Educational Uses of Social Media and Problem-Based Learning

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Abstract

Although potential educational uses of social media was not the reason behind the emergence of social media tools, a trend towards recognizing the educational uses is visible. Social media allows learners to learn from each other (horizontal learning) in the real-life context (authentic learning) most of time, to collaborate with each other to reach a goal, and to participate actively to educational processes. Problem-based learning which is strongly associated with case-based learning is a common approach in medical schools in particular. However, the links between educational uses of social media and problem-based learning are not researched extensively in relevant literature. Thus, in this article, the following were considered: Definitions of problem-based learning, its applicability at the program level, the process of tutoring, effectiveness of the model, tutoring by staff vs. students and experts vs. non-experts, educational uses of social media and finally, feasibility of social media for problem-based learning.

Keywords: Social Media, Education, Problem-Based Learning.

Sosyal Medyanın Eğitim Amaçlı Kullanımları ve Problem-Tabanlı Öğrenme

Öz

Sosyal medya araçlarının çıkışının gerisindeki neden, sosyal medyanın eğitim amaçlı kullanımları olmasa da, eğitim amaçlı kullanımların kabul görmesine yönelik bir trend görülmektedir. Sosyal medya, öğrenenlerin, çoğu zaman, gerçek yaşamdaki bağlamında (otantik öğrenme) birbirlerinden öğrenmelerine (yatay öğrenme), bir amaca ulaşmak için birbirleriyle işbirliği yapmalarına ve eğitim süreçlerine aktif olarak katılmalarına izin vermektedir. Örnek-tabanlı öğrenmeyle yakın bir ilişki içinde olan sorun-tabanlı öğrenme, özellikle tıp okullarında yaygın bir yaklaşımdır. Ancak, sosyal medyanın eğitim amaçlı kullanımlarıyla sorun-tabanlı öğrenme arasındaki bağlar, ilgili literatürde kapsamlı olarak araştırılmamıştır. Bu nedenle, bu makalede, şu konular ele alınmıştır: Sorun-tabanlı öğrenmenin tanımları, bunun program düzeyinde uygulanabilirliği, özel ders verme süreci, modelin etkililiği, akademik kadro ya da öğrenciler ile ve uzmanlar ya da uzman olmayanlar ile özel ders, sosyal medyanın eğitim amaçlı kullanımları ve son olarak, sosyal medyanın sorun-tabanlı öğrenme için elverişliliği.

Anahtar Kelimeler: Sosyal Medya, Eğitim, Sorun-Tabanlı Öğrenme.

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Introduction

What is Problem-Based Learning (PBL)? Shanley (2007) defines PBL as a method of case study that features (1) piecemeal presentation of cases to students as "problems," (2) self-directed framing of issues by students for independent study, and (3) small-group work with tutor–facilitators as the primary means of instructional interaction (Shanley, 2007: 480).

In PBL, students are presented with problems. To solve these, they have to find information by their own. The learning process is both individualized and in groups. Teacher is no longer a teacher but a facilitator (Glew, 2003: 53). Savin-Baden (2003) lists the following as the key principles of U.K.-styled PBL which would not necessarily overlap with other styles:

> Curricular organization revolves on "problem scenarios rather than subjects or disciplines". Students work in groups or teams.
> There are "no predetermined series of "right answers"" for the tasks.
> Groups or teams and their facilitators (academic staff) continue to exist for a long period of time (i.e. not for a few class meetings only) (Savin-Baden, 2003: 340).

Medical disciplines are the most frequent application areas for PBL, as this approach originated from the field of medical education. One of the reasons for why PBL is promoted in medical education is that it perfectly fits with the lifelong learning model required in the medical profession.

1. How PBL Can Be Applied at the Program Level?

Savin-Baden (2003: 341-342) derives 7 modes of curriculum practice associated with PBL:

> Mode 1: Single Module Approach: In Mode 1, PBL is utilized for a module in a course of the final semester of the program, as it is assumed that students would not have received problem solving and/or critical thinking skills in other courses. As such, PBL exposure is minimal.
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> Mode 2: Problem-based Learning on a Shoestring: In Mode 2, due to the interests and passion of a few academic staff, PBL is utilized in a small number of courses in the program. The use of PBL is course-specific and not interdisciplinary at this level. Furthermore, lack of institutional support might be frustrating for academic staff applying PBL model.
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> Mode 3: The Funnel Approach: In this mode, from their first year until the final year, students are gradually being moved from lecture-based teaching to PBL.
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> Mode 4: The Foundational Approach: Mode 4 which is common among engineering and science departments aligned with PBL supposes that it is necessary to complete a foundational year with traditional teaching-learning models, before moving to PBL in the upcoming years. It is assumed that basic concepts can't be taught by PBL, and PBL can't be successful without the knowledge of basic concepts.
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> Mode 5: The Two-strand Approach: In Mode 5, the aim is the receipt of the maximum utility from the use of PBL as well as traditional learning models. In this mode, these

two are interlocked whereby PBL tasks are matched with traditional curriculum components. This is especially common in service courses (i.e. in compulsory courses for a major that are taught by staff of other departments), in order to meet the needs of students which may not always be addressed in the original course program.

Mode 6: Patchwork Problem-based Learning: This mode corresponds to implementation of PBL model in a disorganized way which leads to confusion among students as well as academic staff.

Mode 7: The Integrated Approach: In this mode, PBL is not viewed as a strategy but a 'curriculum philosophy'. Examples of this approach are quite a few, although many aspires to implement it. It is characterized by learning in team-work, one problem at a time, facilitation by tutors, and an interdisciplinarily integrated curriculum where problems are sequentially organized and linked with each other, although assessments might be traditional (e.g. multiple choice) (Savin-Baden, 2003: 341-342).

Regardless of the mode, reception of PBL by academic staff is critical. Lloyd-Jones et al. (1998: 280) presents a newly applied PBL curriculum at a British medical school. While resistance by some academic staff to PBL is noted, a participatory planning approach for construction of PBL curriculum is advised to promote ownership of the courses (Lloyd-Jones et al., 1998: 281). Savin-Baden (2003: 339)'s qualitative study with academic staff resulted in 4 categories of academics with regard to PBL:

'(Dis)placed Academic': This corresponds to the impression that academic staff involved in PBL is no longer attached to the discipline of his/her own only, but by an interdisciplinary spirit that goes in tandem with PBL. For many, this meant "confusion and discomfort". This process brought out the issue of student autonomy in learning which might be summarized in the following question: "What should be the extent of academic autonomy to be granted to students by academic staff?"

'(Re)positioned Academic': Some other academics responded to PBL with a positive light, as they were not satisfied with traditional modes of teaching/learning.

'(Dis)located Academic': These academics totally rejected PBL, since they prefer to hold the authority conferred by traditional modes of teaching/learning.

'Commodifying Academic': This category of academics concentrated on practical knowledge to the exclusion of other valuable knowledge that are not necessarily and immediately practical (Savin-Baden, 2003: 339).

2. How is the Process of Tutoring?

Context and tutors' flexible adaptation to student needs are critical for students' satisfaction with tutors in PBL (Papinczak et al., 2009: 377). In a qualitative study, Papinczak et al. (2009) derives 3 themes on tutoring in PBL. These are, 'role confusion', 'management of sensitive issues' and 'facilitation 'style'' (Papinczak et al., 2009: 377). Role confusion involves tutors' oscillation between traditional didactic approach and facilitation, while management of sensitive issues refers to ways to handle potentially embarrassing information arising from group discussions. Tutor's facilitation style covers issues such as the degree of scaffolding in tutoring (i.e. student

autonomy vs. guidedness), the manner of group-work management (i.e. the way tutor ensures that the group serves as the platform of PBL with equal contribution by each member) and tutor input (e.g. time management and right timing of input to allow self-directed learning in groups) (Papinczak et al., 2009: 377). Such micro-level analyses could contribute to the effectiveness of tutoring in PBL.

In Das et al. (2002)'s study, students evaluate tutors of PBL sessions on the basis of the following criteria:

Clarified objectives
Guided students in meeting objectives
Guided students to identify learning issues
Stimulated students to participate actively
Guided about information resources
Facilitated collection of information
Stimulated evaluation of self, peers and tutors
Communicated clearly
Stimulated interest in learning
Was aware about learning needs of students
Encouraged students' efforts and contributions
Was enthusiastic about the role of tutor.

A point to discuss would be whether these criteria differ and should differ from the criteria used to evaluate traditional lecturing. It is clear that these do not differ from so-called 'effective teaching' in general. Then, what would have been the criteria specific to PBL tutoring? This discussion would be conducive to the success of PBL sessions.

3. Is PBL Effective?

Glew (2003: 52-56) reviews and discusses years of PBL practice in medical education and proposes that despite of the validity of the theoretical basis of PBL, the applications are problematic at best and disappointing at worst. From his point of view, PBL has failed to keep up its promises due to the following:

> Curricular support by basic scientists is lacking due to the traditional notions or primacy of research over teaching.
>
> Assessment of PBL by various stakeholders of the process is not appropriate.
>
> Overreliance on clinicians (rather than educators in proper) for teaching of basic scientific concepts is not successful (Glew, 2003: 53-54).

Glew (2003: 52-56)'s ideas are based on 2 decades of teaching by PBL model in a medical school where he was disappointed to witness the shallowness and inadequacy of PBL-based medical students in basic scientific knowledge. Some medical students bemoaned that PBL failed in basic science education, and that was why they were disadvantaged in Medical Licensing Examination (Glew, 2003: 53). In the same vein, Lohman and Finkelstein (2002: 121-127) finds that students of PBL model are not technically competent. PBL in Glew's case was also a victim of the notorious fact that fund-pulling activities rather than teaching are rewarded by the so-called 'minimum state provision regime over universities'. Furthermore, Glew (2003: 52) states that teaching hours by

medical faculty is not sizeable enough as compared to basic science faculties. Thirdly, clinicians are not pedagogically qualified to embrace and explore PBL (Glew, 2003: 53).

Contrary to Glew (2003), Enarson and Cariaga-Lo (200: 1050) finds that students of institutions implementing PBL received similar results with Traditional Curricula students on Medical Licensing Examination, based on their study with more than 500 participants. This finding can be interpreted in three ways: First of all, this may show that medical education model (i.e. the model implemented) does not matter. Second of all, it is not true that PBL is not effective. Thirdly, Medical Licensing Examination may not tap the skills acquired by students of PBL. Furthermore, clinical practice after graduation could be a better indicator for comparing these two groups of students. Likewise, Bahar-Ozvaris et al. (2006: 556) concludes that whether team skills acquired in PBL sessions are transferred to medical careers in real life is an understudied topic.

Prince et al. (2003: 15)'s findings converge with Enarson and Cariaga-Lo (2001: 1052) showing that anatomy knowledge of PBL vs. non-PBL students do not differ. This is despite of the fact that both PBL and non-PBL students perceive themselves as less competent and not properly trained (Prince et al., 2003: 17). It should be noted that Prince et al. (2003: 18) used both problem-based assessment (i.e. the question was presented with context) as well as traditional assessment, which excludes the possibility that the results are a confound of assessment structure.

Eshach and Bitterman (2003: 491) contrasts case-based reasoning with rule-based reasoning and proposes that the former is indispensable in medical education. They support use of PBL model in medical education, as it originated from case-based reasoning. From a different perspective, Shanley (2007: 479) claims that PBL is far from cost-effective, as it involves 'small-group work with tutor-facilitators'; and that PBL is not pedagogically successful, although case-based learning would be useful without the PBL framework. As an alternative, he discusses reading and discussion of cases in large groups (the class as a whole) in which academic staff do not act as facilitators. Furthermore, he states that PBL which implements a small-group work model is incompatible with individual initiative championed by Western educational practices and that there exists a tension between "finding your own solution" and small-group work. Consequently, he recommends the use of PBL not as a mode of content delivery but as a supplement, and rejects overestimation of students' knowledge. In another study (Pastirik, 2006: 261), it was found that PBL was effective, although some students objected to the way groups were formed. They preferred to choose their group members rather than being assigned to one of them, as random assignment led to group unevenness.

4. Who Should Be Tutoring in PBL?: Staff vs. Students and Experts vs. Non-experts

Steele et al. (2000: 23) finds that PBL small groups led by academic staff do not differ in assessment scores with those by fellow students, but students show preference for fellow student facilitators rather than academic facilitators. The latter finding is due to the students' perception that student-led groups are more cooperative, efficient and less stressful. In contrast, faculty-led groups are more competitive, as the presence of faculty forms a more evaluative atmosphere. Furthermore, in comparison, it is found that for complex topics, faculty presence is preferred, while students complain that in faculty-led sessions, focus shifts to trivial and esoteric topics. In other words, student-led PBL allows participating students to work to the point at a low-competition and high-cooperation milieu, while expertise is needed for complex cases (Steele et al., 2000: 28). Students would like to receive feedback on complex cases so that they can feel that they are on track. Obviously, this polarity can be settled by determining the level of difficulty of the cases

beforehand, and assigning faculty to the sessions for difficult cases only (Steele et al., 2000: 28). It is also noted that in some of the student-led sessions, students do not follow PBL instructions, and rather use shortcuts to move to the learning objectives (Steele et al., 2000: 28) which can be considered as an underminer of PBL process from a negative perspective and as a self-pacer to adapt to the academic needs of the students from a positive one.

Gilkison (2003: 12) compares expert tutors (medical tutors) with non-expert tutors (non-medical tutors) at a medical school, and observes that although both uses the similar tutoring strategies, they differ in the use of questioning as a tutoring technique: The former questions the students, while the latter has students question each other, as non-expert tutor does not know the answers anyway. (Under the category of the 'tutoring techniques', Gilkison (2003: 10) lists the following and provides details for each: Elicitation, re-elicitation, prompting, refocusing, facilitating, evaluating, summarizing, giving feedback, informing, and directing learning.) Secondly, expert tutor asks more questions, provides more comments, talks more; and more talks are initiated by expert tutors than by non-expert tutors. Thirdly, expert and non-expert tutors differ in 'PBL tutor interventions' which comprises raising awareness (that combines elicitation, re-elicitation and prompting), facilitating group process (that combines facilitating, refocusing, summarising, feedback and evaluation), and directing learning (that combines informing and direct learning). Expert tutors utilize all three more frequently than non-expert tutors, while raising awareness and facilitating group process are found to be more frequently utilized by both compared to directing learning. Finally, non-medical tutors are found to be more successful in facilitating the group process compared to medical tutors.

5. What Are the Issues under Construction in PBL Applications?

Savin-Baden (2003) points out the following issues about PBL:

> How PBL and other active learning models (e.g. project-based learning) are related.
>
> How PBL model can survive vis-a-vis "cuts and poor university administration" (Savin-Baden, 2003, p.338). In a more detailed manner, Savin-Baden (2003) identifies the following issues:
>
> The role of the facilitator, present or otherwise;
> The way problem-based learning is implemented in the curriculum;
> The unplanned-for, long-term running cost of problem-based learning;
> The extent to which facilitators are experiencing burnout;
> The way in which tutors are trained, equipped, and updated;
> The extent to which the assessment is driving the learning;
> A debate about whether teaching science was different from teaching other disciplines (Savin-Baden, 2003: 338).

Among these issues, Savin-Baden (2003: 338) focuses on two which are the notions of facilitation and curriculum. In some cases, the notion of facilitation assumes that students can learn by themselves which is not always true. Not everything can be taught via PBL; however, PBL can be integrated with basic science teaching.

Online tools could be incorporated to PBL in classes to manage the programs with a lower

number of tutors (cf. Pastirik, 2006: 261) which would contribute to the cost-effectiveness of PBL applications. Good et al. (2008: 163) presents a case study in which PBL and constructionism were used as an educational model in an immersive virtual environment ('Second Life'). In a computing course, students were asked to design an 'educational experience' for Second Life in groups; and their learning processes have been documented. They discuss the advantages of immersive virtual environments such as 'Second Life' for PBL models stating that:

> Second Life allows ongoing feedback for students by the tutor(s).
>
> Second Life allows students to collaborate with the wider community of Second Life which provides more positive academic results.
>
> The nature of relationship in Second Life moves tutors to the role of peers rather than authority figures.
>
> Students are more motivated to learn through Second Life, as it is a new technology.
>
> The end-product of the design process is publicly available on Second Life. As works on Second Life are visible, they can easily be evaluated.
>
> Second Life tends to provide open-ended problems for students, as it is relatively unexplored (Good et al., 2008: 168).

Another hot issue in PBL research is on assessment. As most of the exams are based on traditional assessment models, evaluation of PBL students by such exams could be problematic. Addressing this issue, Bahar-Ozvaris et al. (2006: 555) introduces collaborative/cooperative assessment methods along with collaborative/cooperative study for PBL sessions. The model used in those sessions was STL (Student Team Learning) which consists of 3 principles: "team rewards, individual accountability and equal opportunity for success" (Bahar-Ozvaris et al., 2006: 553). In this model, students are assessed based on their individual learning as well as group members' learning. This is operationalized as average group scores awarded to each group member. Bahar-Ozvaris et al. (2006: 556) found that collaborative/cooperative PBL led to the highest scores on collaborative/cooperative assessments in comparison to individualistic/ competitive PBL and assessment.

Another understudied topic relevant for PBL is the culture. In their study with Emirates students and their expat tutors, Das et al. (2002: 272) focuses on a neglected dimension of PBL, which is the cultural background. This reminder is reasonable as most of PBL research is by 'Westerners' and on 'Westerners'. An ethnographic study of tutoring could present new ideas for future research.

6. What Are the Educational Uses of Social Media?

Redecker et al. (2010) states that educational institutions can use social media to

> facilitate access by current and prospective students to information, making institutional processes more transparent and facilitating the distribution of educational material;

> integrate learning into a wider community, reaching out to virtually meet people from other age-groups and socio-cultural backgrounds, linking to experts, researchers or practitioners in a certain field of study and thus opening up alternative channels for gaining knowledge and enhancing skills;
>
> support the exchange of knowledge and material and facilitate community building and collaboration among learners and teachers;
>
> increase academic achievement with the help of motivating, personalised and engaging learning tools and environments;
>
> implement pedagogical strategies intended to support, facilitate, enhance and improve learning processes (Redecker et al., 2010: 7).

Bonzo and Parchoma (2010) proposes that:

> [s]ocial media are more than the technology behind the social applications and programs. Their use includes a set of ideas about transformation and social gathering, mass participation, user generated content, openness, flexibility, collaboration, community, and they are user-centred. If higher educational institutions can understand and adapt some of their practices to these principles, perhaps there is a chance for significant change in how tutors teach and how students learn (Parchoma, 2010: 917).

Griesemer (2012: 9) states that the use of social media in his course transformed his role from a mere presenter of knowledge to a facilitator and mentor; and such use promoted active learning. Redecker et al. (2010: 8) adds more roles in this transformation: From an instructor or lecturer to a designer, coordinator, moderator and mediator. Another advantage of the use of social media is the fact that even time out of class could be devoted to learning. Likewise, Wagner (2011: 51) states that Facebook can be used as a 'learning management system' much like Blackboard or Moodle; and for reference citations, announcements, posting class notes and creating class discussions, while Twitter can be used for "logging a teachable moment", quizzes, tracking a concept, tracking time and as a learning diary.

According to Redecker et al. (2010: 9), social media enhances innovation and creativity, improves "the quality and efficiency of provision and outcomes" (social media is a space of "experimentation, collaboration and empowerment"), makes "lifelong learning and learner mobility a reality" and promotes "equity and active citizenship" (Redecker et al., 2010: 11). Furthermore, it fits well with a new model of educational institutions that would match the labor needs of the 21st century knowledge-based economy. From a different perspective, Rodriguez (2011: 539) stresses the fact that contents of education by social media can be stored in archive, and be used positively or negatively. E.g. students can check the past sessions for study, but they can also be refused job offers due to what they had posted on social media long time ago. Thus, teaching is no longer transitory nor ephemeral by the introduction of social media (Rodriguez, 2011: 539).

In addition to the advantages, it is possible that social media use in educational settings can compromise students' impulse control, as non-educational uses of social media can prevail over the educational uses. Thus, use of social media can be particularly problematic, since impulse control is vital for daily and long-term working habits. Furthermore, fragmentation of attention due to social media overload would be detrimental for educational purposes (Connoly, 2011: 1).

As stated before, educational uses of social media requires a change in teacher's role, but this is not always positively received by all educators (Redecker et al., 2010: 11). In addition, safety and privacy concerns limit the educational use of social media. In this vein, Kent County Council e-Safety Strategy Group (2011: 20) draws attention to online child abuse and online bullying that might be a consequence of the educational uses of social media. Thus, the group provides a detailed list of safety principles in educational uses of social media which will not be presented here, since it would be slightly off the topic.

Reporting from a Canadian medical school, Bonzo and Parchoma (2010: 913) states that there exists an inherent conflict between academia that goes in tandem with values such as quality assurance, and social media which is mainly a popular tool rather than an academic one. Furthermore, by the use of social media for educational purposes, the distinction between formal and informal learning are blurred which contradicts the emphasis of academia on formal learning only (Bonzo and Parchoma, 2010: 913). Relevant to this point, Rodriguez (2011: 545) points out the issues related to intellectual property rights in educational uses of social media, since user generated content is usually on public space. Additionally, Redecker et al. (2010: 9) reminds that social inclusiveness of social media is limited, as not everybody has internet access. Another obstacle for the widespread use of social media is the fact that not all educators feel at ease with digital skills.

Nevertheless, Redecker et al. (2010: 9) recommends that experimentation should be supported, teachers should be encouraged, the efforts of institutions should be catalyzed, assessment strategies should be revised, and synergies should be created among stakeholders.

7. To What Extent Social Media is Feasible for Problem-Based Learning?

Although hundreds of works appear on problem-based learning and a growing number of works on educational uses of social media, use of social media for problem-based learning is an understudied topic. An appropriate way to bridge this gap would be the notion of social constructivism, since problem-based learning is strongly associated with this approach.

Elaborating on the links between the properties of social media and social constructivist approach to education, Bonzo and Parchoma (2010) compiles the following table:

Table 1. Social Media and Social Constructivism (Bonzo and Parchoma, 2010: 915)

Social Media	Social Constructivism
Are dynamic and based on active participation rather than passive viewing	Active participation where learning is created based on collaborative effort
Information sharing	Knowledge is built upon experience
Communication	Social interaction
Information is created by the individual participation and interactivity of the users/Collaboration	Shared interaction creates common knowledge
Information sharing	Learning takes place best in a sociocultural context

As the table shows, social media is the best tool for the social constructivist approach, which closely follows problem-based learning. Active participation, self-pacing, collaboration, interaction and group work characterizes problem-based learning applications.

Social media "allow individuals to acquire competences in a holistic manner, embedded in real-life contexts; and effectively and efficiently support competence building in a lifelong learning continuum" (Redecker et al., 2010: 10). Likewise, problem-based learning fosters life-long learning. That is why it is considered to be the best match for medical professions. It is also a holistic model of education, as the group-work in problem-based learning necessitates an interdisciplinary perspective. Finally, problem-based learning involves real-life contexts, in contrast to rule-based learning which is common in traditional practices of teaching.

Redecker et al. (2010: 8) mentions 4 C's of Learning 2.0 which characterize the educational uses of social media. These are: Content (freely available), creation (user generated content), connection (learning from each other), and collaboration (working together for a common objective). In fact, these 4 C's define problem-based learning without naming it. Problem-based learning involves collaboration in knowledge creation, solution focus and learning from each other.

The use of social media for problem-based learning addresses some of the critiques against it. For instance, Shanley (2007: 483)'s claim that PBL is not cost-effective due to the necessity of the existence of a number of tutors would be solved, as not a high number of tutors would be needed on social media. Social media would save time that would have been necessarily spent on face-to-face sessions in the original formulation of PBL. Shanley (2007: 483)'s second critique which involves the tension between individual initiative and group-work which is portrayed as in conflict in the implementation of PBL could be addressed as well, since social media allows both individual and group-level actions. Third of all, social media can reduce the stress due to tutoring by academic staff rather than by fellow students as discussed in Steele et al. (2000: 25). Fourthly, 'Second Life' game as a social media can provide more chances for PBL to reach its objectives as discussed in Good et al. (2008: 170). Fifthly, social media can be used not only for teaching/learning, but also for collaborative/cooperative assessment as presented in Bahar-Ozvaris et al. (2006: 555).

To conclude, educational uses of social media and problem-based learning continue to be uncharted waters. Theoretical papers as well as empirical studies are desperately needed to explore the applicability of social media in educational settings as well as to extend problem-based learning. In this paper, the following questions were considered:

What is problem-based learning (PBL)?
How PBL can be applied at the program level?
How is the process of tutoring?
Is PBL effective?
Who should be tutoring in PBL?: Staff vs. students and experts vs. non-experts
What are the issues under construction in PBL applications?
What are the educational uses of social media?
To what extent social media is feasible for problem-based learning?

More research would be necessary to answer them comprehensively.

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