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A Video-based Connection Tool
Supporting Competence Development

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Abstract—The vast majority of knowledge management initiatives fail because they do not take sufficiently into account the emotional, psychological and social needs of individuals. Only if users see real value for themselves will they actively use and contribute their own knowledge to the system, and engage with other users. Connection dynamics can make this easier, and even enjoyable, by connecting people and bringing them closer through shared experiences such as playing a game together. A higher connectedness of people to other people, and to relevant knowledge assets, will motivate them to participate more actively and increase system usage. In this paper, we describe the design of TENTube, a video-based connection tool we are developing to support competence development. TENTube integrates rich profiling and network visualization and navigation with agent-enhanced game-like connection dynamics.

Index Terms—competence development, connection dynamics, connection games, intelligent social agents, knowledge management, learning networks, network visualization, virtual communities.

I. INTRODUCTION

Knowledge exchange is particularly valuable in situations where feedback and advice from others is key. One such context is competence development, where people require access to knowledge and people to help them reflect on their current competences, learn which functions or jobs are within their reach, and explore the possibility of learning new skills or working in a new field. However, the vast majority of knowledge management networks and communities fail to thrive because they do not take sufficiently into account the emotional, psychological and social needs of individuals. Even if the system's repository contains many knowledge assets and has a large user community, it is difficult to connect people to relevant knowledge assets. This important issue was highlighted recently in a 2007 survey of IT professionals [1]. When asked what would make on-line IT communities more beneficial the most frequent response was better search capabilities. Other areas for improvement included full-time moderators, whose role includes connecting people to content or people to people, and resident subject matter experts.

In order to address this issue, new features such as games, agents and network visualization and navigation tools, which can help users find relevant material and support the social exchanges that occur between community members, particularly the ability to generate 'connections' between people, need to be embedded along with the traditional knowledge management functionalities normally found in such systems [2][3][4][5] in order to give users more opportunities to engage in informal knowledge exchange with others, and stimulate them to actively participate in sharing and building on each others' knowledge and experience [6][7].

In order to increase the "connectedness" within TENCompetence (a European Learning Network and community), we have developed an online environment which supports knowledge exchange related to competence development. TENTube integrates the latest web trends (such as video-based communication, social network visualization and navigation tools), as well as a number of game dynamics aimed at stimulating and reinforcing connections among members or between members and relevant content. In addition, TENTube contains embedded connection agents which gather

information about a user's profile and system use, select the most appropriate videos and users to connect with, and stimulate users to watch and submit videos.

II. THE VALUE OF "CONNECTEDNESS"

The concept and value of "connectedness" has been explored in many diverse disciplines such as knowledge management, psychology, sociology, social network analysis, organizational learning and strategy. Connecting people allows them to fulfill their needs for being, knowing, building and ensuring. First and foremost, contact with other people is a basic human need. Our need to belong is only outclassed by our physiological needs and our need for safety [8]. We need other people to affirm that we exist. When we are ignored our sense of self and presence fades [9][10].

Beyond the need for being, a second reason individuals connect with other people is because they need access to knowledge. Recent research has found that many people prefer to obtain information from people rather than documents [11][12][13]. Building professional or personal projects is a third reason that people need connections. Increased "connectedness" helps generate ideas, especially from connections with creative people and people in other disciplines [13][14]. It also appears that a fourth reason people need to increase their connectedness is to ensure their future. As a job for life is no longer the norm, many people feel increasingly insecure about their future. As we often hear that most new jobs come through contacts, we seek to increase our number of professional connections as insurance against unemployment.

Connecting people increases the number of their social ties which increases their social capital. Social ties can help one discover opportunities, sharpen one's thinking, keep in touch with what is happening, give emotional support, and provide links to new people. However, there is a limit to the number of people with whom we can reasonably connect. Research suggests that we can only have genuine social relationships with 150 people [15]. Social networks require time to build and maintain, and if we let a connection languish or die, it is often harder to recreate then it was to create in the first place.

Social ties are commonly classified into two main groups: strong ties and weak ties [16]. Strong ties are found between friends, while weak ties are found between acquaintances. While strong ties bring many advantages such as emotional support; ties that are too strong can cause relational network inertia, i.e. the ease of collaborating with those you already know well can actually prevent you from seeking out new ties. This can have an impact on new competence development, learning and adapting to new challenges [17].

Weak ties take less time to maintain so one can have more of them. Weak ties are good sources of useful non-complex information [18]. Weak ties can help people find a new job, develop new competences, encourage learners to adapt to new challenges, and develop their cognitive and social skills. Thus helping people connect with relevant others and develop more weak ties is one way of adding value to their online community and learning network experience.

III. TENTUBE DESIGN

In order to increase "connectedness" of the TENCompetence community members, TENTube integrates rich profiling with a structured Video Exchange Channel, a Network Visualization and Navigation Space, and a number of game dynamics and connection agents.

A. Video Exchange Channel

On the TENTube Channel users can very easily view, search, comment, tag, rate and submit videos in a similar way to YouTube. The key specificities of the TENTube Channel are:

- The environment is "closed" (i.e. not public).

- Users are identified when entering, have a profile, and their activities are recorded in a log file.

- Videos can be either imported from other sources, such as YouTube or produced and submitted by the users.

- Videos in the TENTube Channel belong to one of these three categories:

  Competence Development Awareness Videos - these videos feature presentations related to competence development in general; for example, "The need for intercultural media competence" or "Teachers can change the world".

  Competence Development Opportunity Videos - these videos feature competence development opportunities; for example, educational institutions, courses, or books. "How to" videos also fit into this category.

  Competence Development Expert Videos - these videos feature individuals presenting themselves as experts in some competence domain. These videos can be seen as extension and complement to the "traditional" user profiles. Video resumes can also fit into this category.
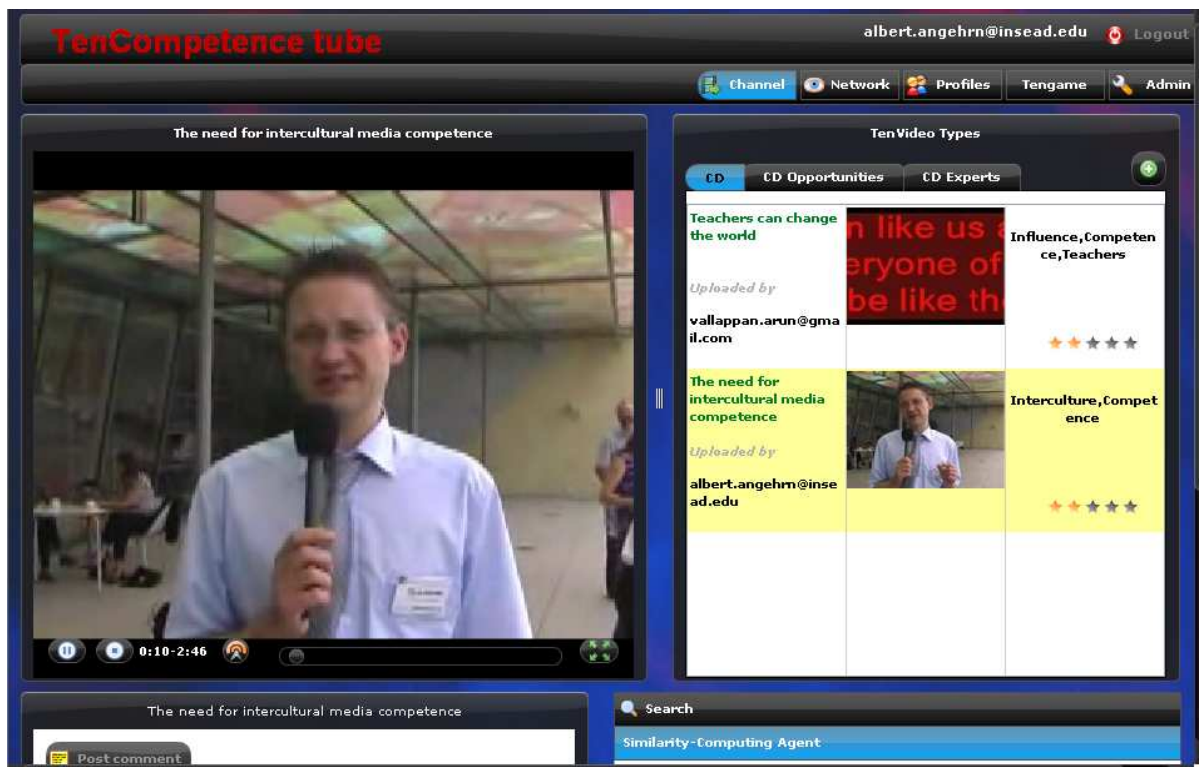

Figure 1. The TENTube Channel

The TENTube Channel (see Fig. 1) creates connection opportunities by enabling users to see competence-related videos submitted by others, and to submit videos for others to see. The Channel also increases connectedness to videos and people by supporting the commenting and discussion of individual videos. Two further connection- oriented embedded mechanisms include tagging videos with specific competences and the possibility of rating videos.

B. Network Visualization and Navigation

A network visualization and navigation tool (NVNT) helps users visualize and browse through the network of relationships created dynamically between three types of objects: people, videos and competences/tags (see Fig. 2). Such relationships/links include:

"Video ← is related to → Competence/Tag"

"User ← has submitted/seen → Video"

"Video ← has inspired → Video"

"User ← knows → User"

The NVNT fulfils an important function by enabling users to freely navigate through the different relationships and networks, and access other members' profiles. Users can also create links to other users (indicating their social network) and rate the intensity of their relationships. In addition, the NVNT includes a "time-machine" which enables users to explore the evolution of the network over time, showing for instance the growing popularity of a specific video or competence.
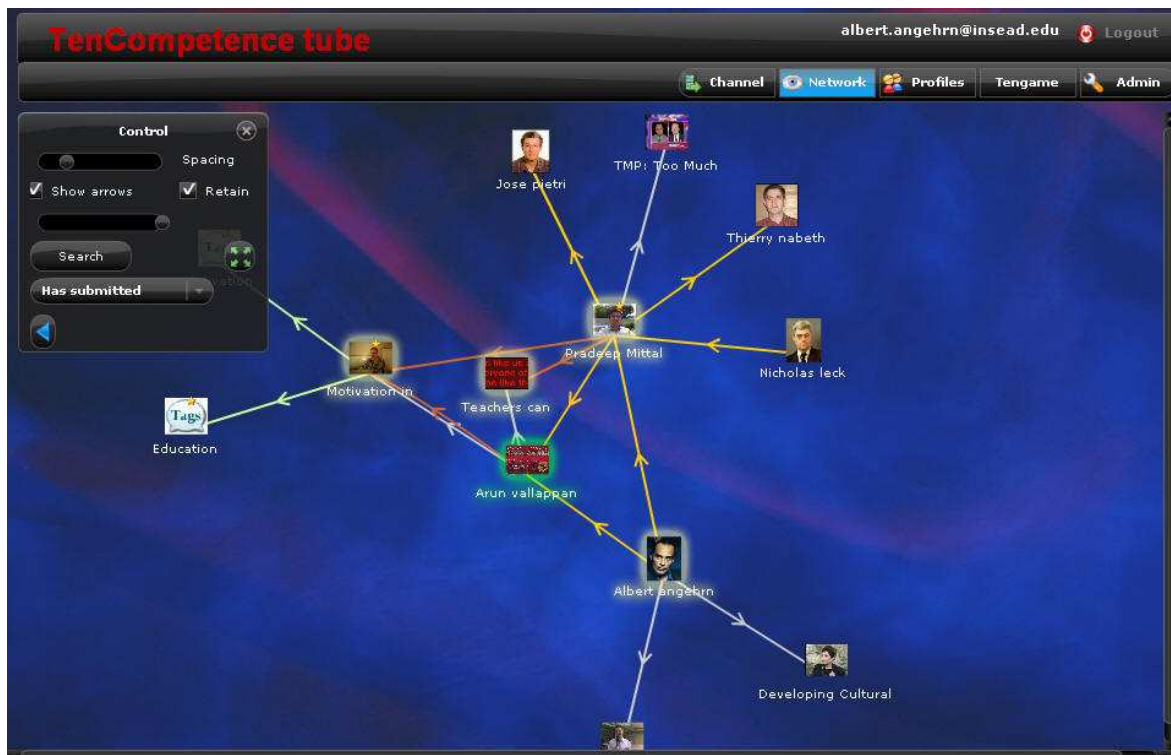

Figure 2. The TENTube Network Visualization and Navigation Tool

C. TENTube embedded Game Dynamics

The TENTube Game proactively encourages users to access videos and connects users to each other. Each game is played between two anonymous players, and can consist of several rounds in which players view one or more videos and try to guess/match what the other player "sees" in the video. At the end of the game, the two players are asked if they wish to reveal their identity. If they both agree, they are connected to the profile and network of the other player.
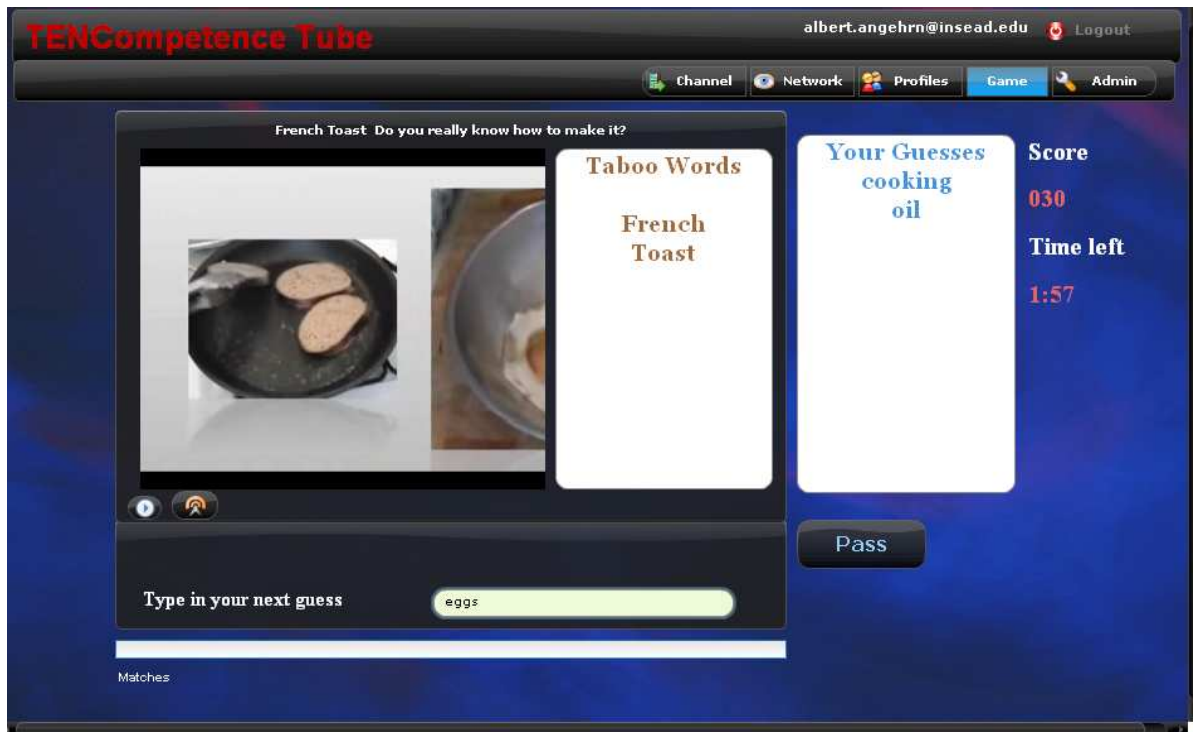
Figure 3. The TENTube Game

The logic of the TENTube Game is similar to the one of the ESP game [19] and the ProfilAMat game [20], with the exception that the objects the users play with are competence-related videos included in the TENTube Channel. During each round, two players view the same video in parallel and try to describe it with words. Each player can type as many words as they want while they watch the video. Players get points for each matching word in their list. At the end of each round/video, points are attributed using an approximately U-shaped scoring function dependent on time (i.e. video duration). In addition, points are subtracted if no match is made during a round. Fig. 3 shows a screen from the TENTube Game. A key design principal of the TENTube Game is the selection of the relevant videos and the matching/connection of users. For each game, the video and users are selected by a Connection Agent operating with an algorithm described in the section D. This algorithm assumes that at least two users are online and willing to play. If this is not the case, the user can play against the machine. Finally, after a video has been used in a TENTube Game session, the event and matching words/tags are communicated to the video's author. This supports the automatic gathering of video-related information and may stimulate video authors to revise their videos, or to submit new versions.

D. Connection Agents

TENTube contains embedded connection agents which gather information about a user's profile and system use, select the most appropriate competence-related videos and users to connect with, and stimulate users to watch and submit videos. In the TENTube game, the video and users are selected by a connection agent operating with an algorithm of the type:

- The video has not already been seen by the two users

- The two users have not played together recently.

- Maximize "similarity" between the two users (for example, have similar competences)

- Maximize matching of proposed video tags with tags/competences of other videos seen by the two users (interesting user-video connection).

- User's preferences (the game can ask at the beginning if the users have a preference for videos in any of the three categories).

Connection Agents identify "similarity" among users as a function of their behavior (e.g. which videos they have seen, submitted, and which competences they have or would like to acquire). Connection Agents also connect people by suggesting that users view the profiles of "similar" users or that they browse through a "similarity" network displayed using the NVNT.

IV. MEASURING "CONNECTEDNESS" IN THE TENTUBE ENVIRONMENT

How can we best measure the "connectedness" of the TENTube Environment, i.e. the connectedness between people, between people and knowledge assets/videos and between videos? Intuitively, the value of connectedness, V_c, for an individual, i, should be based on the number of connections the individual has, n, and the quality or relevance, q, of those connections, $V_c^i = f(n,q)$. The value function of connectivity should increase as the number of high quality connections increases. In addition, we must base our metric on data which can be easily collected within TENTube, either by asking users directly or by studying their profiles and on-line behavior.

A. Connectedness between People

First we consider the minimal data we need in a person's profile in order to find and connect with relevant people (see Table I). A person's interests are key. In addition, we need to know who she already knows as this will have an influence on her connectedness value propositions – are we connecting her to someone new or are we reinforcing an existing link? In order for a relationship between two people to develop outside of the community, we need to be able to communicate their names and contact information to each other.

TABLE I. MINIMAL PEOPLE SPECIFIC CONNECTION METRICS NEEDED

Metric Name	Information Provided by the Metric
hasInterest	Interests that the person has
hasNetwork	People the person knows
personName	Name of person
contactInfo	How to contact the person

We can also collect data about the on-line behavior of users. Table II shows the actions that people can either spontaneously take, or actions that agents can propose in order to stimulate a person's interest. First of all, an agent can suggest that a person might like to view another person's profile. If the person actually does view the profile then the agent has contributed to "connectedness" value by making the user either aware of a new person or up-to-date with someone he already knows. An individual can also search for and view profiles on their own. Secondly, an agent can suggest that two people play a game. If the two people then play the agent has contributed to both of their "connectedness" values by helping them get to know each other better via a shared experience. If after the interaction, the two people decide to share contact details with each other then the connection can be deemed a success. Thirdly, they can connect to their new contact and rate the intensity/quality of their people connections using the Network Visualization and Navigation Tool (NVNT).

TABLE II. ACTIONS BETWEEN PEOPLE

Action Name	Action Dynamics
suggestView(p_i ,p_j)	An agent suggests that a person might be interested in viewing another person's profile
View(p_i ,p_j)	A person views the profile of another person
suggestGame(p_i ,p_j)	An agent suggests that two people play a game
Play(p_i ,p_j)	Two people play a game
Share(p_i ,p_j)	Two people decide to share contact details after the game
Connect(p_i ,p_j)	A person connects to another person by linking in NVNT.
Rate(p_i ,p_j)	A person rates how well they know the other person on a scale of 1 through 5 – relationship intensity.

Three additional people specific metrics can be derived from individuals' actions (see Table III). The connection preferences of the individual, the average intensity of an individual's connections to other people, and the average intensity that other's rate their relationship with the individual. For example, if the person consistently does not view suggested profiles, then we can assume that he is not interested in connecting with people, and propose more connections directly to knowledge assets instead. The connection preference structure can either be derived from analyzing behavior, or by asking user's directly.

TABLE III. CONNECTION METRICS DERIVED FROM ACTIONS - PEOPLE SPECIFIC

Metric Name	Information Provided by the Metric
hasConPref	Connection preferences that the person has (people, videos, both)
givesRating	Average relationship intensity rating of individual's connections to other people
hasRating	Average relationship intensity rating of other peoples' connections to the individual

In summary, the value function of connectivity between people, $V_c(p_1,p_2)$, is a function of the number of profiles that each user views, the number of games that each user plays, the number of times an individual shares his contact information, and the number of proposed new people connections that eventually end up connected to the user. By suggesting possible interesting connections to people, the agent contributes to increasing user to user connectivity. The quality of the connection is also important. We measure the quality through the relationship intensity rating. The value function of connectivity between people is also a function of reciprocity. If two people both view each other's profiles and eventually connect to each other then their value function of connectivity has been maximized.

B. Connectedness between People and Videos

The minimal meta-data we need about a video in order to connect it to interesting people and similar videos is shown in Table IV. The video needs a name to identify it, and must be tagged with competencies in order to classify it. Knowing who submitted the video provides information about the competencies that are of interest to that person. The date the video was submitted is necessary for the "time-machine" to function, and to allow easy identification of new videos submitted in the last week, or the tracking of new versions. Finally, it can also be useful to see which videos have inspired other videos.

TABLE IV. MINIMAL VIDEO SPECIFIC connection metrics needed

Metric Name	Information Provided by the Metric
assetName	Name
hasTags	Subjects/Competencies covered in video
submittedBy	Name of person who submitted video
submittedOn	Date was submitted
wasInspiredBy	Video that inspired it

We can also collect data about a user's on-line behavior concerning videos. Table V shows the actions between a person (*p*) and a knowledge asset/video (*k*). A person can submit a video. A person can update a previously submitted video. An agent can suggest that a person might like to view a video. If the person actually does view the video then the agent has contributed to "connectedness" value. An individual can also search for and view videos on their own. A person can comment a video. Finally, a person can rate the quality of the video. Combining the ratings of all users provides one additional and very important action-derived video specific metric which is the average rated quality of the video (Table VI).

TABLE V. ACTIONS BETWEEN A PERSON AND A VIDEO

Action Name	Action Dynamics
Submit(p_i ,k_j)	A person submits a video to the repository
Update(p_i ,k_j)	A person submits a new version of a previously submitted video
suggestView(p_i ,k_j)	An agent suggests that a person might be interested in viewing a video
View(p_i ,k_j)	A person views the video
Comment(p_i ,k_j)	A person comments a video
Rate(p_i ,k_j)	A person rates the quality of the video

TABLE VI. CONNECTION METRICS DERIVED FROM ACTIONS – VIDEO SPECIFIC

Metric Name	Information Provided by the Metric
hasRating	Average rated quality of the video

The value function of user to knowledge asset connectivity, $V_c(p_i, k_j)$, is then a function of the number of videos that each user submits, updates, views, and comments and the quality of the video based on asking the user to rate its relevance. By suggesting possible connections to videos, the agent contributes to increasing user to knowledge asset connectivity. The more high quality videos a user submits, updates, views, and comments the higher the value function of user to knowledge asset connectivity.

C. Connectedness between Videos

Videos can be relevantly connected by having the same submitter, the same subject, or by being different versions of the same video. There is also a connection between videos when one video has been inspired by another. The value function of knowledge asset to knowledge asset connectivity, $V_c(k_i, k_j)$, is then a function of the number of new connections between videos. The more new connections, the higher the value function of knowledge asset connectivity.

V. CONCLUSIONS

In this paper, we have described the design of TENTube, a video-based connection tool we are developing to support distributed communities of members focusing on competence development. TENTube integrates rich profiling and network visualization and navigation with agent-enhanced game-like connection dynamics. TENTube was designed to motivate users to establish connections that do not exist by creating awareness, stimulating interest, and providing a pretext for making new connections. We also aim to strengthen connections that already exist by encouraging individuals to "reconnect" from time to time.

TENTube includes the possibility to attach documents and links to videos. It can therefore be seen as a value-adding layer designed on top of more traditional content and knowledge management systems.

Currently our first line of research is to deploy TENTube in different organizational and inter-organizational contexts.

A second line of research consists in gradually extending TENTube's functionality, e.g. with the integration of graphic analysis tools supporting the visualization of the combined competencies of specific subsets of members (teams), the enhancement of user profiles, the addition of user privacy controls, and the incorporation of rich competence profiling.

Our third, and most important line of research consists in validating, through the analysis of TENTube logs, surveys and user interviews, that the design principles underlying this type of system contribute in a measurable way to stimulating knowledge exchange, collaborative learning, and ultimately effective competence development in online communities.

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