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Integrating Social Media Concepts as Tools in a Pedagogical Approach for a Technology-enhanced Learning Environment

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Abstract— The use of social networking sites and social media tools is on the rise, as the most common activity of today's youth. Thus, leveraging social media concepts in learning can make education more relatable to the youth in this digital era. This paper identifies key current social media concepts, such as user profiles, activity streams, and status updates, among others, and analyses how they support pedagogical learning approaches, with the progressive inquiry-based model used as an example. The preliminary study serves as an introduction to a series of future research and empirical studies on the integration of key existing social media concepts and the development of novel ones in a hybrid educational environment, called Science, Technology, Innovation, Mathematics, Engineering for the Young (STIMEY). The STIMEY environment will combine social media components, robotic artefacts, and radio, and connect students, educators, parents and organisations, based on a pedagogical framework researched and developed to increase the European youth's interest and engagement in Science, Technology, Engineering and Mathematics (STEM) education and careers.

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

I. INTRODUCTION

In a world that is becoming more technology-oriented, it is getting difficult to engage and maintain the interest of young learners in formal settings. Contemporary educational systems fail to successfully awaken the desire for active and responsible learning. Learners' levels of engagement during their years of schooling are low and many students report feeling bored or even hating school [1]. On the other hand, the popularity of social media continues to rise each year, currently with over 2.3 billion active social media user accounts globally, at a penetration rate of 31% of total global population [2]. Thus, leveraging social media concepts can be key in attracting the students' interest for Science, Technology, Engineering, and Mathematics (STEM) education and careers, and making it more relatable to them from a young age. This paper presents a preliminary concept of integrating social media concepts in the pedagogical framework for a hybrid educational environment with multi-level components, called Science, Technology, Innovation, Mathematics, Engineering for the Young (STIMEY) [3]. The STIMEY project is funded by Horizon 2020 H2020-SEAC-2015-1 program, ongoing between September 2016 and

August 2019, with partners in Germany, Spain, Finland, Greece, and Belarus. It aims to make STEM education and careers more attractive for 10- to 18-year-old students in Europe, with a hybrid learning environment that combines social media components in its Web platform, robotic artefacts, and radio broadcasting. The socially motivational environment for emotional and educational engagement is being designed and developed based on a pedagogical framework to educate, engage and increase the youth's interest in STEM [4].

The STIMEY environment will also provide the necessary modern tools for teachers, parents and organizations to take part in the students' progress and development, such as social media tools, gamification, collaborative and creative tools, entrepreneurial tools, serious games, and tools for challenges, activities and competitions. Thus, universities, schools, teachers, students, parents, business and media partners come together to complete a circle in which STEM becomes a part of the daily life of youth in an educational environment that also prepares them for future careers [4].

A. Research Objectives

The overall objective of the STIMEY project is to contribute to the increase in competitiveness of the European Union economy, with results that will enable young people, ages 10 to 18, to become highly competent in STEM topics and be motivated to pursue STEM careers [4].

The specific objectives, stemming from the general goal, in relation to social media components, are to:

- create a pedagogical framework that exploits the full potentials of social media for STEM topics in formal and informal contexts;
- create a Web platform for multimodal communication, social media concepts and tools, and professional identity development. The e-profile and social media tools of the STIMEY Web platform will support students' needs to communicate, share and interact with peers, STEM event organizers, academic members, professionals, companies, etc.
- create electronic portfolio presentation tools to support students in promoting their STEM activities and achievements – participation in relative activities in formal (e.g., schools) and non-formal (e.g., science centre activities, competitions, etc.) education, STEM project completion, competition awards, etc. – with

multimedia and social media tools that also enable them to receive feedback from the STIMEY members.

The STIMEY project addresses the specific challenges in achieving the objectives by creating a shift from traditional towards innovative and effective methods [5] to increase the attractiveness of STEM education and careers, and boost the interest of young people in STEM.

Based on extensive research, testing and European-wide collaboration, the STIMEY project is then developing a set of novel pedagogical approaches grasping a holistic vision of existing challenges to offer an educational multi-channel solution that integrates social media, robotic artefacts, radio broadcasting, entrepreneurial tools and serious gaming, into a complex learning environment [4].

In Section 2, a literature review on the use of social media in learning and education serves as a starting point when researching and developing a technology-enhanced learning environment for raising European youth's interest and attraction towards STEM studies and careers. An overview of the research and development of the pedagogical framework follows in Section 3. In Section 4, key social media concepts are identified and their role as learning tools is discussed in detail. The risks of social media use and strategies to mitigate them are briefly introduced in Section 5, while Section 6 presents a conclusion of the research with an outlook on future research within the project.

II. SOCIAL MEDIA USE IN LEARNING AND EDUCATION

Social media concepts are forms of electronic communication, such as Web sites for social networking and microblogging, through which users create online communities to share information, ideas, personal messages, and other content (as videos). That is only one of the various definitions of social media across different disciplines and points of views [6]. While many may think of social media exclusively as social networks like Facebook [7], its landscape is far more inclusive of basic forms, such as microblogging (e.g., Twitter [8] and Snapchat [9]), blogs (e.g., Tumblr [10] and Wordpress [11]), wikis (e.g., Wikipedia [12]), podcasts (e.g., Apple iTunes [13]) and content communities (e.g., Instagram [14] and Youtube [15]). And those are only some of the current modern forms of social media. As it is seemingly difficult to pinpoint a single definition of social media, it is better to understand it as a group of new kinds of online media, which share most or all of the following characteristics [16]:

- Participation: social media encourages contributions and feedback from everyone who is interested. It blurs the line between media and audience.
- Openness: most social media services are open to feedback and participation. They encourage voting, comments and the sharing of information. There are rarely any barriers to accessing and making use of content – password-protected content is frowned on.

- Conversation: whereas traditional media is about “broadcast” (content transmitted or distributed to an audience), social media is better seen as a two-way conversation.
- Community: social media allows communities to form quickly and communicate effectively. Communities share common interests, such as a love of travel, an environmental issue or a favorite artist.
- Connectedness: Most kinds of social media thrive on their connectedness, making use of links to other sites, resources and people.

Teenagers are among the most prolific users of social networks and social media tools. While they primarily use them to communicate with friends, they also use them and other interactional technologies to gather information and aid in decision-making. These advances are expanding the world of today's youth in ways that have yet to be fully understood [17]. Additionally, studies show that young people learn differently with social media and online technology tools, and as a result, the need for more flexible education and online interaction has become critical [18].

Given its increasing popularity and significance, various literature has researched the use of social media in different disciplines, such as business, marketing, software engineering, collaboration, etc. Special focus has also been given to researching the use of social media in education, as it is increasingly being leveraged as a learning and teaching tool. Yet, there is not much research and literature published on the intellectual and social practices that the youth demonstrate—either in top social networks, such as Facebook—or in niche social network sites, social gaming, or mobile networking applications designed for educational purposes. Preliminary research results indicate that [19]:

- 96% of students with Internet access report using social networking technologies
- 75% of students in 7th through 12th grades have at least one social media profile
- 59% of students who use social networking talk about education topics online
- 50% of students who talk about education topics online, talk specifically about schoolwork
- 59% of schools say their students use social networking for educational purposes
- 27% of schools have an online community for teachers and administrators

Other studies have found that some school tutors have embraced smartphones and social media as mobile learning devices [20]. While critics say that social media discourages communication, supporters feel that it can enhance learner interactions, particularly for those learners who are too shy to fully participate in class [21].

Nonetheless, only few studies examine the influence of social media features and their attendant social practices on learners. Although educational research devoted to understanding young people's purposes for using social media is increasing, research on the features they find most engaging, the socio-technical practices they employ, and ways to define and assess learning and communication using social

media, is still lacking. Thus, so far, educators, researchers, and designers remain unclear about whether social media can support or inhibit learning, how and under what conditions [22]. The STIMEY project thus aims to clear that out, by researching how key social media concepts can be integrated in an e-learning environment based on pedagogical framework to support learning. The following section examines in detail how a pedagogical model can be adopted then integrated with social media concepts and tools.

III. PEDAGOGICAL FRAMEWORK RESEARCH AND DEVELOPMENT

In the development of a pedagogical framework for the STIMEY environment, various pedagogical models, such as project-based, problem-based, inquiry-based, exploratory, experiential, and expansive learning are analyzed in the context of technology-enhanced STEM learning environments. However, in the initial phase of the project, and for this research paper, the progressive inquiry model [23] is used as an example to demonstrate how social media concepts can be integrated to support its elements [24] in a general learning environment:

- *Creating the context:* A study project is connected to its context (e.g., real-world problem to be solved) and its meaningfulness to learners is made clear.
- *Setting up research questions:* Learners formulate questions which arise from their own attempts to understand and explain the problem.

- *Constructing working theories:* Learners formulate hypotheses and initial intuitive conceptions based on their background knowledge.
- *Critical evaluation:* Learners evaluate strengths and weaknesses of their working theories.
- *Searching deepening knowledge:* More information is searched so as to examine better the working theories in the light of new information.
- *Generating subordinate questions:* New, more specific questions are formulated so as to progressively deepen the inquiry.
- *Constructing new working theories:* More articulated working theories are formulated and displayed based on progressive inquiry.
- *Shared expertise:* All aspects of inquiry can be shared with other learners. Through social interaction, contradictions, inconsistencies and limitations can be made evident. Further, instructors play an important role in guiding and scaffolding learners' process of inquiry.

Understanding and developing pedagogic theories and approaches under the pedagogical framework allows for better reflection on learning, and its implications for the design of a social media-powered learning environment. Thus, for this paper, a mix of learning approaches is developed and adopted, as seen in Figure 1, and then further explored, as an example of how it can be supported with social media concepts. The learning approach covers the set of theories and underlying

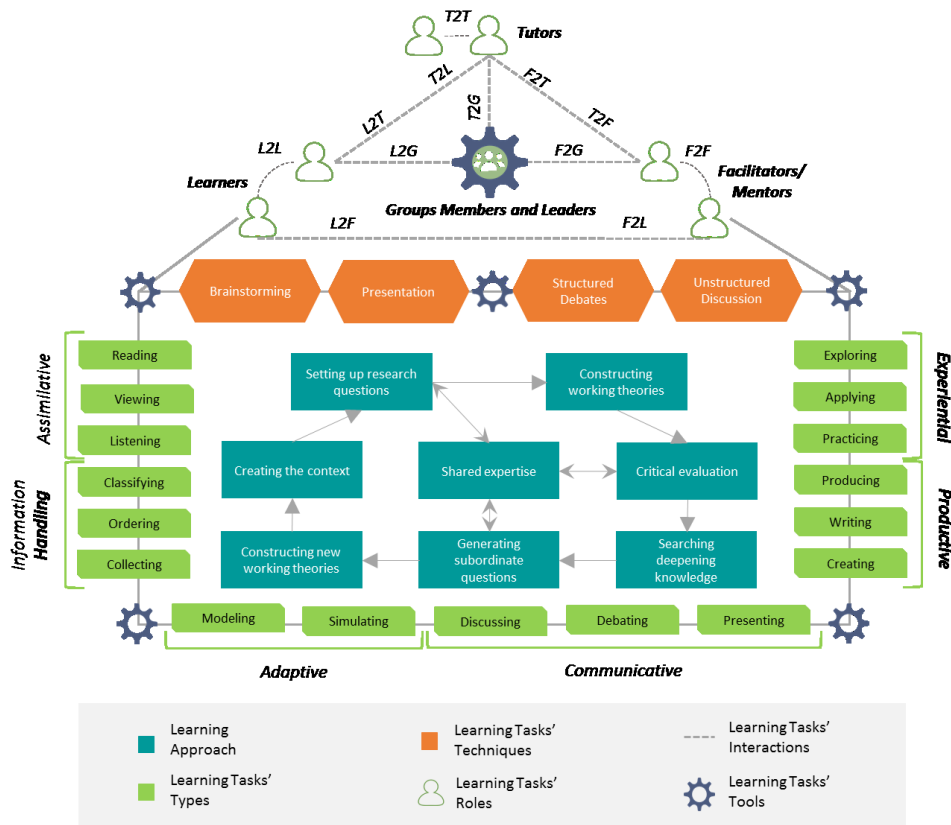


Figure 1. Learning Approach Model Development

models adopted for this research, while the learning tasks relate to the different components of learning activities [25]. Based on this model and the STIMEY project objectives, the learning tasks' components are divided as follows:

- *Types*: assimilative, information handling, adaptive, communicative, productive, and experiential.
- *Technique*: brainstorming [26], presentation, structured debate, and unstructured discussion.
- *Roles*: learner, tutor, facilitator or mentor (referring also to parents, organization members, etc., in the STIMEY environment), and group leader or member.
- *Interaction*: individual, 1 to 1 learner to learner, 1 to 1 learner to tutor (and vice versa), 1 to 1 learner to facilitator (and vice versa), 1 to 1 tutor to facilitator (and vice versa), individual to many and many to many (as in groups and discussions), etc.
- *Tools*: can be interactive, adaptive, communicative, productive or narrative. These include social media concepts suggested in the next section based on how they can support and enable this learning model.

In the following section, key social media concepts are proposed as the tools (see Figure. 1) to enhance and facilitate learning, based on their significance in supporting the progressive inquiry model as an example. As the pedagogical framework research continues, with detailed literature review, focus groups and testing, STIMEY will develop a learning approach specifically suitable for a STEM learning environment, which will form the basis of the social media concepts integration in the final stages.

IV. IDENTIFYING KEY SOCIAL MEDIA CONCEPTS AND THEIR ROLE AS LEARNING TOOLS

As the STIMEY project aims to investigate the use of social media in supporting learning activities, the research is initiated by evaluating key contemporary social media concepts and how they can support a pedagogical learning model. These concepts are intuitively derived from common features in popular social networking sites, such as Facebook [7] and Google Plus [27], and e-learning platforms, such as Khan Academy [28], Digischool [29] and Edmodo [30].

A. User Profile

A user profile is the visual display of personal data associated with a specific user in a platform. The profile refers, therefore, to the explicit digital representation of a user's identity [31]. This feature allows users to add personal information, and showcase their knowledge and skills, while also controlling the visibility and privacy of the profile. This form of self-presentation satisfies several human needs, as a study by MySpace has shown [32]. The profile is also the cornerstone of a user's activity on STIMEY, containing a timeline of their activities and progress, connections, status updates, and other content as explained in detail hereafter. The user profile's role in teaching and learning, as shown in Figure 1, is, therefore, indirect but elementary in enabling the rest of the concepts and supporting activities. User profiles can also

help, for example, to identify learners' interests so as to choose study projects which are personally meaningful for them (creating the context) and to group learners based on their expertise areas (shared expertise).

B. Status Updates

A status update is a feature that allows users to discuss their thoughts, opinions, or important information with their connections. Similar to a Tweet on Twitter, or a status on Facebook, a status is usually short and generally gives information without going into too much detail as a blog post, but may also contain other types of media, such as image or link. When the status is updated, it posts on the user's profile, as well as in the activity stream of their connections [33]. This feature enables the most basic form of communication, yet most crucial, in support of various phases of inquiry-based learning, see Figure 1. For example, through status updates, users can post information about the context they are working on or share their research questions or working theories, as well as generate context based on other users' posts and updates, contributing to shared expertise. It also supports various learning tasks' types, such as reading and viewing (other users' statuses), writing (text updates), creating and presenting (media status updates), and discussing (through Social Feedback, seen next). Moreover, it enables the techniques of brainstorming, presenting and unstructured discussions.

C. Social Feedback

In a social media environment, it is critical for users to have the ability to add their opinions about the quality or relevance of the content. Common examples are "like/not like," "thumbs up/thumbs down," star ratings, social commentary, tagging, flagging and reporting. Feedback has long been utilized as an effective tool to enhance learning, and social media concepts serve as a platform for effective feedback communication to improve relationships and performance in a learning environment [34]. Social feedback is most significant in supporting the co-creating of working theories and in critical evaluation, but overall plays an important role throughout sharing the expertise in inquiry-based learning, in Figure 1, especially in enabling discussing (through comments and replies), reading and viewing (of other users' comments and replies), and writing and presenting (of comments and replies, with media).

D. Social Connecting

The essence of social media, as well as the STIMEY project, is being used by people to build social networks or social relations with others who share similar personal or career interests, activities, backgrounds or real-life connections [35]. Thus, functions, such as "invite friend", "add friend", "follow account", etc., are at the cornerstone of social media concepts, to enable communication, collaboration and knowledge sharing among members. Young people particularly value social and interactive opportunities for learning [36]. This concept, therefore, drives multiple pedagogical frames that depend on the interactions of various roles (learners, tutors and facilitators/mentors), such as

brainstorming, critical evaluation (by exchanging feedback), and sharing expertise.

E. Activity Stream

With the development of social media, the activity stream has become a common way to present a list of recent activities and aggregated information to users. Essentially, it is a digital interface component that lists activities or events relevant to a person, group, topic or everything in the environment in which it is built [37]. Thus, it is a central component in a social learning environment where users can keep track of their connections' and communities' updates (whether in benefit of generating context or critical evaluation), platform's news and updates, and any other elements' updates they subscribe to. In relation to inquiry-based learning (see Figure 1), the activity stream sets the stage for most steps, especially in generating context from activity updates, and receiving/providing feedback on those updates for critical evaluation.

F. Social Messaging

Instant messaging (IM) is not a new concept, or one that is specific to social media, yet it has become an essential integrated part of the experience. It refers to the exchange of text messages through a software application in real-time [38]. Popular features of social messaging applications include text chat, group chat, message notifications, status updates, media (file) sharing, and most prominently, the usage of stickers or little rich images to depict mood and convey messages in non-verbal format [39]. This concept enables deeper discussions, collaboration, brainstorming and sharing expertise in inquiry-based learning. It is also most essential in enabling the interactions between the various roles, whether through one to one (bilateral chat) or many to many (group chat) communication

G. Community

Online communities are generally regarded as online 'spaces' which individuals 'feel part of' and where they can go to interact on a common topic or interest [40]. They allow users to create, post, comment to and read from their own interest- and niche-specific forums. What makes communities so appealing is the ability to control access to them, to find and connect with only "like-minded" people or people who share a common purpose. Thus, such communities have "moderators" or admins, who create them, set their privacy settings (public or private), and grant special permissions to others (to join, to comment, to post, to invite, to approve invitations, to moderate, etc.). These communities are essential in promoting a sense of community among learners, and access to them is even more important than the physical education environment [36]. Communities enable assimilative, communicative and productive learning tasks' types, all of the learning tasks' techniques, and sharing expertise among members (through contribution to setting up research questions, critical evaluation, and generating subordinate questions), all relevant to inquiry-based learning.

H. Discussion Forum

Discussion forums exist in a variety of distance learning platforms, such as e-learning platforms (Moodle [41], Blackboard [42], e-tutor [43], etc.) or mobile platforms (WhatsApp [44], etc.). These forums provide online learners opportunities to collaborate and cooperate to construct knowledge [45]. Therefore, they are not specifically a social media concept, but they are a basic form of digital socializing that is essential in a learning environment. The main difference between discussion forums and communities is that in a forum, all users are at equal level, requiring no special permissions or access to post and discuss with others. Any user is allowed to start a topic and to respond to one. Content is usually segmented by topic, rather than by people [46]. Other discussion-related concepts, such as Q&A, can also be helpful and employed to facilitate more direct question posing, searching and answering, with users given also the ability to "vote" for and feature the correct answer (relevant to "critical evaluation") to enable better and more reliable expertise sharing around a specific topic (for e.g., courses). As in communities, discussion forums enable assimilative, communicative and productive learning tasks' types, all of the learning tasks' techniques, and sharing expertise among members.

V. RISKS OF SOCIAL MEDIA USE AND MITIGATION STRATEGIES

Although social media presents many benefits and opportunities, as demonstrated earlier, it can also pose some risks and challenges, especially when children and adolescents are involved. The main risk they face online today are risks from each other, risks of improper use of technology, lack of privacy, sharing too much information, or posting false information about themselves or others [47]. These risks must be recognized, addressed and mitigated whenever possible through social media principles and guidelines. Apart from developing and enforcing guidelines and policies to mitigate these risks, educating and encouraging users to engage in risk mitigation activities is considered good practice. By providing users with functions, such as privacy settings, controlling user permissions (adding or blocking users), flagging and reporting abusive or illegal content and users (as part of the social media concepts' features presented earlier), they gain better control over their own security and privacy. Thus, raising awareness among users about these risks, and empowering them to take more control over their privacy and security, are among the top mitigation strategies that will be researched and employed in STIMEY.

VI. CONCLUSION AND FUTURE RESEARCH

While the use of social media in learning and education is still open and in need of much research, early indications show very promising results. With most European youth using social media increasingly in many aspects of their lives, it is critical to research its uses and benefits. In the context of

education, social media must be based on strong fundamentals to leverage its benefits as a learning tool. Thus, it is essential that the social media concepts designed and employed in an e-learning environment are based on and emerge from a well-developed pedagogical framework. As demonstrated in this paper, social media concepts can be investigated to be used as tools that can support the various learning tasks in learning approaches, such as the progressive inquiry model. Key social media concepts, such as user profiles, activity streams, and communities, can enable and facilitate learning through discussions, collaborations, sharing expertise, and other learning fundamentals.

As the project evolves, with more concrete research results on the pedagogical framework, end-user involvement, the STIMEY platform's requirements engineering, and a structured analysis of e-learning and blended learning environments, additional social media concepts will arise and be further investigated, and quantified experiment results will be conducted for verification. Moreover, research will be carried out on the technical integration of the social media concepts as learning tools within the STIMEY environment's multiple technological components.

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