

### Effects of a Virtual Classroom in social media platform on the Knowledge of Emergency Department Interns: A Randomized Interventional Trial

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**Background:** Emergency medicine has always been a leader in taming new technologies for medical education. Many forms of social media have been reported in medical education with very little quality evidence to clarify their role. In this study we look at a popular multimedia messaging application in our setting and the aim was to evaluate the effects of a virtual classroom in social media platform on the knowledge of emergency department interns.

**Methods:** This was a randomized controlled trial carried out on 65 interns divided into lecture (n=31) or virtual classroom (n=34) groups during their emergency medicine rotation. A block randomization method was used. Ten blocks of emergency medicine interns were randomly assigned to either a traditional lecture course on the subject of shock, or a virtual classroom conducted in the Telegram Messenger© via a group chat. Students' knowledge of the topic was assessed before and after the courses using a pretest and a posttest. The group participating in the virtual classroom were also asked to fill a questionnaire regarding their rate of satisfaction with the method. The results were analyzed using independent and paired t-tests in SPSS software version 21.

**Results:** The groups were found to be homogenous prior to the course in all demographic variables and their pretest scores. Most students participating in the virtual classroom preferred this method (81.5%) but the majority found it not to be effective in motivating clinical enthusiasm, solidifying knowledge, or exposing their shortcomings (59.3%). The pretest and posttest revealed that both groups' knowledge had improved ( $P < 0.001$ ) before and after teaching regardless of the method used. But there was no significant difference in posttest scores between the two methods ( $P = 0.788$ ).

**Conclusion:** A virtual classroom in a social media messaging platform appears to be as effective as a traditional classroom in conveying knowledge, and it is more preferable for the interns.

**Keywords:** Communications Media, Emergency Medicine, Knowledge, Medical education

### تأثیر آموزش مجازی توسط رسانه های اجتماعی بر روی دانش اینترنت های بخش اورژانس: یک کارآزمایی بالینی

**زمینه و هدف:** پزشکی اورژانس همواره پیشرو در استفاده از تکنولوژی های جدید در آموزش پزشکی بوده است. نقش اشکال مختلف شبکه های اجتماعی در آموزش پزشکی بسیار کم رنگ گزارش شده است. در این مطالعه از یک برنامه پیام رسان چند رسانه ای مشهور استفاده شده است و هدف، ارزیابی تأثیر آموزش مجازی توسط رسانه اجتماعی بر روی دانش اینترنت های بخش اورژانس می باشد.

**روش:** مطالعه حاضر یک کارآزمایی بالینی است که بر روی 65 اینترنت بخش اورژانس انجام گردید. مشارکت کنندگان در طول دوره آموزشی خود در بخش اورژانس به دو گروه آموزشی سخنرانی (31 نفر) و آموزش مجازی (34 نفر) تقسیم شدند. از روش بلوک تصادفی استفاده گردید. ده بلوک از اینترنت های طب اورژانس به طور تصادفی به یک دوره سخنرانی سنتی با موضوع شوک یا یک کلاس مجازی در پیام رسان تلگرام از طریق یک چت گروهی اختصاص داده شدند. دانش مشارکت کنندگان در مورد موضوع مورد نظر، قبل و بعد از دوره آموزشی با استفاده از پیش آزمون و پس آزمون مورد سنجش قرار گرفت. مشارکت کنندگان در گروه آموزش مجازی پرسشنامه مربوط به میزان رضایتمندی از آموزش مجازی را تکمیل نمودند. نتایج با استفاده از آزمون t مستقل و زوجی در نرم افزار SPSS نسخه 21 مورد آنالیز قرار گرفت.

**یافته ها:** تمام متغیرهای دموگرافیک هر دو گروه قبل و بعد از دوره آموزشی، همگن بودند. بیشتر دانشجویان مشارکت کننده (81.5٪) آموزش مجازی را ترجیح داده، اما اکثریت آنها (59.3٪) معتقدند که این روش در ایجاد انگیزه و شور و شوق در آموزش بالینی، تقویت سطح دانش و یا کاستن از نقاط ضعف آنها موثر نمی باشد. در هر دو گروه سطح دانش مشارکت کنندگان صرف نظر از روش مورد استفاده، بهبود یافته است ( $P < 0.001$ )؛ اما تفاوت معناداری در نمرات پس آزمون بین دو روش وجود ندارد ( $P = 0.788$ ).

**نتیجه گیری:** آموزش مجازی توسط پیام رسان اجتماعی (تلگرام) بر روی سطح آگاهی و دانش اینترنت ها نسبت به کلاس های سنتی (سخنرانی) موثرتر می باشد.

**واژه های کلیدی:** آموزش پزشکی، پزشکی اورژانس، دانش، رسانه های ارتباطی

### تأثیر التعليم الافتراضي في شبكات التواصل الاجتماعي على تعلم الأطباء المتدربين في قسم الإسعاف: تجربة داخلية عشوائية

**الأرضية والهدف:** دائماً ما كان طب الإسعاف سباقاً في استخدام التكنولوجيا الحديثة في الطب. كان دور وسائل التواصل الاجتماعي المختلفة ضعيفاً في هذا المجال. في هذه الدراسة تمت الاستفادة من برنامج إرسال رسائل معروف وكان الهدف تقييم تأثير التعليم الافتراضي عن طريق شبكات التواصل الاجتماعي على علم الأطباء المتدربين في قسم الإسعاف.

**الطريقة:** التحقيق المالى هو تجربة سريرية وقد طبقت على 65 طالب طب متدرب في قسم الإسعاف. المشاركين في هذا التحقيق تم تقسيمهم إلى مجموعتين وذلك حسب طريقة التعليم مجموعة التعليم بالخطابة (31) طالب ومجموعة التعليم الافتراضي (34) طالب. وتم الاستفادة من طريقة العنقولة العشوائية. 10 كتل من الأطباء المتدربين في قسم الإسعاف تم اختيارهم عشوائياً وتم تدريسهم موضوع شوكة (shock) بالطريقة التقليدية الخطابية، أو المجموعة الافتراضية حيث تم تدريسهم بالإعتماد على برنامج تليجرام. تم حساب مقدار إلمام الطلبة بالموضوع قبل وبعد الدورة التعليمية بالإستفادة من إختيار ما قبل وما بعد الدورة التعليمية. تم ملأ ورقة الأسئلة الإستفسارية من قبل المشاركين في مجموعة التعليم الافتراضي. تم تحليل البيانات بالإعتماد على إختيار t المستقل والزوجي في برنامج SPSS النسخة 21.

**النتائج:** كانت جميع المتغيرات الديموجرافية قبل وبعد الدورة التعليمية متجانسة أكثر الطلبة المشاركين (81.5٪) رجحوا التعليم الافتراضي. ولكن أكثرهم (59.3٪) أيضاً اعتقدوا أن هذه الطريقة غير مؤثرة في إيجاب التشويق في التعليم السريري وغير مؤثرة في تقليل نقاط الضعف. تحسن السطح العلمي للمشاركين في المجموعتين بنصف النظر عن الطريقة وكان ( $P < 0.001$ ): لم يكن هناك اختلاف في علامات قبل وبعد الدورة التعليمية في كلا الطريقتين وكان ( $P = 0.788$ ).  
**النتيجة:** التعليم الافتراضي عن طريق برنامج تليجرام كان مؤثراً أكثر من طريقة التعليم التقليدية على تعلم الأطباء المتدربين.

**الكلمات الدلالية:** التعليم الطبي، طب الإسعاف، المعرفة، شبكات التواصل.

### ایمرجنسی روم میں انٹرنز کے لئے سوشل میڈیا پر تعلیم دینے کی افادیت. ایک کلیینکل جائزہ

**بیگ گراؤنڈ:** میڈیکل سائنس میں ایمرجنسی روم نے ہمیشہ نئی نئی تکنالوجیوں کے ذریعے میڈیکل تعلیم کے لئے راستے کھولے ہیں۔ یہ دیکھا جا رہا ہے کہ میڈیکل تعلیم میں سوشل میڈیا کا کردار بہت کم ہے۔ اس تحقیق میں ملٹی میڈیا سے لیس ایک سائبر چینل سے استفادہ کیا گیا ہے تاکہ یہ دیکھا جاسکے کہ سوشل میڈیا کے ذریعے تعلیم دینے سے ایمرجنسی روم میں انٹرنز کو کیا فائدہ پہنچ سکتا ہے۔

**روش:** یہ ایک کلیینکل جائزہ ہے اس میں ایمرجنسی روم کے پینسٹھ انٹرنز نے شرکت کی۔ شرکت کرنے والے افراد کو دو گروپوں میں تقسیم کیا گیا، پہلے گروہ کو روایتی طرز پر تعلیم دی گئی اور دوسرے گروہ کو سوشل میڈیا کے ذریعے تعلیم دی گئی۔ کچھ انٹرنز کو صدمے کے موضوع پر لکچر دیا گیا تھا اور کچھ طلباء کو ٹیلی گرام پر چیٹ کرنے کا موقع دیا گیا تھا۔ تحقیق میں حصہ لینے والوں کی صلاحیتوں کو پوسٹ ٹسٹ اور پری ٹسٹ سے جانچا گیا، ڈیٹا کا تجزیہ ٹی ٹسٹ اور ایس پی ایس ایس ڈرزن آکس سے کیا گیا۔

**نتیجے:** اس تحقیق سے معلوم ہوتا ہے کہ دونوں گروپوں کے ڈیموگرافکس خواہ پری ٹسٹ میں یوں یا پوسٹ ٹسٹ میں تقریباً ایک جیسے تھے۔ اکیاسی اعشاریہ پانچ فیصد افراد سوشل میڈیا پر تعلیم کو ترجیح دی، لیکن انسٹھ اعشاریہ پانچ فیصد طلباء نے کہا کہ اس روش سے طلباء میں تعلیم حاصل کرنے کے محرکات اور جوش و جذبہ پیدا نہیں ہوتا ہے اور کلیینکل تعلم نیز ان کی صلاحیت بڑھانے میں بھی مفید نہیں ہے۔

**سفارش:** سوشل میڈیا کے ذریعے تعلیم دینے سے روایتی طریقے کی نسبت طلباء کو زیادہ فائدہ ہوتا ہے۔

**کلیدی الفاظ:** تعلیم، سوشل میڈیا، ایمرجنسی روم۔

## INTRODUCTION

Despite huge advances in medical knowledge and the advancement of medical technology, the methods used in medical education have remained relatively constant throughout the last century (1). This is not all bad, as the essence of medical education is, and should remain, the bedside (2). Yet, in recent years teaching methods based on computer technologies and simulation have entered the medical education arena and have opened new horizons (3). Emergency medicine (EM) is considered to be a leader in taking advantage of these possibilities and the number of sites and podcasts dedicated to this has grown substantially in recent years (4).

But alongside the rapid growth, another phenomenon is happening. Originally, e-learning focused on production of virtual and electronic learning material (5). The concept of computer learning was simply offering multimedia presentations aiming to convey knowledge or change attitude (6). Introduction of technologies which allow an interaction of data as well as its electronic presentation have changed this landscape and signs of a revolution in medical education are showing. Social media have made it possible to bring together dispersed groups of individuals with similar interests and to aggregate their knowledge and experience within a real-time virtual community. Furthermore, they have made it possible to "push" new content on to the "followers" rather than waiting for them to "pull" it off a weblog or website (5). The interconnection between teacher, content, and learner as much more balanced and visible within these media (1, 7). Moreover, these media are very popular amongst the youth who will be entering university positions in the near future (8).

The first sites offering medical education were introduced in the early years of this millennium. Since then, web content related to medical education has shown a logarithmic growth and EM has been a leader in this arena (4). Many educational courses throughout United States and Canada have twitter followers and so have entered the virtual world (5). On the one hand, medical students look to social media as their primary source of information. On the other hand, studies have shown that integration of social media into the medical education process has a positive impact on the students' attitude towards gaining knowledge and skills (3). This has turned the issue into a hot topic in medical education.

Until now the core literature on internet-based methods in medical education have focused on weblogs, Microblogging, websites, and social media (3, 7, 8). In Iran the implementation of filtering on sites such as Facebook and Twitter has pushed the medical education community towards other virtual social mediums. The most popular of these include text and multimedia messaging systems such as Viber, Line, WhatsApp, Telegram, among others. To date only a paucity of literature have look at the effect of such media on medical education.

Telegram Messenger© uses an open-source platform to offer completely free services in an ads-free environment. The application can run on iPhone, Android, and windows PCs. It has been named the most popular free social network in

more than forty countries. Compared with similar contact-based messaging applications Telegram offers more. It gives you the option of creating group chats of up to 5000 members. Also chats are stored in cloud, thus previous communications are not lost and people joining later, can access previous conversations within a group. But Telegram's most prominent feature is its sharing abilities. A variety of file types can be shared and viewed via Telegram without limitation in file size (9). These features make Telegram a flexible and literally limitless platform to hold educational virtual gatherings. Everyone can join in the conversation from different devices and different files can be shared quickly. The aim of the study was to evaluate the effects of a virtual classroom in social media platform on the knowledge of Emergency Department Interns.

## METHODS

This was a randomized interventional trial comparing a new teaching method with traditional lectures for medical doctorate (MD) interns during their EM rotation. A single topic (management of shock) was chosen as content in both groups. The subject of Shock was chosen for two reasons: first, members of the research team had the experience of teaching the topic in the past so the effect of education would not be significant with time passing; second, members of the team had assigned this topic in the course plan and so a closer control of educational content was possible.

The present randomized clinical trial was conducted at 2016. At Imam Reza educational hospital, MD interns are assigned to the ED for a month long internship during their general medical education. Although the course is mandatory for every intern, the timing isn't fixed and interns may be assigned to the ED at any time during their 19 months of internship.

A block randomization method was selected, meaning predetermined blocks of students were randomly assigned to either the lecture or Telegram group. Each block consisted of 6 to 10 Interns and included all the interns assigned to the EM rotation at our center during that month.

The inclusion criteria for this study encompass all the MD interns Also, exclusion criteria included unwillingness to participate in the study, absent for 3 sessions in the class. Interns were excluded from the study if it was not their first time participating in an EM rotation or if they were unwilling to participate in a social media classroom platform.

Based on previous studies comparing teaching methods, a minimum of 30 students in each group were determined to be sufficient to assess statistical significance. The study was approved by the ethical committee at Mashhad University of Medical sciences, School of medicine.

The study period lasted ten months, during which blocks of interns were consecutively assigned to either the lecture or the telegram groups. The first block's method of teaching was randomly designated using a coin toss. Because all interns in each rotation received the same teaching method and contact between consecutive rotations is very limited, the authors believe that the risk of contamination between the intervention and control groups was minimal.

Before initiating the study, lesson plans for both teaching

methods were designed and clearly planned out based on the determined goals and objectives in the curriculum. The lesson plan was then accredited and approved with minor revisions by five members of the EM faculty and medical education experts. Moreover, based on these lesson plans, an assessment exam was formed which after approval for validity and reliability by ten EM faculty members, was used as both pretest and posttest examinations. All students were assessed using a pretest exam at the beginning of their course, and by a posttest at the end of their one month rotation, usually about two weeks after the class. The examinations consisted of ten clinical vignette questions with multiple choice answers. A score of zero to ten was possible in each test.

In the lecture group, teaching was conducted in the original teacher-centered method. The information was presented using PowerPoint slides and clinical examples were included. The students were advocated to participate when questions were asked.

In the telegram group students were not expected to participate in a physical classroom. Rather, a Telegram group was created by the facilitator and the students were invited to join. Then a time and date was fixed for all students to be online in the group. In the telegram group participation was assessed by the number of participant marked "online" by the application at the time of discussions. Also the facilitator conducted random surveys during the class which all student were expected to reply accordingly in a timely manner. In the telegram group, text, pictures, slides, voice messages, and short videos were shared with the group by the facilitator during the discussion and student participation was advocated. Students could interact using voice or text messages.

In the intervention group a separate questionnaire was designed and validated to assess the students' satisfaction towards education using the telegram application. The questionnaire was revealed to the students after the posttest and consisted of three parts:

1. General demographic information including gender, age, and the number of months served as an intern prior to EM rotation.
2. A single yes or no question and five questions including:
  - a) Do you prefer learning using social media? (Yes/no)
  - b) Overall how satisfied are you with the course being taught using social media?
  - c) How satisfied are you with the resemblance between the teaching material and what you encounter in the clinical setting?

d) How successful was the social media based method in motivating you to be more active on clinical shifts compared with other methods of teaching?

e) How successful was the social media based method in making you aware of your educational shortcomings compared with other methods of teaching?

f) How successful was the social media based method in solidifying your knowledge on the topic compared with other methods of teaching?

Which were answered on a five-point Likert scale [Fully satisfied (5), Mostly satisfied (4), Neutral (3), Mostly unsatisfied (2), Fully unsatisfied (1)].

3. Two open questions asking about the "strengths" and "weaknesses" of using a social media platform to host a virtual classroom.

The data was assessed using SPSS software version 21. Descriptive indicators (mean, standard deviations, and frequencies) are used to describe observed variables. Chi-squared was used the test the two groups homogeneity regarding gender. Continuous variables in the two groups were compared using the Student-T test. Pre and posttest scores within each of the groups was compared using a paired student t test. While pretest and posttest scores of the intervention and control groups were compared using the Student T test. P value of <0.05 was considered significant.

## RESULTS

Overall 65 students in ten blocks entered the study, 34 in the telegram and 31 in the lecture group. The mean age of students was  $24.2 \pm 0.9$  (range 23-26) and the number of months spent in internship rotations prior to entering the ED rotation was  $8.0 \pm 4.4$  (range 2-19). Most students were female (69.2%). Table 1 compares the two groups prior to intervention.

In order to assess the effects of teaching method on knowledge, the students' pretest and post test scores were compared. The results are presented in table 2. A paired Student T test was used to compare pretest and post test scores in each group and an independent Student T test was used to detect any significant difference between the two groups. The two groups showed no significant difference in knowledge before the course was held ( $P=0.207$ ), also both groups showed significant improvement in their scores after the course ( $p<0.001$  for both groups). But the post test scores were not found to be significantly different in the two groups ( $p=0.788$ ) (table 2).

Regarding satisfaction in the telegram group, only 27 students returned the questionnaire (participation rate of

**Table 1. Comparing both groups before intervention**

	Telegram group	Lecture group	P value
Age (mean $\pm$ SD)	24.21 $\pm$ 0.81	24.25 $\pm$ 0.93	0.810
Gender (Male-Female)	12-22	8-23	0.435
Months of internship (mean $\pm$ SD)	7.5 $\pm$ 2.3	8.7 $\pm$ 3.4	0.090
Pretest score (mean $\pm$ SD)	5.3 $\pm$ 1.4	4.8 $\pm$ 1.4	0.207

Table 2. Assessment of knowledge before and after course presentation			
Type of teaching	Telegram mean $\pm$ SD (n=34)	Lecture mean $\pm$ SD (n=31)	P-value
Pretest	5.3 $\pm$ 1.4	4.8 $\pm$ 1.4	P=0.207
Posttest	7.4 $\pm$ 1.7	7.3 $\pm$ 1.8	P=0.788
Effect of course on knowledge of each independent group	P<0.001	P<0.001	

79.4%). Among the participants 81.5% (n=22) preferred to learn through social media rather than through traditional lectures. Fifteen students (55.5%) were either “mostly satisfied” or “fully satisfied” with the course being taught using social media. When asked about similarity between course content and clinical encounters on the ward, 66.7% (n=18) of students expressed full satisfaction or were mostly satisfied. Only 40.7% (n=11) of the students found integration of social media into their education to be at least “relatively successful” in regards to inducing greater clinical participation, recognizing student knowledge deficiencies, or in solidifying previously gained knowledge.

### DISCUSSION

Medical students, like the rest of us, are faced with the growing influence of Web 2.0 in their daily lives. Therefore it's not surprising that researchers are looking to exploit this platform to enhance medical education (8). In this study we looked at a unique form of social media, the Telegram<sup>®</sup> Messaging application, as a convenient and capable medium to hold a virtual classroom. Our findings suggest that such a virtual classroom can be as effective as a traditional lecture in conveying information to interns and that most students found this method of teaching preferable. Yet when asked about their opinion regarding this new method of teaching, most interns in the intervention group did not find it to be successful in creating a mock clinical experience. Nor was it thought to be effective in motivating further clinical engagement, exposing knowledge gaps, or solidifying previously accumulated knowledge. The improvement of knowledge scores as assessed by a topic-specific examination was also not significantly greater than what was achieved with the traditional lecture despite the need for greater effort on the part of the facilitator.

Different methods have been described on the use of social media and web-based interactions in the education of EM. Social media can take up different roles in the medical education process based on the characteristics of available applications and software. Some institutes have used Twitter to disseminate and summarize key concepts of classes and conferences. In this method, one student is in charge of selecting and posting key points on twitter, so that other students who are on shift at the time of class can also benefit from the points at their convenient time. Another method is live tweeting from lectures and seminars. Virtual gathering media such as Google hangout also allow a medium for virtual journal clubs (5, 10). Robert's et al systematically reviewed papers looking at holding journal clubs for the aim of professional development via microblogging (11) while

others have looked at Facebook in different grades and contexts to boost medical education. In undergraduate medical education Facebook is mostly used as a virtual learning and teaching environment, whereas in graduate medical training most focus on digital professionalism. Also the possibility of using Facebook as a platform for continuing medical education has been looked at (8). Here we looked at a messaging platform to host a virtual classroom. Keeping in mind all the limitations of holding a classroom in this medium, we chose Telegram<sup>®</sup> because of several distinct characteristics. First it has the ability to form groups and channels in which material can either be discussed or broadcast to the audience. Second it has diverse file sharing capabilities allowing users to quickly share large files and media. Third it is available in most operating systems including iOS, Android, and Windows desktop. But the fourth and most important reason was its availability in Iran and its popularity among our interns for social purposes.

Cheston et al. in 2013 systematically reviewed the use of various social media in medical education and found that Blogs were the most used tool followed by wikis, tweets, and Facebook. The authors report that only one study included in the review was a randomized controlled trial (3). Randomized interventional trials, as the highest level of evidence, are lacking in this field. Most available studies are descriptive or use before and after methodology. The authors state that there is an urgent need to develop evidence on use of social media in medical education to demonstrate any benefits; because they must be weighed against potential risks and concerns about patient privacy and online professionalism (12, 13) when social media are incorporated into educational interventions.

Most analytic studies have failed to show an improved outcome when social media is used. In their review Cheston et al. reported that in tests of knowledge acquisition similar scores were found in groups using and not using social media (3). Later, in 2014 a Swedish systematic review failed to find a single study that proved significant improvement in outcomes when social media was used in medical education. The study insists that apparently this readily accepted medium does not improve the learning process, or affect knowledge, motivation, and outcome on examinations (14). In a review exclusively looking at the use of Facebook in medical education Pander et al found that despite colorful descriptions on how the medium was used, no study actually conducted before and after or interventional analysis of its effect (8). In 2009 Raupach et al, compared an online course on clinical reasoning with an in-person problem-based learning course in a randomized trial. Nine blocks of 8

students were included in each arm of the study and an examination score was used as the measure of outcome. Researchers found no significant differences between the mean scores of the study arms (15). In their 2011 study Triola and Holloway used a virtual microscopy system in the training of 164 first-year medical students. They compared student performance on the final summative practical exam to compare end-of-course skills of students to those from one year prior and one year after the intervention. They found that while the class had become more efficient, there was no significant difference between the exam scores across the two modalities (16). In this study we wanted to see whether a virtual classroom as described would actually improve on the current methods of training and so an interventional trial was designed. Our results reaffirm previous finding that although interns prefer this process, it does not significantly affect their knowledge acquisition when compared to a traditional classroom.

Nonetheless use of a messaging platform for conduction of a virtual classroom did prove to be as effective as a traditional classroom in conveying knowledge. When before and after data are considered the interns in the intervention arm did show significant improvement in their knowledge. Previous finding have also shown the use of social media to be effective by itself. Geyer and Irish in 2008 looked at the online teaching of evidence based medicine informatics to medical students. The pass rates improved compared to the previous year and most students rated the intervention as good, very good, or excellent (17). Another important aspect is learner preference. As we found in our study, Cheston et al report in their review that satisfaction with introduction of a social media method was described as positive in most studies (3). In another review published in 2013, Cartledge et al. looked at the use of social-networking sites in medical education and after fully reviewing 9 relevant papers, found that most studies assessed learner satisfaction and rarely investigated higher outcome measures. The authors conclude that incorporation of social networks in medical education is well received by learners. However, they insist that no solid evidence supports the notion that such tools are equally or more effective than other media available for educational purposes (18). In the current study we did also look at knowledge acquisition as a higher endpoint. We report once more our interns' preference to use social media and we also show that knowledge acquisition in the Telegram group was similar to a traditional classroom.

The issue of student participation must also be addressed since it appears that benefits of using social media in medical education relies on the amount of active participation by students. In 2009 Carvas et al. conducted a virtual Clinical research training course at Harvard which was broadcast internationally. It was found that the 25% of participants with the greatest number of postings scored significantly higher in the final exam than the 25% with the least postings (19). Robert's et al. reported that in their study, although active participation was on the rise, most of the activity came from the top ten participants and rest of the members were mostly bystanders. Also voluntary participation complicates recording of participation and thus its applicability to

continuing professional development (11). In our study interns were frequently asked to participate; whether through sharing of opinion or random surveys aimed at assessment of student engagement to eliminate any bystanders.

During this study we made several observations which were not among our measured outcomes. One such outcome was engagement of interns in learning through the web. Free Open Access Meducation (FOAM) is a movement which takes advantage of social networks to freely share locally produced educational resources. The material enjoys the vast penetration offered by these networks while it gives everyone a chance to produce and share material. A unique feature of FOAM advocates is their approval and support for dissemination and domestication of contents they produce (2). Through FOAM resource poor areas of the world can take advantage of the material produced in more resourceful areas (1), but they are still allowed to contribute mostly by focusing on what makes their particular area of practice unique. In this study we did not aim to produce new educational material nor had we devised a tool to measure out of class learning through the web. Yet our facilitators observed that the interns who participated in the virtual classroom group, were more likely to look up the links shared during the class, than those who were offered the same links during a lecture presentation. This is an intriguing finding which needs to be confirmed in studies specifically designed for this outcome.

Another possible application of using this platform may be to expand the concept of a reverse classroom. A "reverse classroom" is one of the most successful methods taking advantage of the internet. This method has been popularized by Salman Khan Academy and fundamentally changes the role of the teacher in the classroom. In this method students spend the night going through the teaching subject via short filmed lectures, and in the morning they only meet to elaborate on vague and complex points (20). The excitement of this teaching method has also gained much recognition, yet its shortcomings have also been discussed (21). Although in our study we did not use the messenger platform as a reverse classroom we see its potential to be used in that manner. In our study students joined the virtual classroom simultaneously and were engaged through sharing of media, voice messages, or short text messages. But in another format the facilitator may share videos or slideshows on the topic prior to class. Then during class students may engage in discussions on vague topics in a question and answer setting, turning the session into a reverse classroom.

The opportunities provided by a virtual classroom in a messaging application are numerous. First the fact that class time becomes more flexible was very attractive to our interns. Also class could be attended in any attire and any setting. The fact that conversations were recorded and one could go back and review them was another plus which lead to quite a few delayed questions and extended conversations. The sum of these criteria led to the fact that 82% of our participants preferred the conditions of a virtual class. This is despite the fact only a minority of the same students found the class to be successful in motivating clinical enthusiasm, solidifying

knowledge, or exposing their shortcomings. Previous studies have also pointed to several opportunities provided by the use of social media in medical education. These include popularity, educational equality, accessibility, dynamic nature, and instant reflection (7).

The challenges and difficulties of integrating social media into the ED curriculum must not be overlooked as well, although majority of these concerns are not based on evidence (5, 7, 21). Maybe the most significant is that not all interns or even facilitators are similarly comfortable with the use of this new technology. The inability to document student participation in such programs makes their use difficult as a core part of the curriculum (21). Moreover, it is an undeniable fact that social media can be distracting. Many EDs in Iran have already banned the use of mobile phones in their departments because it is believed that preoccupation with social networking sites may compromise patient care. Unpredictable internet access may be another fact limiting the use of technology in core curriculums. Another point that we encountered in our study was the facilitator's limited ability to control the discussion. While a teacher can simply ask the class to "be quiet", stopping ten interns from typing at the same time is not as simple or swift. Previous studies had pointed to a similar problem when blogs were used (3). Last but not least the issue of professionalism and patient

information sharing must be brought to attention (5).

In a field where strong evidence is scarce we conducted a randomized controlled trial to assess the effects of a virtual classroom in a messaging application compared to a traditional lecture. Our findings show that this approach is preferred by most students and is equally effective in conveying the knowledge to interns in the ED. Our study was limited by the fact that only 79.5% of students participated in our satisfaction survey and the fact that we only assessed the acquisition of knowledge as an end point. Use of social media may have significant effects on improvement of skills and may influence both attitude and practice none of which were assessed in our study. More complicated trials are needed to further examine the role of such applications in the future of medical education.

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## REFERENCES

1. Sherbino J, Frank JR. The power of social media to transform medical education. *Postgraduate Med J* 2014; 90(1068): 545-6.
2. Nickson CP, Cadogan MD. Free Open Access Medical education (FOAM) for the emergency physician. *Emerg Med Aust* 2014; 26(1): 76-83.
3. Cheston CC, Flickinger TE, Chisolm MS. Social media use in medical education: a systematic review. *Acad Med* 2013; 88(6): 893-901.
4. Cadogan M, Thoma B, Chan TM, Lin M. Free Open Access Meducation (FOAM): the rise of emergency medicine and critical care blogs and podcasts (2002-2013). *Emerg Med J* 2014; 31(e1): e76-7.
5. Scott KR, Hsu CH, Johnson NJ, Mamtani M, Conlon LW, DeRoos FJ. Integration of social media in emergency medicine residency curriculum. *Ann Emerg Med* 2014; 64(4): 396-404.
6. Ruiz JG, Mintzer MJ, Leipzig RM. The impact of E-learning in medical education. *Acad Med* 2006; 81(3): 207-12.
7. Roy D, Taylor J, Cheston CC, Flickinger TE, Chisolm MS. Social media: Portrait of an emerging tool in medical education. *Acad Psychiatry* 2016; 40(1): 136-40.
8. Pander T, Pinilla S, Dimitriadis K, Fischer MR. The use of Facebook in medical education--a literature review. *GMS Z Med Ausbild* 2014; 31(3): Doc33. [In German].
9. Sutikno T, Handayani L, Stiawan D, Riyadi MA, Much Ibnu Subroto I. WhatsApp, Viber and Telegram which is best for instant messaging? *International journal of electrical and computer engineering* 2016; 6(3): 909.
10. Cevik AA, Aksel G, Akoglu H, Eroglu SE, Dogan NO, Altunci YA. Social media, FOAMed in medical education and knowledge sharing: Local experiences with international perspective. *Turk J Emerg Med* 2016; 16(3): 112-7.
11. Roberts MJ, Perera M, Lawrentschuk N, Romanic D, Papa N, Bolton D. Globalization of continuing professional development by journal clubs via microblogging: a systematic review. *J Med Internet Res* 2015; 17(4): e103.
12. Guseh JS, 2nd, Brendel RW, Brendel DH. Medical professionalism in the age of online social networking. *J Med Ethics* 2009; 35(9): 584-6.
13. Chretien KC, Greysen SR, Chretien JP, Kind T. Online posting of unprofessional content by medical students. *JAMA* 2009; 302(12): 1309-15.
14. Arnbjörnsson E. The use of social media in medical education: A literature review. *Creative education* 2014; 05(24): 2057-61.
15. Raupach T, Muenscher C, Anders S, Steinbach R, Pukrop T, Hege I, et al. Web-based collaborative training of clinical reasoning: a randomized trial. *Med Teach* 2009; 31(9): e431-7.
16. Triola MM, Holloway WJ. Enhanced virtual microscopy for collaborative education. *BMC Med Educ* 2011; 11: 4.
17. Geyer EM, Irish DE. Isolated to integrated: an evolving medical informatics curriculum. *Med Ref Serv Q* 2008; 27(4): 451-61.
18. Cartledge P, Miller M, Phillips B. The use of social-networking sites in medical education. *Med Teach* 2013; 35(10): 847-57.
19. Carvas M, Imamura M, Hsing W, Dewey-Platt L, Fregni F. An innovative method of global clinical research training using collaborative learning with Web 2.0 tools. *Med Teach* 2010; 32(3): 270.
20. Parslow GR. Commentary: the Khan academy and the day-night flipped classroom. *Biochem Mol Biol Educ* 2012; 40(5): 337-8.
21. Faust JS, Shah KH. The integration of social media into residency curriculum has obstacles. *Ann Emerg Med* 2015; 65(1): 125.