Self-modeling and Self-reflection of E-learning Communities

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Abstract. Numerous e-learning communities die over the course of time as they do not manage to adapt themselves to the changes of the community environment. We support the communities by providing possible solutions to problems the communities deal with. Firstly, we model communities and their environments and analyse them. As a result, the comparison of communities, environments and their evolution is possible. Afterwards, we propose to identify what solutions of communities were successful and enable communities to survive. These solutions are vital for communities that find themselves in similar situations. We suggest to share the solutions with other communities to keep them fit. To evaluate our approach, we propose to simulate communities and their environment to estimate whether a proposed solution effectively helps communities to survive.

Keywords: community of practice, community patterns, fitness of communities

1 Introduction

Communicating, sharing knowledge and achieving goals are the fundamentals of communities [16]. Humans are social beings. Thus, participating in communities is an unavoidable part of human life. Communities have different participants, different topics of interest and different goals but in general the structure of communities is similar.

Communities mature or die over the course of time. Therefore, we aim to preserve the knowledge of communities by discovering and exploiting patterns of community fitness so as to support them in reacting on changes inside the community and in their environment.

2 Discovering Patterns of Community Fitness

As we require to find the most fit communities, we need to compare them with each other. We need an approach for modeling communities so that we can compare models of communities with each other. Firstly, a modeling approach must be extendable: as soon as a disturbance, an unexpected event, appear, a community has to adopt to the change. Furthemore the approach has to be able to represent desired situations, i.e. community goals. Goals of communities have potentially positive or negative impacts on a community. Most of the modeling techniques coming from process modeling, business process reengineering and requirements engineering focus on technical systems that support work. Actors of technical system models support functionalities that cover users' needs and, thus, the users are interacting with the systems only for covering the needs. Hovewer, no indication is done on user motivations and goals [17]. Even Learning Process Modeling that includes a reengineering concept and considers learning goals [12] cannot give an appropriate view on a learning community as it consider needs that a learning module cover but not goals that a community / a leaner has. The IMS Learning design can express learning activities that are performed by a learner using a learning object. The activities can be shared and reused. However, as in the case with process modeling the focus of the IMS Learning design is on user actions but not on user goals. We find that i* from Yu covers all requirements we defined.

As soon as an appropriate approach for community modeling is found, components of a community as well as techniques for computing the components should be clarified. Afterwards, a database schema which represents a community model should be created. Using the schema, community parameters are stored in a database. Moreover, the computation of the changes of a community over the course of time and their storage should be solved. We are interested in finding patterns of fitness in the stored data. The patterns are solutions for repeatable events, where a problem doen't mean . Thus, a community is characterized by a set of components and sets of a community on different time intervals may be different. Investigating the sets, we can discover patterns, e.g repeatable events, and solutions, e.g. adoptation, of communities . We support a community to survive as we compare its parameters with parameters of other communities. As soon as we know that the community has a pattern, same that the other communities have, we can suggest the community solutions that the other communities used. It is upon the community if it wants or donnot wants to take suggestions into consideration.

3 The loop of community survival

As it was mentioned in the previous section, we observe life of a community in a changeable environment. Figure 1 depicts a circulation that normally happens if something unexpected appears, i.e. *disturbances*. The *disturbances* are positive, negative or neutral events that are unexpected and appear inside of a community or outside it. The *Self-modeling* phase stands for mining community parameters and changes of those parameters over the course of time. The *Self-reflection* phase stands for analysing parameters of communities within all time periods when parameters where captured. Moreover, patterns of communities are discovered and stored in the phase. Last but not least, the support of communities is perfomed by finding similar disturbances that other communities met and by proposing solutions the other communities have applied.

In Figure 1 is depicted that Community of Practice (CoP) [16], Activity Theory [4] and Actor Network Theory [11] create a consolation for the theoretical basis for the *Self-modeling* phase. The CoP suits better in our methodology than learning networks as the CoP focuses on communities that are informal and not institutionalised as explained by Cumming and Zee [3]. Wenger claims that a CoP consists of three main components. These are about interactions of community members, same context and possessing a similar knowledge domain. As we consider communities' actual and desired states, we need to extract the goals communities have. A CoP stresses collaborative work of learners while Engeström explains learning through goal-directed activites of learners. As we are interested in both, communities and goals, we find correlating points between both theories and use them for our investigations.

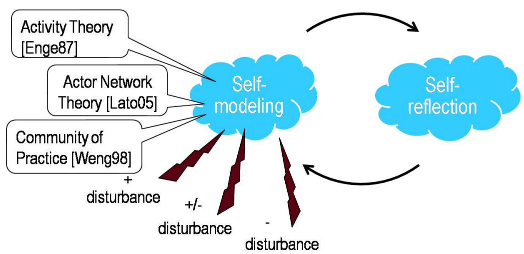

Fig. 1. The loop of self-modeling and self-reflection for e-learning communities

For creating a model of a community, we apply not only the learning theories but Actor Network Theory (ANT) which considers environment as a set of agents. It states that all elements in environment as an actor. Hence, all members of a community are actors as well as Media and Artefacts they use. We need to create a model of a community that is extandable as environment and the community change and we do not know what actor should be added to the model over the course of time. According to the ANT, we can add any event or resource as an actor if it is still not defined in the model.

4 The repository of community fitness patterns

We observe (in the *Self-modeling*) and support (in the *Self-reflection*) the life of learning communities in changeable environment and care about survival of communities.

According to CoP and Activity Theory, learning communities components should be computed. Collaborations between learners can be examined using Social Network Analysis (SNA) [2], users influence measures or measures of collaborations are explicified through SNA parameters. Observing the parameters, we can suggest roles a learner plays and understand a state of a community collaboration in general. Moreover, we can extract patterns based on the parameters. The *example of a pattern*: If 2/3 of community members organizes cliques, isolated groups of learners, and a number of members in the cliques is no more than 2/10 of all community members than the community needs to refine the structure of its network and increase communication between the cliques. The density will increase, clustering affect will descrease and connections between isolated groups will be established.

Technologies of the Semantic Web [1] allow to get a clear idea about concepts and contexts of knowledge that are mentioned in a community-generated content. This information can be used as a set of community parameters that answer for a community knowledge domain. Using an API like OpenCalais [1], it is possible to clarify main topics of discussions and documents in communities and to discover emergent themes. The *example of a pattern*: A topic cannot be supported by community members involved in the discussion, so that the members are unsatisfied. Members of the community are need to be found that have expertise in the topic.

Moreover, activities performed by learners over the course of time express goals of learners and their communities. Goal mining is required to understand which goals communities have and how do they reach them, e.g., how do they deal with disturbances and what solutions do they have. To define goals, we refer to the phases explained in [5]. During the *Plan*, *Learn* and *Reflect* phases a goal is set, achieved and future goals are set. During the *Self-modeling* phase we collect community parameters over the course of time when a community achieves its goals and during the *Self-reflection* phase we define patterns that were applied for the community as well as we suggest solutions of other communities if the community hasn't still achieve a goal.

Summarizing all, a community model includes community parameters that are computed by techniques expalined in previous 3 paragraphs. So that different states of a community over the course of time are saved in a database. The pattern dicovery should be then performed under community parameters in the database. The challengable task will be to form patterns and combine different community patterns in them as parameters devoted to communication and parameters devoted to concepts are not correlating [14].

As soon as patterns are discovered, they should be evaluated on a test set of communities. Particularly, the simultions of communities implemented as multi-agent systems [15] can be used to define changes within communities if a particular pattern is applied.

The results that are achieved so far:

- Modeling of communities with i* and utilizing extracted *parameters* of the communities in models to define the changes over the course of time and adoptations to the changes [8, 13].
- A Community-oriented database, the Mediabase, was reengineered according to Actor Network Theory principles [7]. The Mediabase is a community-oriented knowledge repository. The Web 2.0 interface for the Mediabase, the Mediabase commander [2], allows users to add different Web media to share within their communities. Furthermore, the resources are analyzed with the

[1] `http://www.opencalais.com`
[2] `http://www.prolearn-academy.org/mediabase`

OpenCalais API and important categories and concepts of the resources are defined. Users can see the most popular media that is used within their communities as well as the most popular tags users attach to media. Moreover, media stored in the Mediabase can be visualized with PALADIN II which pictures interactions between community members within media and defines different roles of community members [9] as well as represents link networks of blogs. On the example of the Mediabase and the Mediabase commander, we apply ANT for the Mediabase model and we try out SNA technique and OpenCalais API for extracting community parameters.

– SNA experiments on different Wikipedias extract roles of community members with consideration of the culture of contributors. We conclude about cultural differences in knowledge creation and differences between people of the same culture but physically located at different places in the world. For example, the amount of contributions of Turkish diaspora from Germany is higher than Turkish diaspora living in other countries. We used SNA technique for defining roles of Wikipedia contributors and check the applicability of those roles over different communities.
– Collaborations between teachers of European SchoolNet [3] were simulated with the purpose to find a perfect partner so that the teachers, forming a partnership, benefit from each other. Simulations were based on teacher profiles based on teacher competences. The simulations were performed with a small amount of data and the algorithm should be found to efficiently compute benefits of teachers againt other teachers. We tried simulation techniques for having experience to simulate communities and their behaviour based on pre-defined models.

5 Related work

The *Multi-method approach* considers different aspects of learning in CoPs [10]. Laat et al. concentrate on analysis and definition of roles within learning communites, however they do not consider modeling of learning communities and support communities in their survival. Glahn et al. support learning communities reflection by providing visualizations of learner interactions but they do not consider if learners achieved the goals they set [6].

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