ORIGINAL RESEARCH

Impact of Social Media Integration in Teaching Methods on Exam Outcomes

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Objective: The objective of this study was to assess the impact of social media integration in teaching methods on exam outcomes.

Methods: This study was conducted at Poonch Medical College, Azad Kashmir, Pakistan from November 2018 to January 2019. All 125 students of 4th year MBBS were included in the study. The mean age of all respondents was 22.96 ± 3.25 years. One unit of special pathology was taught using traditional teaching methods and a second unit was taught using traditional teaching methods supplemented by social media. One exam was taken before the integration of social media and a second exam after its integration. Written informed consent was secured from all the participants before starting the project.

Results: The mean difference in examination score after social media integration was 8.97 ± 5.23 which was statistically significant (95% CI -7.954–9.988, $p < 0.001$). However, classroom attendance was significantly higher before social media integration (95% CI 0.668–0.197, $p < 0.001$). Social media integration provided better examination outcomes for the students and gave voice or space to those who never previously asked questions or participated in the class.

Conclusion: Social media broke down the barriers and students communicated with confidence. Educationists may work together to create a guideline on how social media can be efficiently incorporated in the education system.

Keywords: social media, teaching methods, exam outcomes

Introduction

The learning process can be divided into three parts: a) What to learn? (cognitive) b) Why to learn (motivational) and c) How to learn (metacognitive recognition)?[1] Different students have different learning styles. Mostly, students can effectively learn if a blend of visual, auditory, writing, reading and kinesthetic strategies are employed.[2] In the last decade, social media has taken the world by storm and its utility for educational purpose needs to be established. Social media is used by 45% to 90% of undergraduate and postgraduate medical students.[3] Research reveals that both students and teachers are eager to explore social media as an educational platform, but the practice is significantly low.[4] According to another research[5] the use of social media such, as Twitter, has proven to enhance student engagement, but whether it leads to deeper learning or not needs to be explored. In addition to this, secure social media tools such as Edmodo appear to be suitable platforms for the facilitation of contemplative discussions in medical education.[6]

The increasing influence of social media on our lives is leading to the re-evaluation of the delivery methods of educational medical content by medical educators and researchers. Social media tools are routinely used for communication, sharing information, and

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having discussions related to the topics of interest by both undergraduate and postgraduate students. Presently, there is more emphasis on the development of guidelines on social media usage for educators and students and there is a lack of effort placed on determining its beneficial effects in medical education.

New technologies are outpacing the old techniques of education delivery. The 21st century-learner is reliant on new technologies to assist in their learning. Social media can be used to supplement traditional educational methods. Educators can employ social media tools to involve these students in a productive way.[7] Both undergraduate and graduate medical students currently and widely use social media to help with their learning and education. The evidence of using social media as a teaching and learning platform is far less than that of its use to teach Facebook professionalism. A couple of studies were conducted to examine the educational methods used to teach Facebook professionalism but not even one single element of research has been carried out which compares the effectiveness of the use of Facebook as a teaching and learning tool in conjunction with other teaching and learning instruments or with other social media tools such as WhatsApp, and Twitter.[8]

The extensive use of social media by medical students and their teachers stresses upon the importance of its incorporation into their curricula.[9] Social Media tools, e.g. WhatsApp, Facebook (FB) and Twitter look very promising platforms for teaching and learning owing to their exciting features through which teachers can engage their students.[10] This study aims to address the gap in the literature on the effects of integrating social media tools in medical education. It will identify the difference between learning through traditional methods and learning through traditional methods supplemented by social media in medical education.

Methods

This quasi experiment was conducted at Poonch Medical College, Azad Kashmir, Pakistan from November 2018 to January 2019. All 125 students of 4th year MBBS were included in the study. Ethical approval was secured from ethical committees of Khyber Medical University, Peshawar, Pakistan and Poonch Medical College, Rawalakot, Pakistan. A questionnaire consisting of items related to gender, age, residence status, mother's education level, father's education level, mother's profession and father's profession, was administered before the start of

the project. Another questionnaire comprising one question regarding how many hours a student has been studying was administered on the day of each examination. Written informed consent was secured from each participant through a data collection instrument.

Study Protocol

1. One question paper on Gastrointestinal Tract (GIT) Pathology and one question paper on Cardiovascular System (CVS) Pathology and their answer keys were prepared by an external examiner not belonging to the same college and who was unaware of the research. Each question paper was composed of 100 multiple-choice questions, out of which 40 were classified as easy to answer, 35 were moderate and 25 were hard, on the difficulty scale. The sealed question papers and their answer keys were handed over to a faculty member of the Pathology Department who opened the respective sealed envelope on the examination day. The faculty member was also unaware of the research project. The papers were marked by the same faculty member using OMR software, especially procured for this research project and scores were checked and confirmed manually by another faculty member. The scores were communicated to the researcher.

2. In the first month of the study, GIT Pathology was taught over 20 lectures, each lecture was of 60 mins, using traditional educational strategies. Three days after completion of GIT Pathology unit, the first examination was conducted.

3. During the second month, all the students of 4th year MBBS were directed to join the WhatsApp group, Edmodo class and Facebook closed group of Special Pathology and were directed to follow a Twitter account (for tweets related to pathology). All the technical issues were resolved in this month.

4. In the third month, CVS pathology was taught over 20 lectures, and each lecture was of 60 mins employing traditional educational strategies supplemented by educational content delivery through social media platforms. The second examination, i.e. CVS Pathology was conducted 3 days after completion of the unit.

5. The content delivered during each in-class lecture was the same as the first 20 lectures.

6. An electronic class of 2 hrs was conducted every third day on WhatsApp.

7. During each electronic class of 2 hrs on WhatsApp, the topics from the same unit were discussed (as taught during in-class lectures) as shown in Figure 1. During discussion, short answer questions, gross and microscopic images were discussed.

8. Five high-yield facts from each topic of the unit was tweeted on Twitter on every third day as visible in Figure 2.

9. On the Facebook group, 05 clinical vignette-based multiple-choice questions were posted and discussed on every third day. Gross and microscopic images were also shared and discussed on FB as exhibited in Figure 2.

10. On Edmodo, the students were divided into small groups. In the small groups, each student was required to start a discussion on the topic of his or her choice and was also asked to engage in the discussion of at least one of his or their group members. Quizzes were posted twice a week on Edmodo as well.

11. Each student's participation was categorized as an active & passive learner.

12. The frequency of participation of each learner was recorded.

13. The examination scores of both examinations conducted before and after integration of social media were compared and analyzed.

14. The paper setter, students, and the faculty member who checked and confirmed the scores were masked. They did not have any knowledge of the research being conducted.

15. Those students who were absent in either of the two tests were excluded in the analysis.

16. In this study exam scores were the exam outcome.

17. Any student who responded to an electronic post within 12 hrs was considered as an active learner.

18. Any student who did not respond to an electronic post within 12 hrs was considered as a passive learner.

19. In this study, response was defined as replying to a post or seeing a post.

20. The posts in this study were any educational material electronically shared by the teacher, e.g. images, high-yield facts, clinical vignette-based multiple-choice questions, answers, explanation of answers, discussions and quizzes, etc.

Statistical Analysis

Descriptive statistics were used to present the demographic characteristics, learner type, and social media participation.

Classroom attendance, study time after classroom lectures, and marks obtained in the examinations before and after social media integration were compared by a paired sample t-test. Examination score difference was calculated for all students by subtracting the examination score before social media integration from the examination score after social media integration. The examination score difference was compared between both genders using independent sample t-tests. Examination score difference in different parents' level of education was compared using the Kruskal Wallis test. The non-parametric test was used because the Kolmogorov Smirnov test and Shapiro Wilk test revealed non-normal distribution of data. Similarly, examination score difference was compared across the parents' occupation by using the Kruskal Wallis test. Correlation between the student's age, mother's age and father's age were done using the Spearman correlation test. The same test was done to observe the correlation between classroom attendance, study time after class lectures, and exam score difference. Active vs passive learning styles were compared for all four social medias in terms of exam score difference by independent sample t-tests. The exam score difference was categorized as low score difference for those who had less than a 10-mark difference and high score difference for the others. Binary logistic regression was done to observe the factors predictive of high exam score difference.

The analysis was performed in 95% confidence interval using the Statistical Package for Social Science (SPSS), version 23.0 (IBM, Armonk, NY, USA).

Results

Out of 125 medical students, 104 (83.2%) were included in this study (21 students were absent for at least one of the examinations, hence, they were excluded) and among them, 29 (27.9%) were male. The mean age of all respondents was 22.96 ± 3.25 years. The demographic characteristics of all students are presented in Table 1. Figure 3 shows the comparative view of the education level of mothers and fathers of the students.

The percentage of passive learners were higher in Facebook and Edmodo, whereas Twitter and WhatsApp users are more active learners. The exact percentages were presented in Figure 4. Students' participation in WhatsApp was the highest (63.07 ± 54.88) among all studied social media (Table 2). The mean examination mark for all students before social media integration was lower (41.86 ± 12.44) compared to post-social media integration (50.83 ± 12.49). The mean difference of examination score after social media

Table 1 Demographic Characteristics of the Students (n = 104)

Characteristics	Mean ± SD/N (%)
Age in years	22.96 ± 3.25
Gender	
• Male	29 (27.9)
• Female	75 (72.1)
Residence of students	
• Day scholar	28 (26.9)
• Hostel resident	76 (73.1)
Mother's age	48.03 ± 4.50
Father's age	53.99 ± 5.06
Mother's profession	
• Doctor	2 (1.9)
• Teacher/Academia	16 (15.4)
• Administration	1 (1.0)
• Housewife	85 (81.7)
Father's Profession	
• Doctor	5 (4.8)
• Lawyer	4 (3.8)
• Teacher/Academia	17 (16.3)
• Businessman	53 (51.0)
• Administration	1 (1.0)
• Others	22 (21.2)
• House husband	2 (1.9)

integration was 8.97 ± 5.23 which was statistically significant (95% CI −7.954–9.988, p <0.001). However, classroom attendance was significantly higher before social media integration (95% CI 0.668–0.197, p <0.001) (Table 3).

The mean examination score difference before and after the integration of social media was compared across gender as shown in Table 4.

However, when the score difference was categorized as high (≥10-mark difference) and low (<10-mark difference), the binomial logistic regression analysis revealed only WhatsApp contributed significantly to the increase in examination mark after social media integration (OR 4.246, p 0.018) as tabulated in Table 5. The exam score pre- and post-SM integration, mark difference, and number of times the students participated in different social media is shown in Table 6.

Table 7 shows that post SM integration exam score increase was strongly positively correlated with Facebook, Edmodo, Twitter, and WhatsApp using frequencies (p-values <0.001). WhatsApp contributed the most to the mark increase. Due to WhatsApp integration, the 6.22 mark was increased out of an 8.97 total mark increase, which means 69.34% of mark difference can be explained by WhatsApp as shown in Table 8.

Discussion

Today's medical students have used social networking sites extensively as a communication tool throughout their teens and early adult personal, professional and educational lives.[9] Because the contents in social networking sites are user-
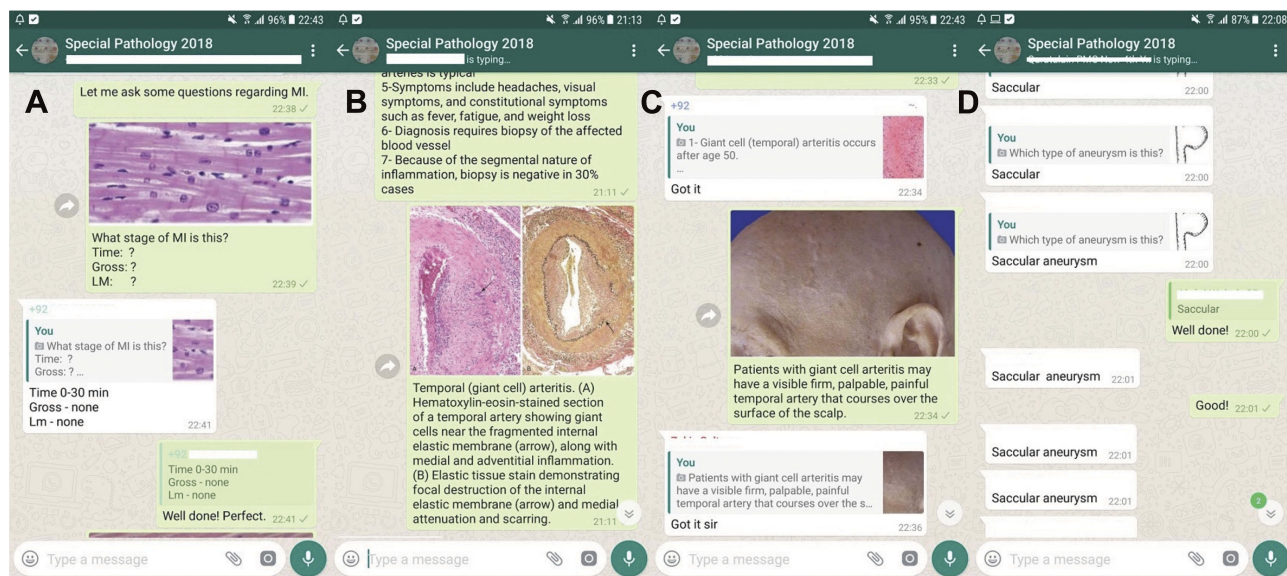

Figure 1 Educational content delivery through WhatsApp. (**A**) Shows response of a student on a microscopic image and feedback by the educator. (**B**) Shows another microscopic image and its features shared by the educator. (**C**) Shows a gross image. (**D**) Shows response of several students over a question.
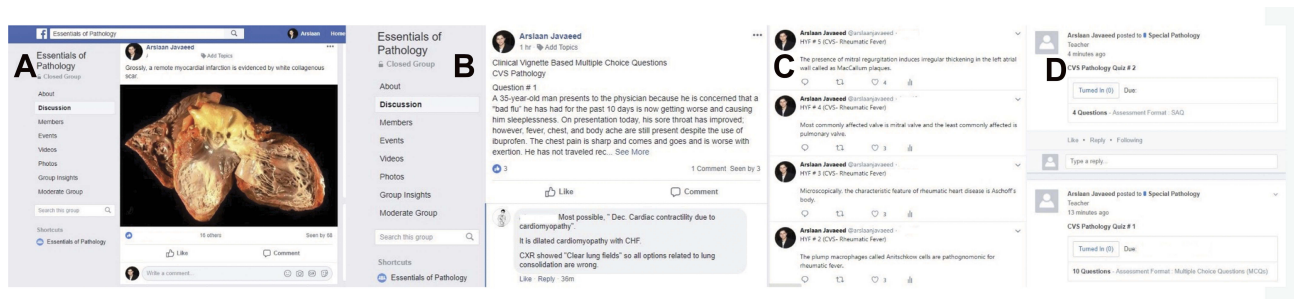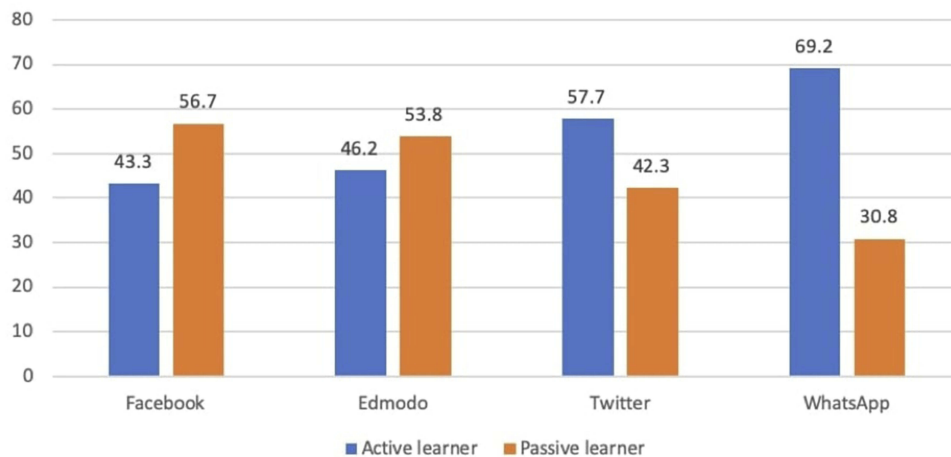
Figure 2 Educational content delivery through social medical platforms. (**A**) Shows gross image shared on Facebook. (**B**) Shows a scenario-based question shared on Facebook and the response of a student. (**C**) Shows a High Yield Facts tweeted on Twitter. (**D**) Shows a Quizzes posted on Edmodo.
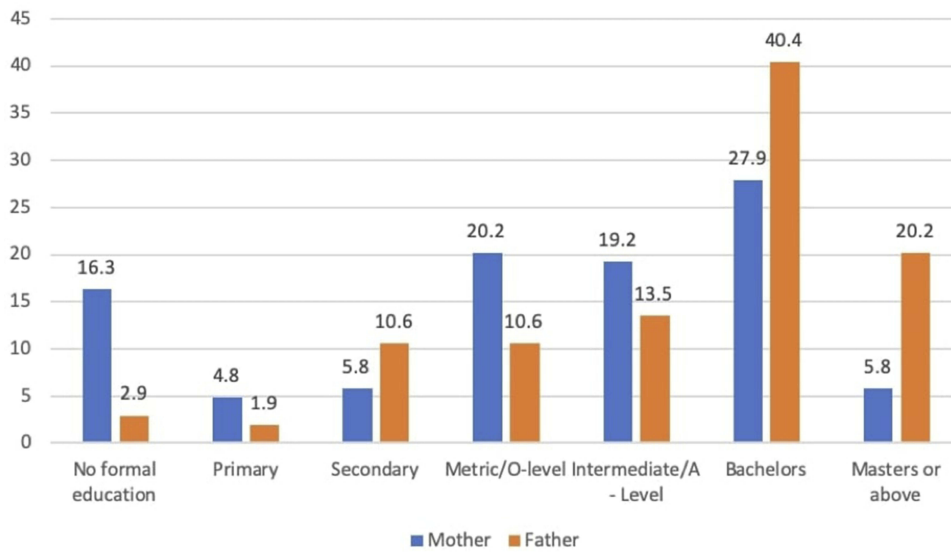
Figure 3 Education level of the parents of the students (percentages) (n = 104).

Figure 4 Learner categories (active/passive) in different social media.

Table 2 Number of Times Students Participated on Different Social Media (Mean ± SD)

Social Media	Participation Frequency (Mean ± SD)
Facebook	8.35 ± 10.32
Edmodo	8.71 ± 10.51
Twitter	10.83 ± 11.17
WhatsApp	63.07 ± 54.88

Table 3 Difference Between Pre- and Post SMI in Terms of Classroom Attendance, Study Time After Classroom Lecture, and Marks Obtained by All Students (n = 104)

Variables	Pre (Mean ± SD)	Post (Mean ± SD)	95% CI	p-value*
Classroom attendance (out of 20 lectures)	15.46 ± 3.08	15.03 ± 3.39	0.197–0.668	<0.001
Study time after classroom lecture (hours)	2.83 ± 1.62	2.79 ± 1.58	0.086–0.162	0.540
Marks obtained (out of 100)	41.86 ± 12.44	50.83 ± 12.49	−7.954–9.988	<0.001

Notes: *p-value obtained by paired sample t-test, Study time in hours, Classroom attendance in numbers out of 20 lectures.
Abbreviation: SMI, Social Media Integration.

Table 4 Examination Score Difference Between Male and Female Students, Pre-& Post SMI

Gender	Marks Pre-SMI	Marks Post-SMI	Mark Difference	p-value
Male	36.76 ± 12.26	44.97 ± 11.77	8.20 ± 5.31	0.356
Female	43.83 ± 12.02	53.09 ± 12.09	9.27 ± 5.20	

Table 5 Binary Logistic Regression to Identify the Relationship Between Learning Style and Exam Score Increase After SMI (More Than 10 or Not)

Active Learners	Odds	p-value
Facebook	1.248	0.778
Edmodo	0.556	0.496
Twitter	1.002	0.998
WhatsApp	4.246	0.018

generated and collaborative, introducing a new dimension of participatory learning.[11] Medical students use social media (Facebook, Twitter, Edmodo, WhatsApp, etc.) as tools to communicate, participate, share, create, and modify information.[12] A survey of students in the health professions shows that the majority of students prefer online and social media as their primary source of information.[13] A meta-analysis and systematic review reported the majority (75%) of the medical students use social networking sites, whereas 20% used these sites for sharing academic and educational information.[14] Students from various universities highlighted that using social media was a more active process than traditional didactic lectures. They felt more confident in terms of knowledge and more able to readily discuss topics and share their thoughts.[15]

Worldwide, there are more than 1.8 billion active users of Facebook and over 300 million active monthly users of Twitter.[16] Between 45% and 96% of health care professionals in all phases of their medical education have a Facebook profile. In terms of the learning and teaching environment, Facebook is well accepted by medical students. It is used to prepare for exams, share online material, discuss clinical cases, organize face-to-face sessions and exchange information on clerkships.[8] Previous research has found that students tend to use Facebook for more informal learning, such as communicating with peers about course content.[17] This was later supported by Prescott et al (2013) that the use of social networking sites helps increase students informal learning; in particular their communication about course content.[18] Twitter offers the unique capability of allowing the user to peruse brief nuggets of information (provided by their own social network) and focus on topics of personal interest. In this way, Twitter offers a platform that can truly be tailored by the individual learner. A previous study reported that incorporating Twitter into traditional learning environments may promote student engagement.[5] The current study revealed frequencies of social media engagements and its association with better exam outcomes.

WhatsApp is very popular among medical students. The current study identified its highest engagement rate among all four studied social media (number of times participated = 63.07 ± 54.88 times). It also contributed the most to the better exam outcome. These findings go in line with a previous study which also revealed WhatsApp to be the most commonly used social media as 69% of the students ranked WhatsApp group activity high or above.[19] According to another previous study,[20] the ability to be able to quickly find and utilize resources, whilst simultaneously participating in an interactive group discussion on WhatsApp Messenger, posting images, documents and web page links that students find useful and wish to share is unique to the smartphone environment.

Table 6 Exam Score Pre- and Post-SM Integration, Mark Difference, and Number of Times the Students Participated in Different Social Media

	Number of Times Students Participated in SM Platforms				Exam Outcomes (Marks Obtained)		
	Facebook	**Edmodo**	**Twitter**	**WhatsApp**	**Before SM Integration**	**After SM Integration**	**Difference**
Mean	8.3462	8.7115	10.8269	63.0673	41.8558	50.8269	8.9712
Median	0.0000	0.0000	10.5000	47.0000	44.0000	52.0000	8.0000
SD	10.31614	10.51367	11.16552	54.88103	12.44204	12.49034	5.22774
Minimum	0.00	0.00	0.00	0.00	16.00	23.00	0.00
Maximum	31.00	31.00	38.00	193.00	70.00	76.00	26.00

Table 7 Relationship Between SM Using Frequencies and Exam Score Increase

Relationship Between		Corr. Coeff.	p-value
Exam Score Difference (post SM integration exam score – pre SM integration exam score)	Facebook Frequency	0.863	<0.001
	Edmodo Frequency	0.703	<0.001
	Twitter Frequency	0.767	<0.001
	WhatsApp Frequency	0.825	<0.001
	Total Frequency (Sum of all SM frequencies)	0.143	0.147

Table 8 True Frequency of SM Use, Percentage of SM Use and True Mark Increase After Each SM Use Based on Frequencies

SM Use	True Freq. of SM Use	Freq. in Percent Scale	Mark Increase (True Value)
Facebook	8.346154	9.176446	0.823233
Edmodo	8.711538	9.57818	0.859273
Twitter	10.82692	11.90401	1.067927
WhatsApp	63.06731	69.34137	6.220721
Sum of all SM	90.95192	100	8.971154

Edmodo is a free and secure learning platform designed by Jeff O' Hara and Nick Borg in 2008 for teachers, students, parents, and schools. Teachers have noted that Edmodo even strengthened the relationships between students and led to a stronger classroom community.[21] All the students in our current study participated in learning activities on Edmodo and it alone contributed to a 9.58% exam score increase.

After social media integration, the percent pass rate was observed among the examinees which was unprecedented in the history of the medical college in concern. Most importantly, none of the examinees scored fewer marks compared to students who took the exam before social media integration.

Both active and passive learners benefited from the discussions on social media platforms. However, one bad effect of social media integration observed in this study was fall in classroom attendance at a statistically significant level (p <0.001) from 15.46 ± 3.08 lecture classes to 15.03 ± 3.39 lecture classes. This might be due to the students being less dependent on the classroom lectures for receiving necessary information and course materials. Study time after classroom lectures was also reduced (from 2.83 ± 1.62 hrs to 2.79 ± 1.58 hrs), but this change was not at the level of statistical significance. Another drawback of using social media for medical learning may come from lack of e-professionalism among the participants. E-professionalism is defined as the attitudes and behaviors that reflect traditional professionalism paradigms but are manifested through digital media.[22] Much of the medical content is inappropriate for minors. Open-case discussion may promote anxiety and bad medical practice among the general population. Additionally, some medical professionals may find it difficult to determine boundaries between their personal and professional lives on social media.[23] In order to minimize these adverse effects, all the discussions for the current study were carried out in closed groups.

After extensive literature search, no previous local study was found that analyzed social media integration in medical education. Therefore, no direct comparison could be presented. One study carried out on Pakistani school students concluded social media to be a compulsory tool for the educationists as it can make education more engaging and ethnically diverse.[24] However, a social medium is not immune to its own harmful effects. A few limitations of the current studies were – single-centered study, relatively small sample size, and the study was concerned with pathology examination only. This study recommends further studies in this respect so that a proper and effective social media integration guideline can be established.

Conclusion

During the study, it has been observed that many students who never asked any question in the classroom became active and started asking questions on social media platforms. Social media gave them the voice or space to ask questions and to participate. Social media broke down the barriers and students communicated with confidence. Somehow it gave them security to participate. It also flattened the hierarchies as students had direct access to the senior faculty which ensured their access to credible knowledge.

Social media integration provided better examination outcomes for the students but at the same time, it decreased classroom attendance and study time after classroom lectures. Among the studied social media, WhatsApp was proven to be the most beneficial for the students. Social media can truly diversify the learning process and provide the students with a personalized and secure learning environment, anytime and anywhere. Today's net generation cannot stay disconnected from social media for any significant period of time. They frequently need it for their personal and professional life. Delivering high-quality educational contents in social media will constantly feed their brain. It also gives them the capability of instant information sharing, group discussion, and making new connections. However, overuse and unprofessional use of social media can be detrimental to the students and the general public. Educationist should work together to create a guideline regarding how social media can be incorporated in the education system in a more efficient way. Based on the results of the current study, an official WhatsApp number of every department, where students can directly ask the questions from faculty, may be recommended.

Disclosure

The authors report no conflicts of interest in this work.

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