To Design Holistic Health Service Systems on the Internet

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Abstract—There are different kinds of online systems on the Internet for people who need support and develop new knowledge. Online communities and Ask the Expert systems are two such systems. In the health care area, the number of users of these systems has increased at a rapid pace. Interactions with medical trained experts take place online, and people with concerns about similar health problems come together to share experiences and advice. The systems are also used as storages and browsed for health information. Over the years, studies have been conducted of the usage of the different systems. However, in what ways the systems can be used together to enhance learning has not been explored. This paper presents results from a study of online health-communities and an Ask the Expert system for people who suffer from overweight. Differences and similarities in regards to posted issues and replies are discussed, and suggestions for a new holistic design of the two systems are presented.

Keywords—Learning, Ask the Expert, online community, health care, holistic, overweight.

I. INTRODUCTION

PATIENTS as well as citizens in general are becoming more knowledgeable and empowered due to new Internet health services [1]. By using the Internet, people can collect information and advice from different sources, and it is also common to have conversations and to get support online. Systems that facilitate online interaction between doctors and patients, as well as those for patient groups and other health-related interest groups, are examples of this trend.

The importance of online health services can also be seen in the development of national health systems and portals. These provide users with health information, access to medical-trained people and personal perspectives from patients and citizens, for example. A goal is to offer appropriate and even proactive health management for the general public [2]. One example is Sundhed.dk, a site that offers an access point on the Internet to healthcare services in Denmark [3], and another one is the British NHS Direct Online that combines online health information with telephone services [4].

On the national health sites, and also elsewhere on the Internet, the number of online communities for people with different health conditions has grown rapidly, and the number of users of these health-communities is high [5]-[6]. Studies

have shown that patients benefit from interacting online with others who face similar health problems [7]. Patients can cope with a difficult life situation more easily by participating in online self-help groups, and by using as well as producing online medical information [8].

Some of the health-communities are for the growing groups of people who face problems caused by their life-styles, who want to change behavior. Examples are communities for people who try to quit smoking, lose weight or give up drugs or alcohol [9]. These communities are also important for the health care sector, since changing established bad habits can help people reduce the risk of getting severe illnesses such as heart conditions and asthma, for example. Empathy, information and advice are communicated in these health-communities, and to some extent are also issues concerning different positions and beliefs raised [9]-[10]. At the same time, when interacting with others, we need to consider the feelings of other people and show one another empathy [5]. A sense of belonging to the same group can stimulate the community members to help and support each other [11].

Also, for people belongs to minority and marginalized groups, such as black women in the United States and sexual minorities, joining the Internet communities have shown to be beneficial for their sense of well being and self confidence. Through new social bounds and knowledge creating processes, they have become more empowered in relation to expertise in the domain of health, computing and information delivery [12].

A characteristic of online communities is that they enable distributed people to think together, ask questions, guide each other and share ideas and insights [13]. Through interaction with others, new ideas and knowledge can be developed [14], and people are able to understand their situation better [13].

However, learning is always a challenge. Especially challenging is learning how to change behavior, to unlearn a bad habit and to develop a healthier way of living. This is the situation for overweight or obese people who need to lose weight, for example. In order to learn how to change behavior, we need to recognize patterns and also challenge our beliefs [15]. Group learning can be of help in this process. At the same time, when health issues are concerned, one must be aware of the risk that people looking for information on the Internet can be misinformed [8], and that online community members can give advice that are not in the best interest of the addressee [16].

Although the main purpose of using online health-communities is to interact with others, the communities can also be used as storages of gathered information, advice and support. Using the online communities to lurk the conversations have previously been regarded a selfish behavior, and lurkers second-class members of a community [17]. However, recent studies have shown that the number of reasons for lurking is many, and that active participants of online health-communities have come to accept lurking as an online behavior [17].

Another type of online system used for gaining new knowledge and to get help in developing new practices is the Ask the Expert systems. This type of system is also used in the health care sector. Through the system, the users can get recommendations, advice, etc., from a medical expert [18], and the system offers even a new type of continuous relationships between patients and medical experts [19]. In this kind of system, information-seeking users can browse for questions and answers, and they can also post their own questions directly to the system to be answered by a medical expert [20]. The experts are professionals such as physicians, psychologists and dieticians, for example. Who will answer the question depends on the subject at hand. According to studies, Ask the Expert services in the health care sector can be of much value to seekers of health information who need to gain new knowledge and guidance [21].

In the field of eHealth for public use, there is a need to come closer to understand the use of the different health service systems. During the past years, several studies have been conducted. However, previous studies lack a holistic view; the relations between the systems, and how the systems can be used together to enhance learning, have not been explored. We need to consider the different ways to communicate online, the patterns of usage and the diversity of posted issues and answers. This paper presents a study of the relations between the usage of online communities and an Ask the Expert system in a Swedish health care site. The question being investigated is in what ways the different types of systems overlap and to what extent they can complement each other. Based on the results, ideas for a new design that uses a holistic approach are proposed.

II. METHOD

A. Online Health Systems of the Study

A practical study was made in order to compare the usage of online health-communities and an Ask the Expert system on a health care site for people with overweight problems, for people who wanted to change behavior. The health care site selected was the Swedish Net Doctor site, www.netdoktor.se.

The most frequently used online health-community on overweight found on the Swedish Net Doctor site consisted of more than 7,000 postings in August 2006. Further 1,000 were added in less than a year; the number exceeded 8,000 in April 2007. There were also more specialized communities on overweight on the site, such as "Diet", "Exercising", "Weight-

reduction medicine" and "Prescriptions". Altogether, the communities on the overweight site included more than 18,000 postings in April 2007.

In order to participate in the online conversations, a form had to be filled in online and an alias name taken. Also for non-members, the community conversations were open for reading. A search engine was available that could be used to search through all the communities on overweight for postings on specific topics. Single keywords or keyword phrases could be used to search for matching postings.

The other health service system on the same overweight site was the Ask the Expert system, with questions on overweight from the public together with answers given by dieticians and physicians. The questions and answers (Q&As) had been divided into five categories, with over 200 Q&As in August 2006 and more than 300 in April 2007. In order to let people use the Ask the Expert system as a knowledge repository, a search engine was available. As for the online communities, single keywords or keyword phrases could be used to search for issues and answers in the whole system.

B. Collection and Analysis of Data from the Systems

1) Study: Part One

Starting point of the study was a comparison between the usage of the main online community on overweight, i.e., the one that was most frequently used and at the same time consisted of a diverse range of issues, and the Ask the Expert system. The first 50 conversations from the targeted open and non-moderated online community were collected, starting from January 2006. The conversation issues in the community were compared to the Q&As present in the archive of Ask the Expert system. In the Ask the Expert system all words were searchable. Exact words and phrases from the community issues (title and description), as well as synonyms and related words, were used in search of matching requests. By using keywords and keyword phrases, corresponding Q&As were systematically searched for.

Community issues and the corresponding requests posted in the Ask the Expert system were analyzed. They were also compared according to information and advice given in the answers. Issues and answers were analyzed in order to find out about similarities and differences. Also, in those cases where no matching request was found in the Ask the Expert system, expert answers targeting the same subject as the community issue were then searched for. The purpose of the analyses was to see in what ways the two systems served as complements to each other. Both quantitative and qualitative analyses were made.

2) Study: Part Two

In order to investigate the reverse relations as well, i.e., the relations between the Q&As in the Ask the Expert system and the interactions of the online health-communities on overweight, a follow-up study was made of the Swedish Net Doctor site. During six months, from November 2006 to April 2007, all the Q&As were collected from the Ask the Expert

system and compared to the online community conversations on the same overweight site.

The total number of Q&As present in the archive of Ask the Expert system during time of study was 70. There were 19 Q&As in the "Overweight" category, 23 in the category called "Food", 13 in "Exercising", 14 in "Medicine and surgery", and, finally, one Q&A in the category called "Motivation".

Each of the questions presented in the Ask the Expert system during the period of study was compared to the start-up requests in the online communities on the same site. Exact words and phrases from the Ask the Expert system (title and content of the question), as well as synonyms and related words, were used in search of matching issues in the online communities. By using keywords and keyword phrases, corresponding community issues were systematically searched for.

The analysis of the relations between the Ask the Expert and the online community conversations was made in the same way as had been done with the reverse relations. The requests posted in the Ask the Expert system and corresponding community issues were analyzed. They were also compared according to information and advice given in the answers. A goal was to find out about similarities and differences between the two types of systems. Also, the question about in what ways the two systems could serve as complements to each other was investigated. Both quantitative and qualitative analyses of the collected data were made.

C. The Results as a Whole

The results of the two parts of the study were finally put together, and the systems relations (both ways) were compared. Based on the results, suggestions for a future system design were presented.

III. QUALITATIVE FINDINGS

In the online communities on overweight, the participants raised issues of different kinds. There were issues left without any responses, and there were also issues that had about 30 responses. Most were questions to the others, but there were also examples of statements and greetings (on birthdays and holidays).

In general, community conversations that had a large amount of responses were often asking for support and friendship. In other conversations, the members asked for more specific information related to their overweight problems. The questions concerned possible side effects of weight-reduction medicine and how much calories one could find in a certain product, for example. Others asked for advice and personal stories of experiences. The conversations showed examples of people with emotional distress and a feeling of hopelessness. Most postings were related to the sender's own overweight problems, but some were also concerning friends and family members.

Also in the Ask the Expert system, most questions were related to the senders' own overweight problems. This was shown through formulations such as "I am a 26 year-old woman..." and "I love cheese...", but there were also questions concerning people who were close to the senders. In some of the questions, the senders asked for advice on how to deal with a certain situation, such as the one who wanted to know how she could go about to help her son who she feared had problems with his eating habits. Other questions were more about factual knowledge, such as the one from a sender who wanted to know what a low-purin diet is.

TABLE I

EXAMPLES OF REPLICATED AND NON-REPLICATED ISSUES

Unique Issues - Online Community	Replicated Issues	Unique Issues – Ask the Expert System
How to find supporting friends	How can I help my son lose weight	Can weight-reduction in itself cause anxiety
Holiday greeting	What is the recommended waist-measurement	Does metabolism change with age
Recommendation of fitness literature	Why don't I lose weight despite great efforts	Is it true that fat from wild animals is quite healthy
How to find out about community challenges	Can I give my child light products	I am advised to have low-purin meals, what is that
Requests for the members' results from past challenge	Are light products such as diet sodas good or bad	Is a fast walk carrying a backpack good exercise
Challenging the others to lose some weight during a certain period of time	How much calories are there in juice	What food is recommended after having exercised in the evening
How to buy weight loss medicine without having a prescription.	I have lost the spirit – what is wrong	Why do I retain water
How to restart a technical weight tool.	Can I exercise while having a cold	Is it normal to have monthly weight variations
	I could need some exercise ideas	
	What kind of exercises are the most effective	
	Does this specific reduction medicine cause side-effects	
	How can I stop my appetite	
	Who are accepted for surgery	

When the issues posted in the two systems were compared, both unique issues and corresponding ones were found. In table 1, examples of replicated as well as non-replicated issues can be seen.

A. Replicated Issues

Issues that both systems dealt with were of different kinds. There were issues that related to factual knowledge and also examples of postings that asked for advice. Among the corresponding questions there was the one about giving light products (with low-calorie sweeteners) to children. In the answer from the expert (a dietician), it was explained that children should not be introduced to sweeteners, and that it was a better idea to continue to put sugar or honey in the tea. Similar answers were given in the responses from the online community members. They also claimed that sweeteners were not for children, and that sugar only taken in tea would probably not be a problem.

For one community request and its corresponding issue in the Ask the Expert system, the sender was apparently one and the same person. This became clear since all information given matched. There were information about how much pending weight the sender had, and it was evident that the sender had good insight into what one should eat and how to exercise. Despite this understanding, the sender was still not able to stick to good habits on a long-term basis. The request was about her need for someone to survey her eating and exercising habits. In the Ask the Expert system, the answer was filled with recommendations on how to change life-style one step at a time instead of trying to change too much at one time, as well as advice on how she should be her own guardian. In the online community, the request was met by responses from members who sympathized with the sender, telling her about their own problems with a pattern of pending between weight loss and gain without reaching a good and stable level. Some of the responses contained advice on how to get a long-term change of life-style.

Another example of a corresponding question was the one concerning how to help a 17 year-old son to lose weight. The expert (a physician) advised the parent to prepare meals with more vegetables, and to keep healthy snacks available at home. The question had corresponding ones in the online communities: one issue was titled "Overweight teenager", and another one "Worried mother". All answers stressed the importance of having healthy food at home, and to talk to the son. One also referred to a web page with more information. The community members added also some experiences from their own lives as overweight children. The answers pointed to the fact that the mother should not exaggerate the problem, since this could lead to an unhealthy fixation with weight and body shape.

Several questions about the effects as well as side effects of weight loss medicine were presented in the Ask the Expert system. Corresponding questions could also be seen in the online communities, where knowledge and understanding of different medicine seemed spread. In one case, the sender asked for advice about a prescribed weight loss medicine that caused her sleeping problems. She also explained that the doctor did not check her blood pressure or asked if she was on medication. In the answer, the expert (a physician) was critical towards the doctor that the sender had met, and said that she ought to see another doctor and to keep track of her blood-pressure. The expert also confirmed that insomnia is one of the documented side effects. There were several corresponding questions on this particular medicine found, in the Ask the Expert system (two more Q&As) as well as in the online communities. In the online communities, the product was well known and the members could tell about their own experiences of side effects, such as increased blood pressure and insomnia. One explained that the medicine really had made her "get going". Another member posted an extract from the governmental medical lexicon with information about different side effects.

B. Unique Issues of the Online Community

When comparing the online communities on overweight and the Ask the Expert system, there were some issues that were recognized as being unique for the community conversations. One example of an online community conversation that did not have a corresponding Q&A in the Ask the Expert system was the one from a member who wanted to buy a certain weight loss medicine (left-over) from the others or get advice on where to buy it on the Internet. This request was met by six responses from the other members. All responses advised the sender to not use any pills without having consulted a physician first. One of the objections was strong, saying that: "I would definitely not manipulate with my body like that. Spend your money on fruit instead..." In the same way as with the corresponding issue about side effects from weight loss medicine (presented in the previous section), also this time there was a community member who passed relevant information by sending a transcription from a medical lexicon showing all possible side effects to be aware of.

Another example of a type of conversation without a match in the Ask the Expert system was concerned with group challenges. There were different issues on this subject: questions from members who wanted to know about upcoming challenges, issues about challenging the others, and requests for results from a past challenge in order to publish these in the community. Most popular challenges were the ones about achieving a certain weight loss during one month, and those about participating in running heats or other real life exercise events. Further one was about giving up alcohol for a period of time.

In the Ask the Expert system, different negative effects that alcohol has on the body as well as on weight loss could be read about. This knowledge of consequences was not exchanged in the online community conversations. Instead, in the community conversations, experiences related to problems with too much to eat when having several drinks were exchanged. The issue of seeking experiences from others was

unique for the community.

C. Unique Issues of the Ask the Expert System

There were also questions in the Ask the Expert system that did not have a correspondence in the online communities. An example of this type came from a person who wanted to know if the fat cells have a sort of memory. There was also the question about how antitrypsin deficiency effects exercising, a question concerning type of fat present in cheese, and a question about purin-low diet. These questions did not have corresponding conversation issues in the online communities.

While many of the community members knew about the official BMI limit for having a gastric surgery, they did not discuss how long one could have to wait for an operation. This question of waiting line was posted in the Ask the Expert system (1-2 years was the answer). However, some of the members of the online community could tell about their own experiences from having a surgery, and they also referred to different web pages (news programs, etc.) for more information about the procedure.

Another question to the expert, that did not have a corresponding one in the online community, was about the accuracy of a pedometer that was used to count the steps of the owner. The pedometer showed fantastic and unrealistic values, and the question from the sender was if she had done something wrong. The expert (a personal trainer) confirmed that the machine probably had been prepared in a wrong way. Among the online conversations, there were, however, other types of questions concerned with pedometers. A couple of questions were about where to buy them, and some of the responses were offering their experiences of what they thought were bad products, and they gave examples of pedometers that they thought functioned well.

Questions about anxiety were posted in both systems. However, the question if weight-reduction in itself could lead to anxiety attacks, did not have a match in the online communities. Also, a couple of questions about the relation between metabolism and age were of this kind. At the same time, several of the online conversations dealt with general issues about metabolism.

D. Corresponding Vs. Different Answers

Previously, while giving examples of issues that were detected in both systems, not only the issues but also the answers given by the experts and online community members corresponded. This was the most common situation for corresponding issues when comparing the postings in the two systems. This section gives another example to clarify the resemblance of answers given in the two systems, but it also gives an example of a question with deviating answers.

A question posted in the Ask the Expert system with corresponding questions as well as similar answers in the community conversations was about exercising. The sender of the question wanted to know if it is alright to exercise while having a cold. Examples and recommendations in the two systems corresponded well. Not to exercise while having a

cold was strongly recommended by both the expert and the community members. Also, another question regarding what type of exercise is most effective for overweight people had both corresponding questions and answers in the two systems. To go for a walk was the common answer to this question.

This exemplified questions and answers that corresponded well. No deviations or contradictory views in regard to given advice and facts were seen.

However, there were also a few examples of corresponding requests but with deviating answers. One example was a request regarding where to measure waist. In this case, the answer in the Ask the Expert system contained a short description of where it should be measured, with related information about when to measure and how. The answer was given in three sentences. The corresponding conversation in the online community had seven answers. None of the answers gave the same information as was given by the expert, and the discussion in the community also contained contradictory answers.

IV. QUANTITATIVE FINDINGS

The quantitative analysis showed that the frequency of issues being replicated differed between the systems. Out of the 70 issues in the Ask the Expert system, the number of issues with matches in the online communities was 38, which corresponds to a match rate of 54%. Almost all of them, 35 issues, had also corresponding answers. For the group of issues without a replication, in 19 out of 32 times there were additional pieces of information detected in the online conversations.

Regarding the reverse relations, i.e., the ones between the online community and the Ask the Expert system, 12 of the 50 studied conversation issues, or 24%, were replicated. This leaves us with 76% having no corresponding issues. Seven of the replicated community issues had answers that corresponded well to the ones presented in the Ask the Expert system. In Table II, the relations between the two systems can be seen.

TABLE II
STATUS OF REPLICATIONS

Type	Ask the Expert System Vs. OLC	OLC Vs. Ask the Expert System
Replicated questions largely with the same advice given	50%	14%
Replicated questions with different advice given	3%	10%
Replicated questions without answer	1%	-
Not replicated, but complementary information given	27%	16%
Not replicated, and with no relation	19%	60%

More than fifty percent of the issues raised in the Ask the

Expert system were replicated in the online communities. With only a few exceptions, these replicated issues were met by similar answers. Regarding the reverse systems relations, the similarities were not as many. About one out of four of the online community conversations had corresponding issues in the Ask the Expert system.

Concerning those cases where there were no corresponding issues, more than one out of four questions in the Ask the Expert system showed to have one or more complementary community issues in the online communities. Regarding the opposite relation, about one out of six of the community issues had Q&As with complementary information. In the online community conversations one could, for example, read about recommendations of practical nature, such as where to buy well-functioning pedometers. This information complemented the answers given by medical experts.

V. Discussion

While having a closer look at the issues with no systems relations whatsoever, different types of issues could be seen. There were examples found in the online community where some conversations concerned the group working together for a common goal. Different group challenges with the purpose of stimulating and motivating the members to struggle for successful weight loss were seen. This type of issues was by default unique to the online community. This was also the case with greetings and other issues raised with the purpose of social bonding.

Also, in those cases when both issues and answers corresponded, the answers from the experts and the community members differed in character. Even though the answers contained similar type of information and advice, the level of details was found to be different. In the Ask the Expert system, information and descriptions about food content, physical effects on body, etc., were detailed. The community conversations, on the other hand, made room instead for story telling about the members' own experiences of medicine, food, exercises, etc. Also with this in mind, the two systems can be regarded as complements to each other.

The correspondence between the Ask the Expert system and the online communities were more extensive than was the case with the relations between the community conversations and the Q&As. This was quite natural for a couple of reasons. One factor was the large amount of conversations present in the online communities of the study, which enhanced the possibility to find a match there. The other factor had to do with the characteristics of the community conversations. There were many community conversations that aimed at letting people show empathy and bond, and there were also examples of issues related to competitions and meetings in real life.

The different characteristics and complementary strengths of the systems could be more explored by the users, if the systems would offer facilities for this. The following are suggestions for future design of a more integrated system:

1) *Initiated cross-usage by the medical expert.* Since the answers in the two systems differ in character, and the community conversations have shown to collect a great deal of complementary information and advice, as well as stimulating group activities, joining the online conversations could be a valuable recommendation of the medical experts.
2) *Links to similar issues.* Links between similar issues of the health service systems could be generated by the systems. To use automatically generated links is especially important for ongoing community conversations. Manual interference in conversations for interest groups should be avoided.
3) *A pool of stored conversations.* To be able to generate links from the Ask the Expert system to specific community conversations, the conversations need to be evaluated first, and the conversations in question should not be ongoing.
4) *Tools for classifying issues.* In order to map different issues to each other, tools are needed to make classes of issues. Classification would help the system generate links of different kinds, allowing user groups with diverse needs to get relevant information and support.

VI. Conclusion

The results from the study showed that the Ask the Expert system and the online communities on the overweight site had different and complementary strengths, both regarding types of issues and answers. While the Ask the Expert system contained a lot of detailed descriptions of requested subjects, the community conversations emphasized personal experiences and practical advice. If the user were able to combine the different systems in an easy way, pieces of information found in both systems would most likely contribute to a fuller picture and better understanding.

The large share of corresponding answers between the systems, with few examples of contradictory ones, indicates that the users of the studied communities in general have good basic knowledge. This makes it possible to introduce links between the two systems, in both directions.

Although the study presented in this paper focused on systems for overweight people, the main results and ideas could be useful in other areas as well. Future studies could be made in order to develop online systems with a holistic view, using the strengths of the different systems. Effective references between the systems would most likely further help the users in their process of gaining new knowledge and heading for a healthier life.

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