Helping each other teach: design and realisation of a social tutoring platform

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Abstract. Today a wide range of technologies exist that support learning and teaching, ranging from learning management systems (LMS) to general social media platforms, such as Facebook and blogs. However, teaching with such tools and platforms can create various obstacles for teachers.Within the Go-Lab project, we aim to engage school pupils with STEM topics by bringing online laboratory experiments into the classroom. Since it can be a hurdle for teachers to use such technical software and implement these experiments into the pedagogical flow of their lessons, we have identified the need to support and tutor teachers on using online laboratories and their pedagogical implementation in the classroom. The Go-Lab Tutoring Platform offers teachers peer assistance for expertise sharing related to online labs, pedagogy, the Go-Lab learning system and portal. Teachers, lab owners and scientists can help each other and share their skills and knowledge. To sustain this tutoring platform, we aim to build a community of practice and apply various social media techniques. This paper elaborates on the design, the first prototype and an early evaluation of the Go-Lab social tutoring platform. Furthermore, the business model is discussed and realisable via a credit system, ranging from social rating to payment mechanisms.

Keywords: online labs, inquiry learning, bartering, tutoring, social tutoring platform, communities of practice, business model

1 Introduction

Nowadays an abundance of tools is available to solve numerous problems and tasks. Facing a chore, people often say: 'There is an app for that!' Likewise, also for learning and teaching various technologies are at the disposal of teachers and students, ranging from classical learning management systems (LMS), learning analytics dashboards to the re-purposing of existing social media platforms, such as Twitter, Facebook, and blogs. Nevertheless, implementing these technologies in the classroom is often not straightforward and can create technical and pedagogical hurdles.

Bringing new technologies into the classroom is the mission of the Go-Lab project[3], where the main goal is to engage school students with STEM (science, technology, engineering, and mathematics) fields by bringing exciting online laboratory experiments into the classroom. Online labs play an important role for science learning at schools [9, 10]. For instance, students could operate the high-powered, robotic Faulkes telescope[4] located in Hawaii from the classroom to investigate astronomy, or students can investigate particle collisions using software to analyse real data from the CERN Large Hadron Collider. However, successfully integrating such scientific software into a course can be difficult. To overcome these barriers, the Go-Lab project wants to assist and tutor STEM teachers on the use of online laboratories and appropriate pedagogical methodologies. The Go-Lab Social Tutoring Platform offers teachers assistance from lab owners, scientists and their peers who can share their expertise and experience with online labs, pedagogy and the Go-Lab portal [8]. This portal consists of two main components: the Lab Repository[5] and the Inquiry Learning Space (ILS) Platform. The Lab Repository focuses on collecting and sharing online labs, supporting apps and inquiry learning spaces. The ILS Platform allows teachers to build such ILS [7], which are learning environments using online labs and supportive apps from the Lab Repository with learning content and tailored to the inquiry-based learning methodology. Teachers can then share such an ILS with their students.

On the Social Tutoring Platform, teachers can request help sessions with peers or experts through different communication channels. Sharing practices and user interactions are considered important factors for learning by many educators [5, 12, 6]. The Go-Lab Tutoring Platform is a social media platform to build a community of practice [12]. For instance, teachers and tutors will have social media profiles that describe their expertise and their skills. Furthermore, their skill reputation can evolve based on social ranking and commenting. Additionally, the social aspect is also reflected in a bartering process for help sessions through a credit system to reward tutors. This bartering process allows tutors to barter their knowledge and time against credits, e.g. social credits such as positive comments and badges. Teachers looking for help can become tutors after they get expertise from peer assistance. Tutors can also lose their tutor position if they get poor rating from users.

In this paper, we present the design, implementation and first evaluation of the Go-Lab Social Tutoring Platform. Our preliminary results show that a tutoring platform is highly needed for online lab communities. This paper is organised as follows. Section 2 analyses the requirements of a social tutoring system based on use scenarios. After a brief theoretical and practical overview of the state of the art, we present the conceptual design of the system, as well as a development road map in Section 4, together with a first prototype. The first

[3] The Go-Lab project, `http://www.go-lab-project.eu`
[4] The Faulkes Telescope Project, `http://faulkes-telescope.com/`
[5] Golabz, `http://www.golabz.eu`

evaluation results are discussed in Section 5 and we conclude with an outlook in Section 6.

2 Use scenarios and requirements analysis

The target users of the Go-Lab Tutoring Platform are mainly school teachers who potentially need help when they prepare for using an online lab in their lessons. To support sustainability of the platform, the target groups are not limited to school teacher communities. Parents can be interested in hiring tutors to help their children finish online lab school tasks. Interested citizens, such as hobby astronomers can be willing to spend time and even money on using online labs for life-long learning.

To illustrate this, we present a simple scenario. A school teacher, John, wants to use an online telescope lab, that he found in the Go-Lab Lab Repository. But he does not know how to operate the telescope. He finds a list of lab tutors on the lab repository page of the telescope lab. He contacts one of the tutors, Chris, books a help session, connects via an online video call and gets detailed info from Chris on how to teach with the telescope. John gives a high rating to Chris and writes a positive review. Based on this, Chris' profile is awarded an "excellent tutor" badge after Chris has helped the 15^{th} happy user.

Based on this scenario, the functional requirements of the platform include:

- **Single sign-on.** Although authentication is needed for most functionality of the Social Tutoring Platform (e.g., not for searching), it should be user friendly, thus the same login information as in the Go-Lab Portal is reused which most social tutoring platform users will already have.
- **Managing a user profile.** A user can create and update a profile with personal information and his expertise. Tutors can add help offers and time slots (help sessions) for their specific expertise to their profiles.
- **Commenting and rating.** Users can comment and rate a tutor after they get help. This will be shown in the tutor's profile.
- **Contacting, bartering, and communicating for tutoring.** Communication channels (e.g. email and video or audio chat) are required for tutoring sessions and the bartering process between tutors and Go-Lab users. A video chatting channel with screen sharing should be provided to create a real-time, face-to-face like help session. Tutors also require a resource upload tool to share learning resources with the users who need tutoring.
- **Booking tutor time.** A booking functionality to schedule a tutoring session is also provided that gives users a clear overview of a tutor's availability via a calendar. Bookings can be cancelled.
- **Recommending tutors.** Recommendations of potential experts will be provided for the labs or ILS on the Lab Repository.
- **Searching tutors.** Users can search appropriate tutors for certain labs, ILS or specific skills.
- **Listing tutors.** A list of experienced tutors is provided per lab and ILS.

- **Assigning credits to users.** Users get a certain number of credits when they start using the Tutoring Platform in order to book a tutor's help session. This functionality extends the complete bartering process. Credits could be social media badges, vouchers, and real currency.
- **Exchange credits among Go-Lab users and tutors.** As a sequence of *assigning credits to users* tutors offer their help sessions in exchange for users' credits. Tutors can re-use them to get help from other tutors.

3 Related work

3.1 Communities of practice

Among many learning theories, we focus our research on the community aspects. Interactions between community members play an important role in communities. Online lab communities are groups of users who share a concern or a passion for online labs or a scientific domain and who interact regularly to educate themselves, which fits Wenger's definition of *communities of practice (CoP)* [12]. Furthermore, three features are specified in [12] that identify communities of practice as different from other communities:

- mutual engagement is the action taking place among users such as participation and collaboration, e.g. cooperative manipulation of online labs;
- a joint enterprise specifies a set of rules, e.g. guidelines to conduct virtual experiments; and
- a shared repertoire refers to a common learning resource repository, e.g. online lab repositories.

Our previous research results show that social media penetrates and helps community building withe success community building in teaching and collaboration research projects [2, 3]. We explore the social tutoring aspect in this paper.

3.2 Existing bartering platforms

As inspiration for the credit system, we surveyed existing bartering platforms to assess how users are motivated to help each other. Various platforms exist that barter a large range of goods or services, e.g. BarterQuest[6], TradeYa[7], and Swapit[8]. These bartering platforms use points or miles instead of money to equalise trades or acquire items or services. Such points can be purchased, which enables non-cash trading on these platforms. If we only observe services, knowledge and skill exchange bartering, these platforms are often evolved from helpdesks or call centres. The recently rolled-out Google Helpouts[9] integrates the

[6] BarterQuest, `http://www.barterquest.com/`
[7] TradeYa, `http://tradeya.com/`
[8] Swapit, `http://www.swapit.co.uk/`
[9] Google Helpouts, `https://helpouts.google.com`

Google Hangouts video chatting functionality to offer help session with experts (e.g. in cooking or repairing your computer) for free or monetary payments.

The bartering credits range from social media badges, virtual currency, to real currency. The Mozilla OpenBadges platform[10] develops the Open Badges standard for online assessment. Similar to badges in FourSquare[11], learners are motivated to learn by collecting widely-accepted Open Badges as an incentive method. Social help platforms, such as the Q&A site StackExchange[12], use social rating mechanisms to rate the best answer and rate the users who provide the answers. [11] proposed a competence model with a virtual currency based decentralised credit system to make incentives for self-regulated learner communities. Google Helpouts employ Google Wallet for the payment system with real currency. In the context of teachers' communities, quality labels at national and European levels are assigned to motivate teachers in eTwinning [13].

In comparison, currency-based exchanges bring users monetary profits, while social media badges motivate users through gamification approaches. Such ratings are then used to compute an overall trust score of the expertise of a tutor, which often provides extra motivation for these tutors [4].

4 System architecture and implementation

The Go-Lab Tutoring Platform enables users to get experts' help and those users can eventually become online lab experts. The Go-Lab Tutoring Platform supports the users' acquisition process of online lab knowledge and skills. The concept of communities of practice supports this dynamic process from the theoretic aspect. In the lab repository as a *shared repertoire*, all knowledge related to online labs can be stored in the inquiry learning spaces. A list of lab tutors is listed on each lab page of the lab repository. Tutors and teachers carry out *mutual engagement* via creating help sessions, searching for helps, getting recommendation, receiving help sessions, and ranking or commenting tutors in the social tutoring platform. The award mechanism of assigning social media badges or involving payment is settled to maintain the platform as a *joint enterprise*. Hence, the social tutoring platform is capable of delivering community specific tutoring services. At the same time, the Go-Lab Tutoring Platform can benefit of the dynamics of a social network, for instance regular users that are highly rated can be upgraded to tutors based on this community (cf. [1]).

4.1 Architecture of the Go-Lab Tutoring Platform

Figure 1 depicts the architecture of the Go-Lab Tutoring Platform and its relationship to the Go-Lab portal and booking system. The Go-Lab Tutoring Platform is supported by a credit system and a set of components to find and book

[10] Mozilla Open Badges, `http://openbadges.org/`
[11] Foursquare, `http://foursquare.com/`
[12] StackExchange, `http://stackexchange.com/`
[13] eTwinning, `http://www.etwinning.net/`

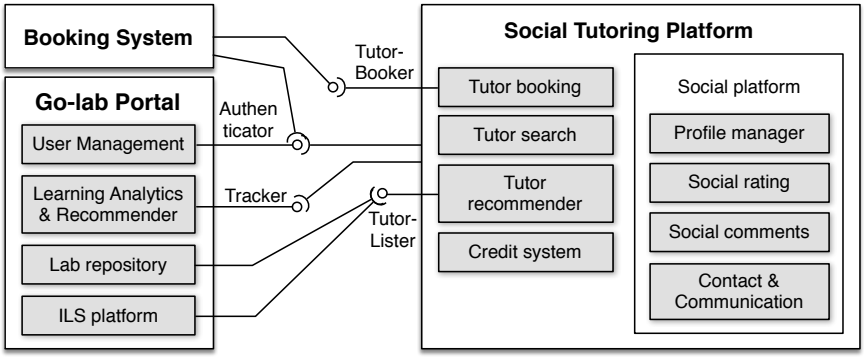

Fig. 1. System architecture

tutors. The social platform components manage user and tutor profiles and provide social features such as user comments and ratings on the user profiles and the help sessions. A user profile includes the name, contact information, a short description, and expertise in related online labs and inquiry spaces, and an activity log. Users can write comments related to the help session and rate the help sessions and the tutor using a five star rating on each other's profile. The average rating is calculated and listed in each user profile. The contact & communication component provides different contact channels between users and tutors. Such channels are required to contact, barter for a help session, and conduct the help session. They comprise emails, contact forms, chat rooms, screen-sharing, and video-chatting. For example, one can email a tutor to make an appointment of a help session, while the help session itself is done through the video chatting tool.

In addition, users can book a help session with a tutor via the tutor booking component, which supports calendar-based booking through the Go-Lab booking system. The booking itself consists of different checks. First, it is checked whether the teacher has sufficient credits to pay for this help session. If this is not the case, then the transaction aborts. If there are sufficient credits, the availability of the tutor is validated by the tutor booking component using the booking system logic via the Tutor Booker component interface. If the tutor is in the meantime unavailable, the transaction is aborted. Only when the tutor is available and there are sufficient credits, the credits are transferred from the teacher to the tutor profile using the credit system. In case an error occurs with this payment, the teacher is notified. Otherwise, the tutor booking is created.

Furthermore, one can search for tutors via the tutor search component and get recommendations of tutors on the portal through the tutor recommender component and the tutor search interface. The credit system provides mechanisms to award tutors for the provided help. Besides the social reputation growth of users on the platform (e.g. via gamification badges or scoring systems), the credit system attempts to explore potential business models for experts and users

requesting help. It uses both vouchers and monetary bartering. Go-Lab teacher communities can get vouchers for free supported by the Go-Lab project, while other users need buy vouchers. Thus, through monetary payment hobby online lab users can get access to a variety of remote labs and virtual experiments, which also provides an exploitation plan for sustainability of Go-Lab portal.

The Go-Lab Tutoring Platform provides on the one hand assistance to teachers that need support to operate online labs and inquiry learning spaces; and on the other hand a social platform for tutors and experts to improve the visibility of their expertise. The tutor's social profile together with the credit system to award tutors, will enable this visibility. Bartering and currency-free bartering will be used to award tutors for the provided help. This bartering process is supported by social rating based social media badges. Social media badges indicate tutors' expertise or trust score. To make this work, a credit system or point system is needed to conduct the bartering process. The credit system is initially optional for the Go-Lab Tutoring Platform to ensure school teachers to receive tutors' support for free. Gradually, it applies vouchers in the credit system. It will involve lifelong learners gradually through payment, which can sustain the Tutoring Platform beyond the Go-Lab project's funding.

4.2 User interface

The Go-Lab Tutoring Platform user interface offers its users to search tutors, to view tutors' profiles, to contact tutors and book help sessions. Most important, it enables users to carry out the help session. It also provides a tutor list on the Go-Lab Portal. When one views the online labs and ILS on the lab repository, one can also see the tutor list with their ratings.

Each tutor's profile is managed on the platform as depicted in Figure 2. It displays a basic description of a tutor with contact information and average ratings as well as labs and inquiry spaces in which the tutor has expertise. A tutor can list the help sessions she/he offers, which can be booked. Tutors have access to a centralised booking calendar, 'My calendar', by clicking the booking button on the upper-right corner, which employs the calendar manager of the booking system. Users can comment and rate this tutor. A user's rating will be calculated as an average. More advanced, robust rating metrics can be considered when needed. A first prototype has been implemented and is available at `http://dev.bpf.golabz.eu/`.

5 Evaluation

In order to continuously improve the design of the Tutoring Platform, participatory design (PD) surveys are conducted to evaluate the current prototype and assess whether the user requirement assumptions are correct. The first survey focused on users' skills and knowledge about physical and online labs, their need for experts' help, the appropriate incentives for tutors, and their experience with the Go-Lab Tutoring Platform prototype.

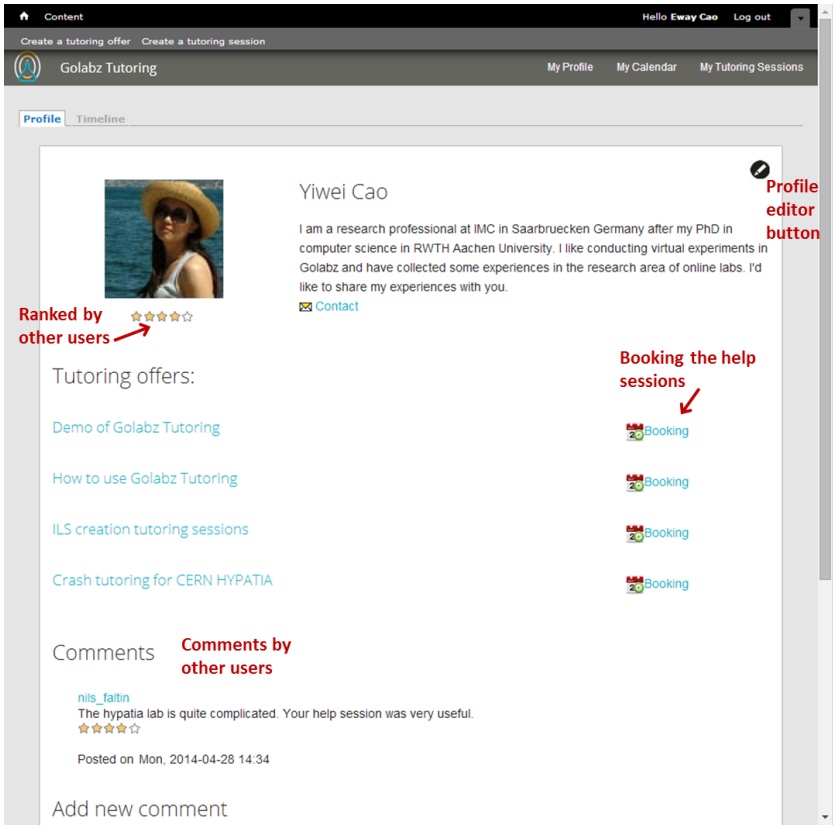

Fig. 2. Tutor profile management and display of help session offers

Seven survey participants were introduced to the platform and played the role of either a tutor or a teacher. Each created a profile. After that, test tutors created help offers. Test teachers explored the tutors' profiles and searched for help sessions. Afterwards, test teachers booked help sessions. If a help session was booked successfully, a Google Hangout link was created for this help session. Then, tutors were helping teachers via Google Hangout. After the hands-on experience, seven participants completed the online survey.

The survey results from the first participatory design workshop show: (i) the users need help and support because they meet with problems and look for expertise during online lab use; (ii) incentives such as being paid or getting social badges motivate tutors mostly. Figure 3 depicts the results related to which incentives users prefer in exchange for tutoring (using Likert scales from '1 – absolutely inappropriate' to '5 – absolutely appropriate'). On the one hand, the participants are indecisive whether they want to provide help for free (Figure 3a) with an average rating of 3.2. On the other hand, they prefer to tutor in return for social media badges (3c, average rating 4.3) or want get paid (3b, average rating

3.9). Bartering for getting help form other tutors (3d, average rating 3.9) is also perceived as positive. Overall, the proposed incentives are deemed appropriate by users. Furthermore, participants were asked which type of help they would prefer. The two most valued types of help were face-to-face and online meetings. Still positively perceived were a helpdesk and online discussion fora, while the participants were indecisive on social media and online search.

Fig. 3. User survey on incentives in the Go-Lab Tutoring Platform

Further users' feedback refers to user account integration with users' Google accounts and limitations of applying only Google Hangout. A search mechanism for domain-specific help sessions is deemed as important. These comments will be taken into consideration for the next iteration of the prototype.

6 Conclusions

A social tutoring platform is a complex system that requires much more functionality than just some social features. We have applied the communities of practice theory to support a community of online lab experts acting as tutors and teachers. Our Go-Lab Tutoring Platform has the potential to make the Go-Lab Portal comprise a sustainable market place of knowledge and skills about online labs and their pedagogical implementation. We have proposed several communication channels to provide assistance and a credit system providing different mechanisms (e.g. social badges) to award tutors for their time and their

expertise. Furthermore, a first version of this platform has been implemented and evaluated. It is a promising solution to support teachers' lab usage skills by tutoring and knowledge sharing. Furthermore, the Go-Lab Tutoring Platform fosters the evolution of specific user communities who have or search for expertise, in order to operate online labs or creating ILS properly.

One can see the Go-Lab Tutoring Platform as a support mechanism for the Go-Lab Portal and its Lab Repository. By providing tutoring activities more teachers will be attracted to use more online labs and the portal. The credit system with vouchers, social badges and payment with real currency could reach out to external user communities beyond school teachers and students. Through their monetary support the online labs and the Go-Lab portal can be made sustainable beyond the Go-Lab project's lifetime.

Our first evaluation shows that online lab users need help and value skill bartering via a credit system to motivate users to help each other. The prototype still needs further improvement and a larger user evaluation needs to be conducted to assess its usability and business model, which assures the realisation of the credit system. The current prototype has just demonstrated the basic features of a social tutoring platform. Hence, we plan to extend it with further features and functionality in future, such as tutor recommendations and advanced search.

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