

Pedagogical Design Principles Guided Integration of Social Media Concepts in a Hybrid Learning Environment

Analysing and Reporting Focus Group Results

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Abstract—The current study aims to identify trends in users' wishes and requirements regarding the integration of social media in teaching and learning. Social media has been widely adopted in everyday life, facilitating communication and collaboration, as well as community development and knowledge exchange between users. Although the added value of social media for learning and instruction has been highlighted widely, still students' and teachers' perceptions on their use and implementation are incongruent with the current state of the art in their pedagogical exploitation. Science, Technology, Innovation, Mathematics, Education for the Young (STIMEY), a European funded project, aims at developing a pedagogical framework exploiting the full potential of social media, particularly for Science, Technology, Engineering and Mathematics (STEM) education. A participatory co-design methodology, with focus group techniques, was employed for the identification of the project stakeholders' wishes, forming the basis of more concrete requirements regarding the use of social media in teaching and learning. Moreover, a qualitative approach was followed for their analysis. Findings are presented and discussed in terms of their relationship with pedagogical design principles and social media concepts previously identified within the project research.

Keywords—*E-Learning; E-Teaching; Europe; Pedagogy; Social Media; STEM; Technologies.*

I. INTRODUCTION

With the universal adoption of social media in everyday life, efforts in educational research have focused on its use in learning, mostly in out-of-school context, where it's often used. However, studies are mostly concerned with the use of popular social networking sites by students and teachers. Only very few studies investigate students' and teachers' perceptions and practices of social media use in formal learning environments, especially in middle and secondary school settings [1].

Social media encompass technologies that facilitate communication and collaboration between users, enabling them to construct communities and exchange knowledge. Educational researches have also recognized them as valuable tools that can be used for learning and teaching purposes [2]. Still, using such technologies as learning tools can be challenging to students and teachers given the lack of pedagogical support [3] and the lack of understanding how different functions of social media tools can be used efficiently in learning tasks [4]. Thus, students and teachers need to collaborate on reconstructing their views of pedagogy to come to a shared vision for enabling the learning experience, in order to leverage the potential of social media technologies for broadening the learning context, blending information and learning resources, and sharing expertise [5].

The Science, Technology, Innovation, Mathematics, Education for the Young (STIMEY) project, funded by European Union's Horizon 2020 H2020-SEAC-2015-1 program, with partners in Belarus, Finland, Germany, Greece, and Spain, aims to develop a hybrid learning environment that connects students and teachers, as well as parents and organizations. One of its main objectives is to create a pedagogical framework that exploits the full potentials of social media, especially for Science, Technology, Engineering, and Mathematics (STEM) subjects, in formal and informal learning contexts, as well as to develop recommendations and guidelines that can be used widely beyond the project [6]. To successfully integrate social media technologies within the STIMEY hybrid learning environment, their use then must be linked to the achievement of learning goals, following a pedagogic strategy. Identifying which features users already use, find interesting and consider important, and recognizing how

their use can be endogenous to learning goals is one way to achieve that objective [7].

This study builds upon previous research, where key social media concepts and features, such as user profiles, status updates, and discussion, were identified for their potential roles as support tools that can enable and facilitate learning tasks and goals [8]. As part of the research, co-design focus groups with students, teachers, parents, and professionals were conducted in 5 different countries. The participants discussed and shared their views on using social media in learning and teaching context, thus fulfilling the approach of participatory co-design of pedagogical principles. In this paper, the participants' wishes related to the use of social media in learning and teaching context, and the resulting pedagogical design principles, are presented and discussed, for their integration in the social media concepts within the STIMEY platform.

In the following background subsection, the key social media concepts and pedagogical design principles identified in the previous research are briefly reiterated. In Section 2, the research questions, and methodology are described in detail. In Section 3, the results of the focus group are presented, with a discussion of how the previously identified social media concepts fulfill the pedagogical design principles based on participants' wishes and requirements in Section 4, and the study limitations in Section 5. In Section 6, a conclusion is drawn with guidance for future research.

A. Background

So far, researchers and educators have had to deal with a lack in the understanding and identification of the social media features that the youth find most appealing and important, and in defining and assessing learning and communication using social media. In the review of 24 studies from the educational research literature that examine the use and perception of social network sites by learners and teachers in primary and secondary education, it was concluded that most studies focus on common uses in students' informal learning outside of school. Only some studies investigated students' formal learning in schools and classrooms. However, none of the studies researched social media technologies' effectiveness at improving student learning and their impact on teaching pedagogy [1].

Therefore, efforts in this research first focused on the theoretical understanding of key social media concepts, identified based on the common features in popular networking sites, and their potential role as learning tools in the progressive inquiry model, to demonstrate their support of pedagogical learning approaches [8]. The concepts identified in that analysis are:

- *User profile*: the foundation of the user's activity on the e-learning platform, and the digital representation of their personal data, which can help identify their personal interests to find like-minded learners based on their expertise areas.

- *Status Update*: the most basic form of communication on the platform, which allows users to share their thoughts, opinions, and important information with others, to enable brainstorming, presenting and unstructured discussions.
- *Social Feedback*: an effective tool in learning context, by supporting the co-creation of working theories and critical evaluation through likes, comments, replies, etc.
- *Social Connecting*: a feature that enables communication, collaboration, knowledge sharing and network building on a social platform, with functions like "add friend" or "follow account", thus driving multiple pedagogical frames that depend on interactions among the various roles in a pedagogical model (i.e., learners, tutors, facilitators/mentors, and group members/leaders).
- *Activity Stream*: the most common method of displaying the list of recent activities on a platform from a user's network, which supports generating context and receiving or providing feedback on those activities.
- *Social Messaging*: rich text chatting that enables deeper private or group discussions, collaboration, brainstorming and sharing expertise, between the various roles.
- *Community*: a feature that allows users to find and connect with like-minded people, in interest and niche-specific private or public forums, enabling learning tasks, such as communicating, assimilating and producing information and knowledge, etc.
- *Discussion Forum*: a common feature in most e-learning platforms, which enables learners to cooperate and collaborate on constructing knowledge, by supporting the learning tasks' types and techniques.

Previous research efforts in the STIMEY project also focused on identifying pedagogical principles to guide the design of a hybrid (physical, virtual, formal, and informal) STEM Learning Environment (STEM LE), such as the STIMEY LE. In the preliminary research, design principles were created based on focus group discussions collecting the wishes of Finnish (n = 27) and Greek (n = 24) primary, lower, and upper secondary school students, teachers, school directors, parents, and STEM professionals on teaching, learning, assessment, and motivation both in general and in relation to STEM studies [9]. In that analysis, 22 pedagogical design principles were formulated, based on the research literature and supported by participants' wishes, in 3 areas:

- General Principles, such as:
 - *Versatility* in teaching, learning, and assessment;
 - *Novelty* in use of methods and tools for learning; and
- Ways of Teaching and Learning, such as:
 - *Reflective learning*, e.g., reflection, deep thinking, critical thinking;

- *Learning outside the school*, e.g., field trips, visits to workplaces;
- Socio-emotional aspects, such as:
 - *Joy of learning* referring, e.g., to the importance of enjoyment, learner satisfaction, and having fun;
 - *Justice and equity*, equal treatment of all students, no discrimination, fair assessment, etc.

In this paper, the pedagogical design principles that the participants related in their social media wishes are presented and considered in employing the previously identified key social media concepts [8].

II. RESEARCH QUESTIONS

This paper extends on the previous research [9] to include the data of focus group discussions conducted in Belarus, Finland, Germany, Greece, and Spain, considering participating stakeholders' wishes related to the use of social media in STEM learning environments. The main research question is: What are the wishes of the participating stakeholders concerning the social media use in learning and teaching context?

The answer thus lies in recognizing which previously identified pedagogical design principles can be pinpointed in the focus group data on social media use in learning and teaching.

B. Methodology

Participatory design approach [10] and focus group techniques [11] [12] were combined in the focus group co-design sessions [9].

1) Participants

TABLE I. PARTICIPANTS

| Stakeholder groups | Countries | | | | | Total n = |
|----------------------------|-------------|-------------|-------------|------------|-----------|-----------|
| | Belarus n = | Finland n = | Germany n = | Greece n = | Spain n = | |
| Primary school students | 2 | 4 | 11 | 2 | 4 | 23 |
| Lower sec. school students | 6 | 6 | 2 | 2 | 5 | 21 |
| Upper sec. school students | 2 | 2 | 7 | 2 | 4 | 17 |
| Teachers | 3 | 3 | 2 | 6 | 2 | 16 |
| Directors | 3 | 3 | 3 | 3 | 2 | 14 |
| Parents | 4 | 5 | 3 | 6 | 4 | 22 |
| STEM professionals | 2 | 2 | - | 3 | 1 | 8 |
| University students | 5 | 2 | 2 | - | 2 | 11 |
| Total n = | 27 | 27 | 30 | 24 | 24 | 132 |

Table I displays information on participants per each stakeholder group and each country. The largest groups of participants were primary, lower secondary and upper secondary school students. Focus group discussions included no STEM professionals (business or research) in Germany; and no university students in Greece. The number of participants per each country was relatively homogenous ranging from 24 to 30 participants. There were slightly more female (n = 73) than male (n = 59) participants.

2) Materials

Materials for the focus group sessions involving various stakeholders in the learning environment co-design were developed in collaboration with the partners participating in the STIMEY project, first in English, and then translated into local languages.

Focus group discussions collected participants' wishes related to the main topics covered in the STIMEY project: Teaching and learning, STEM subjects, cross-curricular skills, social media, games and gamification, digital platform, radio, social robots, gender, and safety issues. These topics were presented to the participants in slides, accompanied by images of each topic for inspiration and to evoke discussions. Participants' wishes related to various topics were collected by using an online form with open-ended questions. Focus groups discussions were also recorded.

This paper concentrates on the analysis of the stakeholders' wishes related to social media, more concretely with the following statements:

- I wish the means of social communication...
- I wish user profiles...
- I wish social networking...

Materials were designed based on the grounded theory approach [13]. Instead of referring to specific theories and pre-defining these concepts for participants, we were interested in their ideas and understandings related to these topics.

3) Procedures

The main focus groups' co-design sessions were organized in all project countries at a primary school, lower secondary school, and upper secondary school during the school year 2016-17. Some participants, who could not be present during the main sessions provided their contributions in separate, additional sessions. Participants' written consents, and in the case of minors, also their parents' consents, were asked in advance. After a short description of the STIMEY project, researchers presented the topics to be discussed one by one, using the presentation slides.

Sessions lasted from 90 to 120 minutes with approximately 5 to 10 minutes time to discuss and write down the wishes related to each topic. While open conversation enabled collaborative idea elicitation between stakeholder groups, writing wishes down enabled

expressing oneself without feeling constrained to voice their views in front of the others [11]. It also gave less extrovert participants chances to participate. Researchers were careful so as not to influence participants' ideas. In the case there was a need to clarify some concepts or give some examples, participants were reminded that there were no right or wrong responses. Participants were, however, encouraged to think and express their wishes as representatives of their stakeholder group instead of thinking only personal preferences [9].

4) Data Analysis

When analyzing what pedagogical design principles could be identified in stakeholders' wishes related to social media, the previously formulated design principles were used as categories or themes to be coded in the data. For instance, under the principle named as *connectedness*, responses wishing that students would learn how to use social media tools in real-life situations, such as job search were coded. Under *collaborative methods*, responses referring to the use of social media in communication and interaction both within and outside the school community, were coded.

The frequencies of wishes related to each category or theme were calculated. As the purpose of this paper is to identify the connection between the pedagogical design principles and the social media design, the focus is on the most frequent learning and social media related wishes as a whole ($n = 132$), not as an exact numeric data, but as overall trends and tendencies. Possible country-, gender-, group- or age-based differences are out of the scope of this analysis. Although commonly mentioned in the data, stakeholders' wishes concerning social media aspects which were not related to teaching and learning, such as safety and privacy issues, are not included or discussed herein.

III. RESULTS

The results in this paper focus on the identification of stakeholders' wishes and requirements with respect to social media concepts use in learning, and teaching. In the analysis of these results, seven pedagogical principles were identified to be relevant in the integration of social media concepts, as presented and discussed herein:

- *Teaching and learning aid* was the most commonly cited category of wishes expressed among stakeholders in all countries; it was related to the use of social media as a *Learning/Instructional aid*. Wishes related to the use of social media concepts as supporting aids during learning and instruction processes were grouped under "*Teaching and learning aid*". This refers to the teacher's role in facilitating effective teaching, learning, and assessment, and motivating students [9] through social media tools. For instance, a female upper secondary student in Spain wished that "social communication becomes a tool, and not a waste. That is, it could, for example, bring people to answer questions in real time". A teacher from upper secondary education in Germany highlighted in his statement that "social networks would provide not only superficial information, but deep conversations, good information exchange, and constructive reasoning". Also, a female parent representing upper secondary education in Belarus suggested that social media "could offer information only with informative character".
- *Collaborative methods* were among the most commonly cited categories; this category included ideas and wishes that referred to the use of social media concepts in different forms of group activities in teamwork and/or group work and communication, and collaboration. For example, a female primary education student from Germany mentioned the importance of "having a smartphone and a group, the teacher writes down homework in that group". Furthermore, a male student from upper secondary education in Germany suggested that "[when using social media], you could text with friends, for example, and solve tasks with them or discuss with them".
- *Connectedness with future life and careers* was outlined by many participants who stated that using social media should be connected to the user's future life and choice of career as it offers an opportunity to relate with companies and industries. Such a wish was expressed by a male primary education teacher in Greece, who indicated that "user profile in social media should be restricted only to professional contexts", as well as by a female director in lower secondary in Finland, who suggested that social media "would support professional development". Also, a female upper secondary student in Germany suggested that user profiles "could be of interest to companies for subsequent application submissions. So special activities or accomplishments on STIMEY should be stored in a user profile".
- *Personalization (including also aspects related to customization)* was a category often endorsed by stakeholders in all countries. Personalization in pedagogy mainly refers to considering personal competence level and differences in knowledge, skills, rhythm, and ways of learning [9]. Under this category, wishes related with the ability of users to adopt and adjust the social media according to their preferences were included. For instance, a male STEM professional in Spain wished that a user profile is "designed [by] myself", while a female parent in upper secondary education in Greece wished for "users to register with a name in their profiles, which in turn they would be able to control". In some cases, personalization and customization were related with visibility, namely that users could gain more visibility by showcasing their interests when using social media. This attitude is expressed particularly in the statement of a male student from a primary school in Germany who stated that "[a

user profile should] show my interests like cars, but I do not want to show my grades to other students”.

- *Multiple representations* were often highlighted by participants expressing their need to employ multiple types of media and tools in learning and instruction processes. Specifically, wishes which referred to combining any kind of digital or non-digital forms of presenting information including visual, multimedia, audio, text, simulations and animations [9] were included here. As a female student in lower secondary education in Finland suggested: “[An instant messaging tool] could be used in biology classes to upload images and discuss nature and animals”. Moreover, a male student from primary education in Germany stated the desire to “share posts about my interests, [using] microphone and audio because I can't type”. This desire is also illustrated by a female student in upper secondary education in Spain who hoped to use social media features in learning to ask questions, send photos or make a video call when needing help with homework.
- *Active knowledge construction* was less commonly referred by the participants. Active knowledge construction is conceptualized considering learners' active agency during learning and instruction processes [9]. Particularly, participants related to it in social media concepts with user-generated content. This is reflected in the statement of a female student in upper secondary education in Germany: “[In social networks], one could see videos that other students had created, aiming to instruct and facilitate knowledge learning of a subject, instead of having a teacher teaching the same subject”. Finally, a quite informative argument was offered by a female parent in primary education in Greece suggesting that “[social media] could [be used to] provide news, digital tools for ICT, materials in text form and could be used by students, parents, and teachers.”
- *Participation and Involvement* appeared more sporadically in data, as the final category. In this category, items referring to participatory, interactive and conversational teaching-learning interaction [9] were included. To illustrate, a male university student in Belarus wished that social networking would “bring together all trainees and trainers into a unified whole, and there would be no barriers in communication between them.”

IV. DISCUSSION

With a myriad of social media features, which are continuously changing and growing, it can be a difficult task to list and identify the ones that stakeholders find most interesting and crucial. This might explain the lack of research in this area, as pointed out earlier. To tackle this task, bottom-up and top-down approaches are employed in this study. In the bottom-up approach, the participating stakeholders' wishes on the use of social media in learning

and teaching are collected and analyzed for emerging themes and pedagogical design principles. These themes and principles then guide the selection, design and development of various features in the pre-identified social media concepts [8] within the STIMEY platform in a top-down approach. Using various pedagogic scenarios, the approach examines how these social media concepts and features fulfill the pedagogical design principles:

- **User profiles and Social Connections** are designed with functionalities that allow users to register and partake in the platform's learning activities, under the various roles of student, tutor or facilitator/mentor, and connect with each other based on their roles, interests or expertise. Thus, user profiles are fundamental in facilitating students' self-regulated learning and personalized learning while still being connected to teachers who can be present as guides (pedagogical design principle named as *teaching and learning aid*). Functioning as a resume, a user profile also encloses other functionalities, such as an **e-portfolio** that collects a student's learning achievements on the platform and can then be shared with potential employers or educational institutions and personnel (*Connectedness to Future Life and Careers*). User profiles also give users the ability to personalize and customize their presence on the platform with text and images (*Personalization*). Users can express their individual identity and interests in an “**About**” section, as well as on other functionalities in the profile like the **timeline** (or the “wall” [14]) where they can post status updates with *multiple representations* of various rich media (text, images, videos, documents, links, etc.). Finally, in order to participate in (*participation and involvement*) and collaborate on (*collaborative methods*) the *active knowledge construction* on the platform, users need first to register and create profiles that give them access and enable them to utilize the other social media features, such as **connecting** with each other to build networks, by **adding friends** to have permission and access to each other's private profiles, and timeline, or **following users** for their public profiles and timelines. In one pedagogic scenario, we have elaborated based on these considerations, an upper secondary chemistry teacher can search the platform for a Pharmacologist (based on her experience and skills, found on her user profile), connect with her, and message her to invite her to join a discussion with his students on the platform.
- **Status updates and Social Feedback** are designed with functionalities that enable teachers to set up contexts in various pedagogic scenarios (*teaching and learning aid*), and allow students to share knowledge among each other, as well as with facilitators/mentors as experts, and provide or receive critical feedback (*participation and involvement, collaborative methods and active knowledge construction*). Status updates also enable self-expression of interests, preferences,

opinions, expertise, etc., (*personalization*)) through functionalities that enable posting media-rich user-generated content containing text, images, videos, etc. (*multiple representations*). The accompanying social feedback functionalities, such as comments and replies, enable the furthering of discussions and knowledge sharing by providing critical feedback on users' status updates. In one possible pedagogic scenario, a primary biology teacher can post a **status update**, asking students to list different types of summer flowers that they will be tasked to plant for a class project. Students can then **comment** on the teacher's status update with photos, videos or links to different types of flowers that they'd like to grow. The teacher can then provide feedback by **replying** to students' comments, to confirm or correct their selections. She can also further the discussion by asking the students to post instructional videos and links to growing their selected flower in their replies. She can also ask the students to read their peers' comments and find a few who have made the same flower selection, in order to form a group that can be tasked with growing their selected flower.

- **Social messaging** is designed with functionalities that enable knowledge sharing and discussions in private bilateral conversations, such as between two peers discussing classwork, or among a predefined group of users, such as a teacher and his/her students continuing an in-class discussion outside of the classroom (*teaching and learning aid*). The rich media (text, images, videos, links, files, etc.) that can be shared in one-on-one or group chat messages, also enable *personalization* with *multiple representation*. The instant nature of social messaging enables quick discussions and easy participation (*participation and involvement*) that are useful during the collaboration between two users or a group of users (*collaborative methods*). In one pedagogic scenario, two lower secondary students working together on a group project can privately message each other when out of class to discuss the nature and structure of the work, share text, images and videos that can be used in the project, and refer to these messages whenever necessary. The students can also share the project file with each other as a message attachment.
- **Communities and Discussions** are designed with functionalities that enable teaching and learning in groups (*collaborative methods*), mirroring a classroom environment online. Teachers can take on a leading role by creating communities or discussion forum topics (*teaching and learning aid*), or a facilitating role by letting students create their own public or private communities and discussion forum topics under his/her supervision and guidance (*active knowledge construction*). At their fundament, communities and discussions are a collection of status updates with

accompanying social feedback (*multiple representations*), confined to a preset list of users, who are members of these communities or discussions (*participation and involvement*), that is specific to an interest or topic, usually identified in the community name and description, or the discussion's title and its location under a topic or a course (*personalization*). In one pedagogic scenario, a lower secondary physics teacher can create a discussion topic, title it "Collision Examples", under her course on crashes and collisions, and ask her students to create their discussions under that topic, listing examples of collisions from everyday life. The students can further their knowledge by researching questions and constructing hypotheses on how the velocity and mass of an object, and the variable of time can affect momentum in these different examples, by reading their peers' discussion posts and the teacher's feedback and providing peer evaluation. The teacher can also encourage the students work in groups. They can create their own private communities, personalize them with a name and photo representing their group, and use them throughout the duration of the project or the course to discuss their work and collaborate on an assignment.

V. LIMITATIONS

This study has statistical limitations, stemming from the study design. Particularly, the focus group data collected and analyzed may not be representative of the general population of European students, teachers, parents and professionals targeted by the STIMEY project, due to the small number of participants represented from the 5 European countries. However, focus groups were used to provide qualitative data, that shed light on trends of pedagogical design principles that are in common among stakeholders, and to enrich the understanding of the main findings from the literature review and the researchers' expertise with relevant examples. Moreover, the analysis of the results was limited to the social media concepts that have been previously identified, while there may be several other social media features that can be apt in fulfilling the stakeholders' wishes and requirements, based on the identified pedagogical principle designs.

VI. CONCLUSION AND FUTURE RESEARCH

Although social media has gotten increased attention in educational research in the recent decade, most studies focus on the use of popular social networks and technologies outside of the classroom, and how they are perceived by students and teachers, mostly in higher education. There is, however, a lack in studies that examine the perceptions and practices of learners and teachers in primary and secondary education. More research is especially required on the use of social media features in the classroom based on preference and importance, and their impact on students' learning and

teacher's pedagogy. One of the objectives of the STIMEY project is to research and adapt a pedagogical framework that exploits the full potential of social media in learning, especially in STEM education. Initial research was geared towards identifying eight key social media concepts, or features, based on popular social networking sites and their potential role as learning tools in a pedagogical learning model. Concurrently, research was carried out on identifying 22 pedagogical design principles in hybrid STEM learning environments, based on focus group data from two European countries, and literature review. In this study, focus group data, from all five European countries represented in the STIMEY project, relevant to the participating stakeholders' wishes on the use of social media in learning and teaching were analyzed. Results from participants' wishes and statements indicated trends of seven pedagogical design principles, such as collaborative methods, teaching and learning aid, and multiple representations. The previously identified social media concepts were then further examined for which features and functionalities they include to fulfill the stakeholders' needs, based on the seven resulting pedagogical design principles. The study has its limitations concerning the size of the focus groups, and the number of social media concepts taken into consideration. However, these limitations have been taken into account for future research, where the focus is on identifying additional social media features and functionalities based on previously collected and emerging stakeholders' requirements, and diverse pedagogical scenarios involving students, teachers, organizations and parents. Finally, user testing and feedback on the STIMEY platform is planned to conduct a mixed qualitative and quantitative study with a larger number of participants which aims to analyze and assess the social media concepts and pedagogical design principles in this study.

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