred to.

Once a problem is solved by an instructor, the content should be made accessible for other peers as well (DR5; DR7), thus avoiding repetitive work (DR3). If peers were to find self-explanatory content (I), their problems will be solved on time (T), same applies to suitable context (Con). The resulting design principle is defined as follows:*DP2 A peer-based support system should match problem description with existing learning content.*

Following the same implementation approach as DP1, we adopt Petkova and Croft's (2006) approach.

With regards to how the interaction and content creation should be constructed, the findings from the learning and education literature have repeatedly shown the importance of the lecturer role (Thurmond and Wambach 2004), even in software-aided scenarios (Oeste et al. 2014). To increase the interaction from peer-to-peer, conversational approach (DR3) creating a dialogue stream between a learner and corresponding lecturer is proposed (Ngoon et al. 2016). The dialogue stream, similar to private messages, can include supports multimedia, such as text, videos and screenshots (*Kogga et al. 2017*). However, with consent from the learner, the lecturer can decide which snippets of their dialogue content should be included in a persistent documentation (DR2; DR3; DR6). This results in a light-weight solution to increase the chance of solving the problem and transferring knowledge more efficiently (Santhanem et al. 2007).

DP3: Different medial forms of learner-lecturer dialogue need to be saved as content.

A conversational approach is essential to clarify many contextual information (Con), which can be saved in addition to the provided information (I). By saving the dialogue lecturers save much time (T) for them and converting it into more fully fledged content they will save time for future peers (T).

Development: Developing PBSS design features as processes

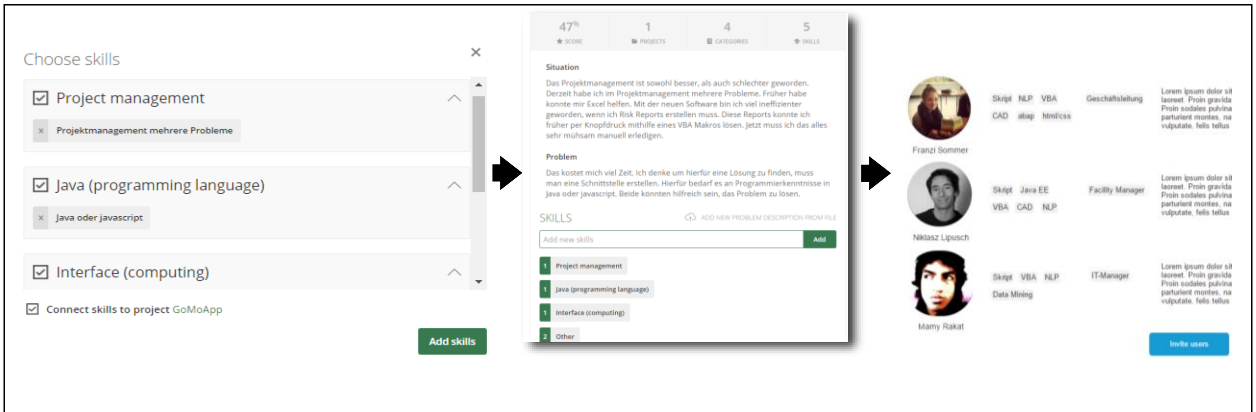

Figure 3 –: Applying recommender protoype for DP1

As figure 2 illustrates, we developed two core functionalities that encompass our design principles based on our previous concept to address our identified PBBS scenario (see figure 2): First, a user faces a problem with a system. Then, he logs onto our PBBS and writes an initial problem description of situation and problem. Our system automatically analyses the description to produce keywords. The user can choose which automatically generated keywords describe his problems best, having the option to input his own keywords as well. Next, the chosen keywords are added to the problem description, which the recommender uses to find suitable expert lecturer candidates (DP1). The user then invites recommended peers as lecturers. Figure 3 shows the prompt to choose from the analysed keywords, the problem description with selected keywords and the prompt with inviting recommended lecturers based on keyword matching.

In addition to requests for peer advices, pers have a view, in which unsolved problems are listed according to their own profile matches (see figure 4). After a peer decides to accept the role of lecturer, a dialgue commences, similar to messenger functionalities. The lecturer engages the learner in active communication. The communication feed enables to post screenshots and embed screencast videos with ease (drag-and-drop). The cocreated message history, including the different media employed, represents the content. By being able to ask questions, the lecturer gains better understanding of the problem and can provide the learner with preferred modes of ineraction (screencasts, screenshots, codes, free text, external links etc. (DP3). Its persitence enables future users to find both potential lecturers, as well as already solved similar problems (DP2).

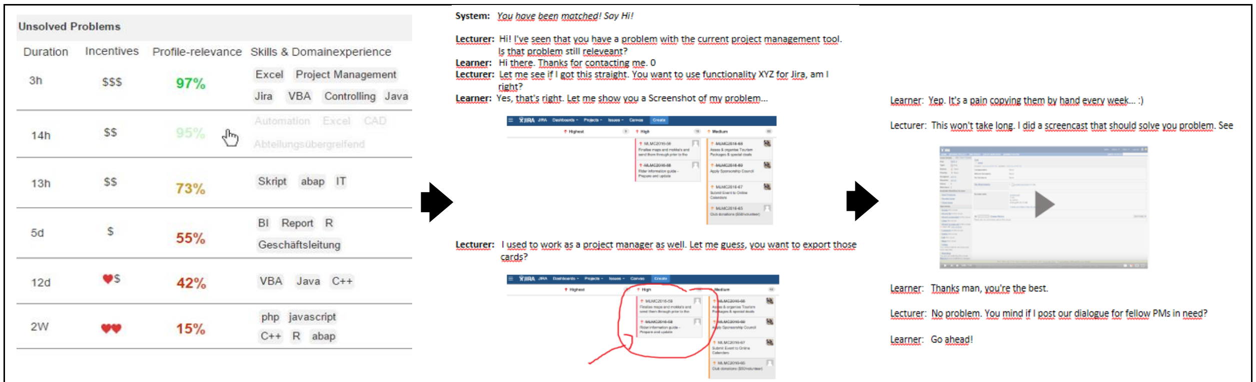

Figure 4 - : Finding suitable unsolved problem and storing messaging history (DP2; DP3)

Discussion and Future Work

We proposed a tentative design for a peer-based support system. It follows recent research on how traditional IT-support can be complemented by leveraging peer advice networks in shakedown (Sykes 2015). Its contribution lies in a set of prescriptive knowledges on how systems should be designed to support peer advice as support structures during shakedown in the form of tentative principles of form and function (Gregor and Jones 2007). The paper presents the problems of currently known traditional support structures for shakedown and the known solution of peer-advice ties to develop an initial peer-based support system. We thus position our design knowledge as an improvement, due to the low solution maturity and relatively high application domain maturity (Gregor and Hevner 2013).

With our research in progress, we aim to design a peer-based support system for the shakedown phase. This short paper provides our conceptual foundation and research agenda for our future design science research endeavour. We will work in close relationship with our research partner and start further feedback and evaluation cycles, while iteratively improving our prototype to gain additional insights and arrive at a proof-of concept (Nunamakter et al. 2015).

Limitations and Future Work

Our main limitations are due to our early stage research progress, in which we have yet to complete our proof-of-concept (Nunamakter et al. 2015) by assessing whether our prototype does make users more inclined to use our PBSS compared to their traditional IT-support structure. To show proof-of-value, we compare ease of access, usefulness and life cycle applicability (Wallace and Sheetz 2014) and network centrality (Kilduff and Tsai 2003) to the traditional IT-support structures. Since our research project involves piloting our system as a plugin in confluence, we will then explore proof-of-use in future research (Nunamakter et al. 2015), which could include activities for maintaining its use, such as motivational factors (Li and Peters 2016). Since we base our design on the results of peer-advice ties functioning as support structures, many unforeseeable events could occur, such as losing top-level support, running out of funding for extensive 3rd party development for the plugin, or the organization switching from confluence to another platform. Each event on its own could easily bring current research to a halt. There is also a risk, that no user is inclined to use our solution, since all users have many and strong peer advice ties already. However, we are confident that our research can create insights on the design of alternative support structures, regardless of its overall success in organizations.

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