2011

Experience in the Use of Social Media in Medical and Health Education

Chris Paton

Panagiotis Bamidis

Gunther Eysenbach

Margaret M. Hansen EdD, MSN, RN
University of San Francisco, mhansen@usfca.edu

Miguel Cabrer

Experience in the Use of Social Media in Medical and Health Education

Chris Paton[1], Panagiotis Bamidis[2], Gunther Eysenbach[3], Margaret Hansen[4], Miguel Cabrer[5]

1. University of Auckland, New Zealand; 2. Aristotle University of Thessaloniki, Greece; 3. University of Toronto, Canada; 4. University of San Francisco, USA; 5. MedTing Ltd, Palma de Mallorca, Spain

Abstract

Objectives

Social media are online tools that allow collaboration and community building. Succinctly, they can be described as applications where “users add value”. This paper aims to show how five educators have used social media tools in medical and health education to attempt to add value to the education they provide.

Methods

We conducted a review of the literature about the use of social media tools in medical and health education. Each of the authors reported on their use of social media in their educational projects and collaborated on a discussion of the advantages and disadvantages of this approach to delivering educational projects.

Results

We found little empirical evidence to support the use of social media tools in medical and health education. Social media are, however, a rapidly evolving range of tools, websites and online experiences and it is likely that the topic is too broad to draw definitive conclusions from any particular study. As practitioners in the use of social media, we have recognised how difficult it is to create evidence of effectiveness and have therefore presented only our anecdotal opinions based on our personal experiences of using social media in our educational projects.

Conclusion

The authors feel confident in recommending that other educators use social media in their educational projects. Social media appear to have unique advantages over non-social educational tools. The learning experience appears to be enhanced by the ability of students to virtually build connections, make friends and find mentors. Creating a scientific analysis of why these connections enhance learning is difficult, but anecdotal and preliminary survey evidence appears to be positive and our experience reflects the hypothesis that learning is, at heart, a social activity.

Introduction

Social Media in Medical and Health Education

Like contemporary education in other subjects, medical education has recently experienced an evolving shift from “teaching” to ”learning” which has been strongly related to an increasing use of information and communication technologies and, in particular, the Web. Over the past five years, the latter has developed into a second generation of dynamic services and communication tools, collectively known as “Web 2.0”(1) or “Social Media”, that emphasize peer-to-peer collaboration, wider (all party) contribution and effortless sharing, both among humans and programs. Moreover, advances in the understanding of learning processes suggest that learning should evolve from

"learning by acquisition" to "learning by participation"(2). Thus, alternative learning approaches have built on concepts of active learning, defined as the process of having students engaged in some activity that makes them reflect upon ideas and comprehend how they might be using them. Such new educational approaches are usually referred to as student centered(3), and include problem-based or case-based learning (PBL/CBL); inquiry and discovery based learning; role and game playing based learning; as well as collaborative and interactive learning of all kinds. These methods are believed to address not only explicit knowledge (conveyed by books, lectures and scientific documents) but also tacit knowledge (directly related to experience and practice, as shared by interaction and collaboration)(4).

Social media tools have crossed Moore's chasm, easily reached early majority and are currently under rapid development and evolution(5). However, the idea of social learning software itself, especially in real educational scenarios, has not been widely developed and exploited, since too few innovators and early adopters are actually using social media technology to enhance existing curricula designs and learning behaviors.

Conferences 2.0

Terms like science 2.0 (15), health 2.0 (16), or medicine 2.0 (17) – inspired by the Web 2.0 terminology - indicate a shift towards more participatory and open ways of "doing things" (17, 18). A prime application for participatory and open approaches are scientific conferences and professional educational meetings, as being "participatory" and "open" is directly related to success in participant engagement and learning.

One way to describe how Web 2.0 impacts face-to-face meetings is that it engages participants in novel ways, and overall extends the period of interaction between participants: While in the old days, participant interaction started with the first day of the conference, and ended with the last day, a "conference 2.0" starts engaging participants long before the actual face to face meeting (giving them a more prominent role in having an impact on program selection, and giving them the opportunity to connect already before the meeting), and lets the conversation continue for months or even years after the conference, through social networking sites, twitter streams, and other social media.

Another key difference of "conference 2.0" is openness, and engaging participants as outlined above is often a direct result of more openness. The traditional way on conducting a conference (workshop, seminar, course) consists of many closed, intransparent, and intermediated "top-down" processes, for example closed peer-review, closed registration processes, so that it is not possible for participants to connect to other registrants before the meeting. These "closed" processes hamper participation, networking, collaboration, and knowledge sharing. Many of these closed and non-participatory processes are "historic" traditions from the pre-Internet age, where more open and participatory workflows were not feasible. In contrast, web 2.0 technologies and social media can open up and fundamentally transform many of these processes.

Experience of Reinventing Scientific Meetings in the Age of Social Media

In the following we illustrate some of these ideas based on our experiences with the annual Medicine 2.0 congress (17) (World Congress on Social Media and Web 2.0 in Medicine, Health, and Biomedical Research), an IMIA-supported conference-series, which also serves as a "testbed" to

experiment with social media in the context of a scientific conference. Many of the authors of this article were involved in the conference, either as organizer/producer (GE), or participant.

We posit (and clearly experienced first hand) that using social media and Web 2.0 approaches can

- help to promote event awareness and attendance,
- increase attendee interaction and engagement,
- enhance learning and knowledge sharing,
- help to build a lasting community, and
- provide tools to measure attendee involvement and identify future speakers.

In the context of the Medicine 2.0 congress, openness started, on a technical level, with choosing an open source platform for managing the abstract submission, peer-review, attendee registration and administration processes. While the software used (Open Conference Systems - OCS) is very much "Web 1.0" (designed to support a traditional conference formats with many closed process), the open source code allowed the conference producer to make significant changes to the submission and registration workflows and to "open up" many closed processes. For example, the functionality of OCS was hacked so that all activity on the site generated RSS ("Really Simple Syndication") feeds, reporting information such as who registered for the conference, titles of abstracts being submitted, etc. Creating RSS feeds creates a basis for sharing and syndication, i.e. feeding news and data into other social media applications such as Twitter, Facebook, Blogs etc., allowing people to see in real time what other people are submitting to the conference and who is signing up for the conference.

Openness also refers to intellectual openness. This includes choosing an open license such as Creative Commons as a standard license for those who submit abstracts or present at the conference. This in turn enables wide distribution of content, in RSS feeds and on the site as well. For example, the Medicine 2.0 conference disseminates talks widely through various platforms, including Slideshare and iTunes (as free Video/Audio Podcasts), as well as an open access Medicine 2.0 Proceedings journal.

Participation continued at the conference. While the Medicine 2.0 conference experimented with audience response systems to engage participants, this expensive "standalone" equipment can actually be superseded by use smart phones and status updates on social networks like twitter, for audience polling or as immediate feedback mechanism for speakers. To encourage this process, the Medicine 2.0 conference provided extra screens in each room showing live twitter feeds with the official conference hashtag #med2 (Figure 5). These not only facilitate silent "backchannel" communication among participants (such as providing audience-generated additional material, asking questions etc.), but also allowed remote participants to follow the conversations at the conference, and helped participants to decide which session to attend.

Figure 1: Twitter feed projected at Medicine 2.0 Conference, Toronto, Canada

During the Medicine 2.0'09 congress, official "bloggers" (students) were designated to blog about each presentation, to stimulate an online discussion. Partly to stimulate blogging and wider dissemination, the photographer poster pictures of the presentations on Flickr in real-time. Pre- and post conference participation and exchange was also enhanced by setting up a social network (the Medicine 2.0 conference used Crowdvine for this, but a dedicated iPhone application is under development). The Medicine 2.0'11 conference uses a YouTube channel to engage participants before, during, and after the conference.

Social Media and Mobile Technology

The use of mobile hardware and healthcare-related applications (mHealth) are on the rise by patients, healthcare professionals, educators and learners(6). mHealth provides access to multiple information sources instantaneously influencing all individuals at the global level who have access to the mobile tools. Notwithstanding the financial caveat associated with the access to such tools, common-place 'smart' phones and ubiquitous portable media players (e.g. Apple iPods) are being used to narrow the communication gap between patients and healthcare providers, as well as between educators and learners. With the advent of the portable notebook-size wireless devices (e.g. Apple iPad) and the plethora of healthcare professional related applications, there is a sense of mobile-health technology proliferating and healthcare professionals see some limitations associated with mHealth, such as size of the devices, fading away. The next-generation technology supports people being mobile and in demand for current information while on the go. Mobile systems allow for patient information to be available at a point-of-care and facilitate healthcare professionals teaching patients about healthcare needs and disease processes.

Thornburg(7) invites educators to "step outside the cave and explore the skills necessary for work in the new century. Getting use to the new light may take effort: the disconnect between current educational practices and the needs of the workaday world may seem too great to bridge" (p. 5). It is time for nurse educators to acknowledge the information technology competencies required of new

graduates as they enter into the healthcare profession of this century. The Institute of Medicine(8) and the American Association of Colleges of Nursing(9) state the need for healthcare professional education to include health information technology skills/competencies in fundamental nursing education. Alexander(10) encourages educators to look at and consider the wireless, mobile learning experiences in higher education in order to stay abreast of the latest technologies affording students' heightened learning and understanding. It is well known students are using mobile wireless technology in the physical classroom to text one another about what the teacher is presenting or about what is going on outside the classroom. Some educators frown upon this movement and request connectionless classrooms or ban the use of wireless devices during class time(11). Currently, the Apple iPad is being explored as an avenue to enhance learning in the classroom and at home(12). Today's healthcare professional students learn differently than students in the not so distant past. Healthcare professional education is being enhanced by wireless hand-held mobile technology(13, 14). Billings(13) poignantly asks academics: "How can we use these learning technologies to improve student learning and the outcomes of our academic programs?" (p.343). Furthermore, one may ask "How can healthcare professional students use mHealth to improve patient learning and add to evidence based practice for patients' overall health and well being?" According to Rhea(6), New York City Health and Hospital Corporation showcased a telemedicine project four years ago affording 500 diabetes patients' "flip-phone-sized" modems with detachable glucometers and therefore providing healthcare professionals the ability to remotely monitor and quickly respond to patients' insulin levels. The use of mHealth to assist diabetic patients' understanding of the relationship between activity and blood glucose levels is an example of on-the-go education.

An Experience of using Mobile Tools with Social Media

Clinical nurse leader (CNL) graduate students enrolled in a Healthcare Informatics and Instructional Design course at a Northern California University develop and implement teaching assignments each semester that include a multimedia component. A "how to create" a blog, podcast and educational wiki was provided by the educator of the above mentioned course and hence students were encouraged to use mHealth during the course of an academic semester.

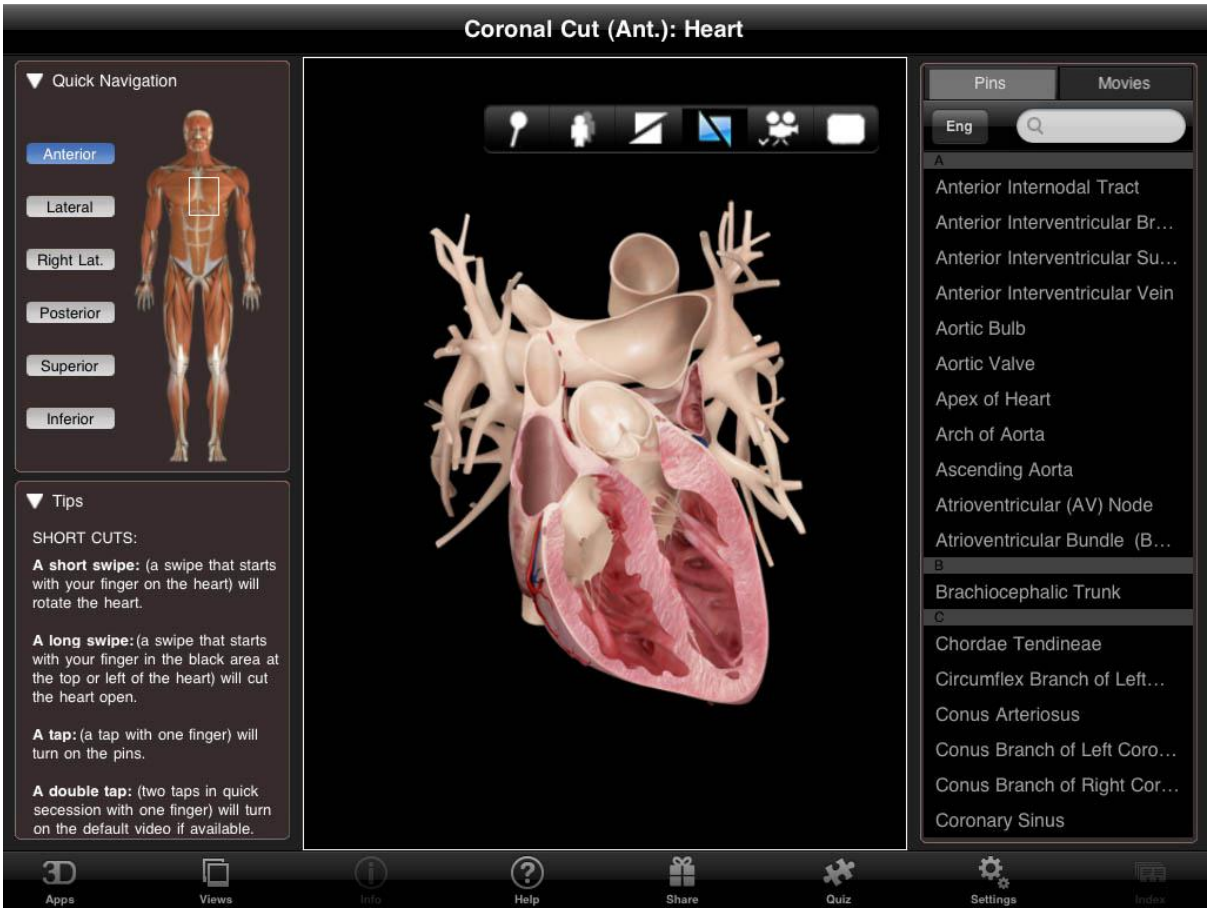


Figure 2: Screenshot of Heart Pro for iPad

The introduction of the iPad tablet technology to Healthcare Informatics students last semester spurred a student to use the technology as a part of the multimedia educational project assigned to the class and students' report using the iPad for accessing social media sites, such as Facebook. L.A.M.'s story of her use of the technology and her desire to learn more about the technology in order to use it in the future shows the mHealth tool as having potential in educating patients and staff in the future. The iPad has only been on the market a very short time, however, its use in healthcare, business and education is "revolutionary" and already being planned as a research tool. The iPad was voted number one of the top ten innovations during 2010(19) and the most "Tweeted" about technology topics in 2010(20). As illustrated in the case study, L.A.M. learned by "doing" and the use of the iPad as an mHealth technology fits in with the Constructivist learning theory and may be the new healthcare professional tool. One may only imagine what the future holds for healthcare and the professionals when it comes to innovative mHealth tools. As L.A.M. states: "The iPad is visually transfixing" and this may be one motivator for healthcare professionals to use it when providing education for patients and colleagues. And, as with many mHealth technologies, it may fit in the lab coat pocket for easy access when on-the-go and may provide access to cutting-edge learning tools, such as Heart Pro (http://ipad.appfinders.com/heart-pro-for-ipad/) (see Figure 4)

Table 1

Advantages	Disadvantages
Portable	User-interface issues with PowerPoint Presentations

High quality display	Not ideal for one-to-many presentations
Long battery life	
Ideal for one-to-one presentations	
Internet enabled	
Always on	
Fun to use	

Case Studies

Here, we present a series of case studies from the medical and health education front lines to try and tackle some of the issues we have faced introducing social media applications in the health and medical education environments.

Case Study 1: HIVE: A Learning Community of Professionals and Students

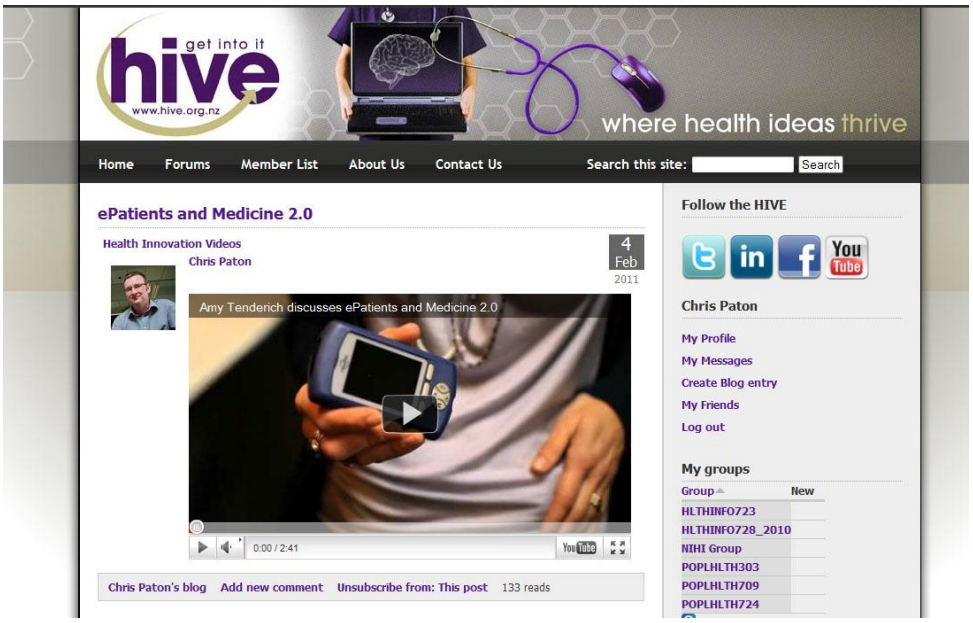


Figure 3: The HIVE website

Objective

The HIVE (Health Innovation Exchange) has been developed as a way to encourage uptake of social media tools by students to support their learning on post-graduate courses at the University of Auckland.

We have developed a professional community (in the domain being taught) as a way of encouraging discussion and debate of the topic at hand(21). Unlike Facebook or other communities that the students use for purely social activities, a professional community can promote appropriate topic-matter discussions and students may not feel the same level of invasion into their private domain.

User Profiles

The students that use the HIVE are enrolled in a variety of post-graduate courses offered at the School of Population Health at the University of Auckland. Most are from clinical backgrounds such

as medicine, nursing or allied health professionals and some of the students on the Health Informatics papers have a background in IT.

The members of the professional community are drawn from across the health sector but include policy makers, clinicians, hospital managers and entrepreneurs. The theme that brings them together is fostering innovation in the health sector.

Development

Establishing a professional community in the health sector is no easy task. A new forum in a University's Learning Management System may not get much use by students but at least it is relatively trivial to set up. Creating a professional community that is actually used by professionals, as well as by students, is a much more daunting prospect. When the University of Auckland's National Institute for Health Innovation (NIHI) attempted this feat they broke the task down into three stages:

1. Develop the website using Open Source technology.
2. Promote the site to the professional community through conferences and demonstrations.
3. Encourage the students to begin using the site and to interact with the professionals.

Lessons Learned

It appears that once a reasonable number of professionals are using a site, the students' interactions with them will drive further professional usage. Students ask interesting questions and prompt spirited debates with the professionals. The NIHI team has found that, although the site is in its infancy, the usage by students is becoming a key to its continuing success in the professional community.

From this experience we have developed a model of virtuous cycles in professional learning communities. As the cycle progresses, more connections are created and the level of trust in the community continues to grow.

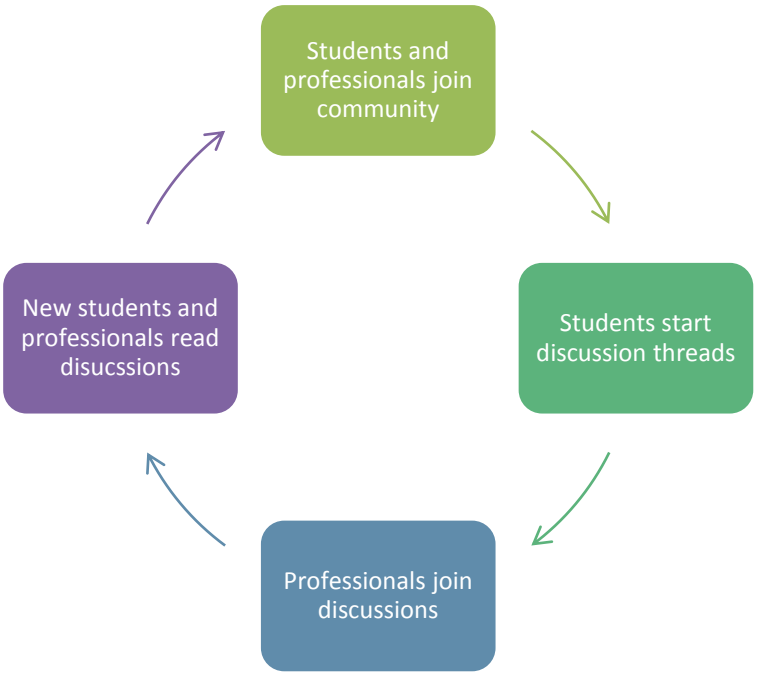


Figure 4: The Student-Professional Social Learning Cycle

Of course, there are dangers to watch out for and the community needs to be carefully nurtured to ensure that the cycles develop in a positive fashion. It is just as easy for negative feedback loops to become established.

If negative contributions are allowed to build up, eventually students and professionals will stop using the tools. Early intervention by moderators and site administrators is therefore needed to ensure the appropriateness of content from both professionals and students.

One technique now implemented in the HIVE is allowing students to have additional private discussion areas where they can have discussions that are inappropriate for display on the public interface where they will be interacting with professionals. This prevents professionals from being put off by overly course-focused topics (such as logistical details about handing in assignments), whilst giving the students an area where they can feel more relaxed to post questions they might be too intimidated to raise in public.

Case Study 2: mEducator

Figure 5: The mEducator website

Objective

The "mEducator" project is an EU funded initiative of 14 organisations that attempts to establish "best practice" towards the repurposing and sharing of medical educational multi-type content (22). An important aspect of mEducator content refers to user-generated content. Its extent and nature varies with the specific content type itself, but ideally it addresses both the theoretical as well as the clinical aspects of medical education. Existing, concrete examples of such user-generated content available within the mEducator partnership are, (i) Web2.0 based PBL; (ii) clinical cases on the MEDTING case repository; (iii) Interaction with Virtual Patients on Open Labyrinth; (iv) Cases in the form of e-traces (web traces of anatomical images); and (v) Interactions with serious medical games (in Second Life or not).

User Profiles

The uniqueness of the afore described content is strengthened by the fact that is produced by academics and clinical teachers, as well as, medical students, in a variety of places and educational contexts. In a typical such example (PBL based on Web2.0 technologies), students and instructors use the web as a virtual place to collaborate and create new knowledge and new educational experiences. For the purposes of this paper, we take the case from a course on Medical Informatics which is taught to postgraduate medical students at the School of Medicine, Aristotle University of Thessaloniki. Postgraduate medical students and academic instructors collaborate virtually over the web in order to "solve" the problem set by the instructor.

Development

Three web 2.0 applications were utilized, namely, discussion forums, collaborative wikis, and blogs. Forums were used in addition to the wiki and several (topic/tag marked) personal blogs within a specific problem related to Electronic Health Records (EHR) (23). Every student had to complete each task in their own personal blogs and when they felt the answer was complete, they had to publish it on the wiki. All students were able to see each other's blogs and comment in there. In this

way, these tools are not utilized to create, store and provide information, but as active tools to support PBL in medicine. The approach is summarized as follows. Instructors collaboratively develop a problem in the course wiki. Discussion is initiated via the problem's discussion forum, where students and instructors collaborate to analyse the problem, identify conquered knowledge and argue about possible solutions. Then, students search and collaborate to solve the case. Student progress and gained experiences and competences are recorded, shared and commended on via their personal blogs, while updates of the collaborative class wiki with "each student's final solution" presumably enhance the problem solving capacity and skill acquisition of the students even further.

Lessons Learned

Evaluations of the PBL case via Web2.0 were conducted through two anonymous questionnaires delivered to 40 MSc students, the first of which emphasised merely on the use of Web 2.0 tools, while the second one was specifically devoted to usual course evaluation practice within the overall postgraduate program. Qualitative evaluation of the results indicates that students were quite satisfied by this approach and found the collaboration tools offered by the system quite useful and enhancing the overall learning process. They were happy with the collaboration opportunities offered to them (most of them admitted that they were tempted to "read what others have contributed in their own personal blogs" - which "on purpose" allowed access to any enrolled in the course student). Finally, the course/module itself has been steadily improving over the last six years (currently only a qualitative result) and the use of such approaches and tools are certainly part of that reason.

Current emphasis within the mEducator project is to properly describe educational resources under a proper (metadata) scheme which roughly includes information for the identification of the resource and its features, its pedagogic elements, its repurposing history/inheritance, but also its associated social tagging information (or else "attention metadata"). The latter may be used as an alternative, and yet innovative, approach to content search and retrieval, but also as a new paradigm of exploiting the richness of user interaction with resources over the web.

Case Study 3: MEDTING: A Scientific and Professional Social Network

Figure 6: The MEDTING website

Objective

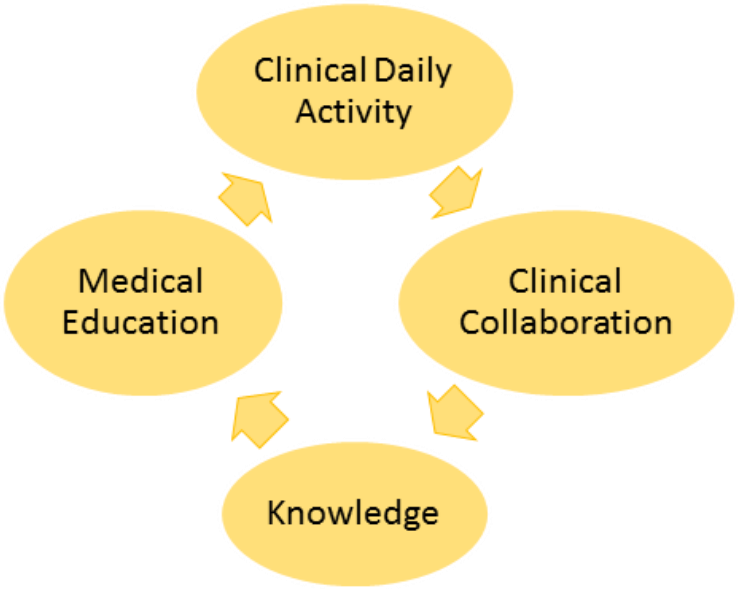
In early 2010, the Community of Madrid launched an innovative project in the area of health professional education through the creation of a Scientific Social Network. The Network aims to validate the use of a Web 2.0 tool for Medical practice by creating a social network to assist professionals in their daily medical activities, knowledge management and medical education. The project was initially implemented in the University General Hospital Gregorio Marañón, starting as a tool to support the Tumor Committee and thus serving as a proof of concept.

User Profiles

The Professional Collaboration Network started as a complementary tool for the Tumor Committee decision meetings. Doctors from different specialties were the main users of the platform.

The Scientific Social Network facilitates consistency of information used in presentations of clinical cases to the Tumor Committee, anticipating and documenting the views of specialists and keeping a record of tumors and statistical analysis of cancer epidemiology. It also standardizes communication between hospitals and enhances scientific and research activity, as it enables the recording of cases treated in this committee as a source of teaching and research material.

After 6 months active, the network has been opened to other specialties and departments. Once a knowledge repository has been built with all daily activity clinical cases students and researchers have also be invited to benefit from the network.



After 10 months the social network has:

- *225 physician envolved*
- *126 medicine students*
- *36 clinical departaments envolved*
- *316 clinical cases*
- *3 hospitals (reference HGUGM and one hospital for referral of clinical cases).*
- *Extension to 3 more hospital in process.*
- *2 integrations (Electronic Health Record and PACS)*

Development

For the implementation of the Scientific Social Network, the Community of Madrid decided to use MEDTING Enterprise. MEDTING is a collaborative web platform for the sharing of clinical cases that allows professionals to exchange knowledge, research and presentation of the organization's relevant clinical cases to different medical committees. Madrid created its own private and enterprise MEDTING space.

Lessons Learned

The project initially defined constitutes the Scientific Social Network of the whole of the Community of Madrid, which consists of 32 hospitals and 500 centers. The proof of concept and validation performed at the Hospital Gregorio Marañón not only reached the set goals and confirmed expectations, but the success among professionals has accelerated the expansion and implementation of the initiative in the other centers. The project is already being extended in three other hospitals as a second stage.

In addition to extending to other centers, the project will extend the use of the social network to other clinical settings in the Hospital Gregorio Marañón, as a center of innovation and implementation of new network functionalities.

The project has allowed for a change in the traditional manner of executing the Tumor Committee. Furthermore, in parallel to the clinical discussion, a repository of clinical knowledge relevant to the clinical community (residents) and continuing education is being created.

An internal assessment process has been launched to objectively measure the results and impact of the project related to avoiding laboratory tests; waiting time reduction; improvements in clinical research; and workflow management.

Conclusion

Although there has been much written in recent years to describe the range of social media technologies being used in medical education (1, 24-29), we have found little hard evidence of the validity and effectiveness of such tools.

The reason for this may be due to the so-called “wicked problem”(30) of measuring the effectiveness of new educational innovations, in particular technological innovations. Often, it seems that good ideas just seem to spread by word of mouth and become adopted without any formal assessment of their effectiveness.

The research that has been done is generally in the form of qualitative questionnaires and feedback from students and teachers(31). From this research it appears that students and professionals are aware of social media tools but the latter participate less than the former.

The case studies presented in this paper demonstrate that social media is becoming part and parcel of how we teach and learn in the healthcare field. From engaging our students by encouraging participatory learning to providing easier and more efficient ways for researchers and clinicians to attend conferences, social media tools appear to be having an influence.

From the experience of using social media to organise the Medicine 2.0 conference, while the list of services and technologies used will change over time, we think that there is a significant opportunity for other IMIA groups and conference organizers to learn from these experiences and to include some of these approaches into their knowledge dissemination and participant engagement strategies.

As academics, it is now time to begin to tease out the lessons from these case studies. Our literature review for this paper demonstrated a lack of empirical research to demonstrate the effectiveness of the use of social media in healthcare. As projects like mEducator, MEDTING, HIVE and Medicine 2.0 progress, we aim to report back on our successes and failures to encourage appropriate use of this new and potentially important suite of tools.

References

1. Andersen P. What is Web 2.0?: ideas, technologies and implications for education: Citeseer; 2007.
2. Berliner DC, Calfee RC, American Psychological Association. Division of Educational P. Handbook of educational psychology: Macmillan; 1996.

3. Donovan MS, Bransford JD, Pellegrino JW. How People Learn: Bridging Research and Practice: National Academy Press; 1999.
4. Kaldoudi E, Konstantinidis S, Bamidis P. Web Advances in Education: Interactive, Collaborative Learning via Web 2.0. Chapter in: A. Tzanavari, N. Tsapatsoulis (eds.),"Affective, Interactive and Cognitive Methods for E-Learning Design: Creating an Optimal Education Experience", IGI Global, Hershey, PA, USA.
5. Ebner M, Holzinger A, Maurer H. Web 2.0 technology: future interfaces for technology enhanced learning? Universal Access in Human-Computer Interaction Applications and Services. 2007:559-68.
6. Rhea S. Going mobile. Wireless devices and technology bring surge in advanced applications for health monitoring and treatment, but legal and privacy issues remain. Modern healthcare. 2010;40(18):28.
7. Thornburg DD. The new basics: Education and the future of work in the telematic age: Association for Supervision & Curriculum Development; 2002.
8. The Future of Nursing: Leading Change, Advancing Health: Institute of Medicine2010.
9. Response to the Institute of Medicine's Report To Err is Human: Building a Safer Health System - AACN White Paper: Distance Technology in Nursing Education. Tri-Council for Nursing; 1999 [cited 2011 14 February 2011]; Available from: http://www.aacn.nche.edu/publications/positions/whitepaper.htm.
10. Alexander B. Going Nomadic: Moblile Learning in Higher Education. Educause Review. 2004:6.
11. Guernsey L. In the Lecture Hall, A Geek Chorus [CORRECTED]. The New York Times. 2003.
12. Hu W. Math That Moves: Schools Embrace the iPad. New York Times; 2011 [cited 2011 14 February 2011]; Available from: http://www.nytimes.com/2011/01/05/education/05tablets.html.
13. Billings DM. From teaching to learning in a mobile, wireless world. The Journal of nursing education. 2005;44(8):343.
14. Maag M. Podcasting and MP3 players: Emerging education technologies. Computers Informatics Nursing. 2006;24(1):9.
15. Shneiderman B. Computer Science: Science 2.0. Science. 2008;319(5868):1349.
16. Hughes B, Joshi I, Wareham J. Health 2.0 and Medicine 2.0: tensions and controversies in the field. Journal of medical Internet research. 2008;10(3).
17. Eysenbach G. Medicine 2.0: social networking, collaboration, participation, apomediation, and openness. Journal of medical Internet research. 2008;10(3).
18. Giustini D. How Web 2.0 is changing medicine. British Medical Journal. 2006;333(7582):1283.
19. Top 10 Innovations of 2010. CNN; 2010 [cited 2010 14 February 2010]; Available from: http://edition.cnn.com/video/data/2.0/video/tech/2010/12/24/2010.top.ten.innovations.cnn.html.
20. Top Twitter Trends in 2010. Twitter; 2010 [cited 2010 14 February 2010]; Available from: http://yearinreview.twitter.com/trends/.
21. Paton C. HIVE. National Institute for Health Innovation; 2011 [cited 2011 2/6/2011]; Available from: http://www.hive.org.nz.
22. Bamidis P, Kaldoudi E, Pattichis C. mEducator: A Best Practice Network for Repurposing and Sharing Medical Educational Multi-type Content. Leveraging Knowledge for Innovation in Collaborative Networks. 2009:769-76.
23. Bamidis P, Constantinidis S, Kaldoudi E, Maglaveras N, Pappas C. The use of Web 2.0 in teaching Medical Informatics to postgraduate medical students: first experiences. Published as Multimedia Appendix in: Eysenbach G. Medicine. 2008;2:1022-23.
24. Santana EFZ, Prado AF, Souza WL, Santana LHZ, editors. A Web 2.0 Based Environment for Simulation Activities in Constructivist Medical Education 2009.
25. Santoro E. Podcasts, wikis and blogs: The web 2.0 tools for medical and health education. Recenti progressi in medicina. 2007;98(10):484.

26. McGee JB, Begg M. What medical educators need to know about “Web 2.0”. 2009.
27. Kamel Boulos MN, Wheeler S. The emerging Web 2.0 social software: an enabling suite of sociable technologies in health and health care education1. Health Information & Libraries Journal. 2007;24(1):2-23.
28. Cain J, Fox BI. Web 2.0 and pharmacy education. American Journal of Pharmaceutical Education. 2009;73(7).
29. Sandars J, Homer M, Pell G, Crocker T. Web 2.0 and social software: the medical student way of e-learning. Medical teacher. 2010(0):1-5.
30. Conklin EJ. Dialogue mapping: building shared understanding of wicked problems: Wiley; 2006.
31. Sandars J, Schroter S. Web 2.0 technologies for undergraduate and postgraduate medical education: an online survey. British Medical Journal. 2007;83(986):759.