# ORIGINAL ARTICLE
## Exploring the digital divide between medical students and medical teachers

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## ABSTRACT

**Background:** People from different generations can approach learning in varied ways. The medical students of today belong to Generation Z whereas the medical teachers belong to Generation X and the Baby Boomers generation. This difference may result in significant gaps in knowledge sharing across generational boundaries. This study delves into one aspect of this i.e. to compare the familiarity and use of Web 2.0 technologies in the aforementioned groups.

**Aim:** To exploring the digital divide between medical students and medical teachers

**Methods**: A digital divide of complex nature was found to exist between medical students and teachers. Both the groups were found reasonably well exposed to Web 2.0 technologies, though with different preferences. However, the teachers use these tools for educational purposes more often as compared to the students. In terms of similarities, the primary device used for accessing the internet by both groups was the smartphone, whereas for academic activities it was found to be the laptop. Both groups were found to be equally familiar with the use of YouTube.

**Results:** A total of 178 health care providers took part in our study. Among the respondents, 61.8% needed to improve their compliance of SSP; whereas 38.2% had good compliance. Regarding safety climate 55.6% had good safety climate of operative rooms (ORs) and 44.4% needed improvement. Regarding teamwork environment, 43.3% reported to have a good teamwork environment but 56.7% needed improvement.

Our study found a statistically significant association between safety climate of ORs and adoption of SSP ($p < 0.001$). A statistically significant association was also found between teamwork climate and compliance of SSP ($p < 0.001$).

**Conclusion:** Web 2.0 technologies have the potential to revolutionize medical education. This study has shown that this potential will only be achieved if medical students are encouraged to use these technologies for educational purposes. This requires increased training of both students and teachers in using technologies like YouTube for teaching and learning.

**Keywords**: Digital Divide, Web 2.0, Undergraduate Medical education, Medical students, Medical teachers, Generations Z, Internet

**Introduction:** Imagine a medical teacher presenting a complex topic from neuroanatomy for which she has shared some slides in advance in a Google Docs folder. The students are having trouble grasping the difference between grey and white matter. One of the students immediately searches online using her mobile phone and comes up with an article that augments the teacher's slide and clears the concept further. She then shares that article on the class WhatsApp (or similar) group. This helps the participants prepare for the Google Forms based quiz the instructor will administer later via her smart phone.

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This is what the modern educational process has the ability to achieve. However even though such challenges are faced by our medical colleges every day, the internet enabled (specifically Web 2.0) solution described above still escapes us. It is high time that our teaching approaches recognize that the new generation of students learns differently from previous generations (Prescott, 2014), and take into account the potential of technology like Web 2.0. A classification of some generational differences related to learning (Borges, Manuel, Elam, & Jones, 2010) are shown here in Table 1.

The medical students of today are Centennials or Generation Z (Forbes, 2015) or even the Internet Generation (iGen) (Rothman, 2014) as they were born and raised in a world where technology is a seamless part of their lives (Vogelsang, Rockenbauch, Wrigge, Heinke, & Hempel, 2018). Research has shown that the part of the brain responsible for complex visual imagery in them is far more developed than their predecessors (Rikhye, Cook, &

Berge, 2009). This makes visual forms of learning very effective for them (Cilliers, 2017). On the other hand, many of the medical teachers of today are Baby Boomers or belong to Generation X. These are dedicated and hard-working generations that prefer face-to-face interaction with the learners (Evans et al., 2016) and are not 'native' to technology in the same way. These differences can have a big impact on teaching and learning practices in a medical university. The idea that digital natives learn differently from digital immigrants was first given by Tapscott (Bossert, 1999) and Prensky (M. Prensky, 2009) (Marc. Prensky, 2012).

The emergence of Web 2.0 (a term coined by Darci DiNucci in 1999) has made it possible to bridge this gap by dramatically enhancing the user interface of Web tools (S. Wheeler; Boulos, 2007). Web 2.0 refers to bidirectional communication on the Web and the growth of social interaction (Cormode & Krishnamurthy, 2008). Content is now being generated by the users themselves. Some examples of Web 2.0 are platforms like Wikipedia, forums and blogs like Mashable and WordPress, social networking sites like Facebook and Instagram, richer content sharing websites like YouTube and communication apps like WhatsApp etc.

The integration of some Web 2.0 tools can help to enrich the learning process significantly, as depicted in the scenario in the beginning. Such a model would enable the students to take control of their own learning, in line with their generational preferences, as well as inspire collaborative work. It can also make the teacher's job easier. While studies have examined the differences in the familiarity and use of Web 2.0 tools between students and teachers in other countries, the current study aims to fill this data gap in the medical education context for Pakistan. This will help our medical educationists understand the extent and nature of the digital divide between these generations here.

Using the findings from this research, Pakistani medical educationists can plan arenas for faculty development and specific tools suited to our students and teachers. Bridging this digital divide can help make teaching and learning effective.

**Methods:** The study was carried out using 128 medical students and 63 medical teachers at Foundation University Medical College, Rawalpindi, Pakistan during the time period between October to December 2019. It is a reputable medical institute where the students spend the first two years studying basic sciences and the last three years studying clinical sciences. The sample comprised of both students and teachers and the sample size was calculated using the sample size calculator from OpenEpi.

A quantitative questionnaire was used for data collection. The questionnaire was developed after identifying similar studies. In particular, the instrument used by Dr. Hafiz Zakaria in a similar study on Malaysian students was found to be relevant (Zakaria, Watson, & Edwards, 2010). The author was contacted, and the consent was taken to use the instrument. Furthermore, studies by EDUCAUSE Center for Applied Research and Cooperative Institutional Research Program (Caruso, 2004), Pew Internet and American Life Project (Kennedy, Dalgarno, Gray, Judd, & Waycott, 2007) and Shakeel Iqbal et al (Iqbal, Khan, & Malik, 2017) were consulted to develop the questionnaire. The modified questionnaire was sent to five experts for content validation and modifications were made accordingly.

The final questionnaire consisted of 33 items divided in four sections. The first section concerned demographics of the participants. Second and third sections were to understand their familiarity and current usage of Web 2.0 platforms respectively. The last section comprised questions regarding the participants' attitude towards teaching (for teachers) and learning (for students) respectively. A brief introduction of Web 2.0 was given at the start of the questionnaire to help the participants understand the term.

Ethical approval was obtained from the Ethics Review Committee of Riphah International University. The study was conducted in the time period between Oct 20, 2019 and Dec 15, 2019 at Foundation University Medical College, Rawalpindi. Data was collected via anonymous paper-based survey which was distributed to 128 students and 72 teachers. The response rate for the students was 100% since the questionnaires were distributed and collected by teachers and module-coordinators at the end of their classes. However, 9 out of 72 teachers did not fill out the survey form. The data obtained was analyzed using SPSS version 21.

**Results:** The sample used in this study comprised 82 (64%) pre-clinical and 46 (36%) clinical sciences students. The teachers comprised 37 (59%) pre-clinical and 26 (41%) from clinical sciences. The number of females was higher in both the samples. Table 2 summarizes the demographic variables of the sample.

Knowledge of Web 2.0 section aimed to measure uses of the internet by the students. The results showed that most of the students ranked 'entertainment' as their top use for the internet. On the other hand, most of the teachers ranked 'socializing with friends' as their top use for the Internet. The percentage of teachers who used the internet for academic purposes was found to be more as compared with the students.

Most of the students and all of the teachers had a smartphone. Furthermore, it was found to be the primary device by which both students and teachers accessed internet. The primary device used for academic activities like Word Processing and making

presentations was found to be laptop for both students and teachers (see Figure 3). Moreover, an almost equal percentage of students and teachers were frequent (more than once a day) users of YouTube. On the other hand, a greater percentage of students compared with teachers were well versed with Wikipedia and Blogging. The detailed account of the use of Web 2.0 tools by both students and teachers is given in Table 3.

Attitude towards teaching/learning aimed to find out the preference of students and teachers towards teaching and learning in terms of six dimensions given in table 4. The findings from this section showed that most of the students opted doing their own research to clear their concepts, compared with the teachers, according to whom asking questions directly from the teacher is the most effective in clearing the students' concepts. A significant difference was found in students' and teachers' views of effective feedback practices, with the students favoring feedback given during class and online, whereas the teachers favoring giving feedback in their offices.

Table 1: Salient characteristics of generational learners (Evans, Ozdalga, & Ahuja, 2016)

| Generation | Born between | Learning style attributes |
|---|---|---|
| Baby Boomers | 1946-1964 | Study on their own, use reference books, interactive lectures, quizzes. Prefer face-to-face interaction with learners, yet often correspond via e-mail. |
| Generation X | 1965-1976 | Assessment-driven learning, participate in study groups, <br><br> Use interactive didactic teaching strategies and provide web-based resources for independent learning, actively provide feedback for learners. |
| Generation Y | 1977-1995 | Variety of styles: visual, auditory, and kinesthetic. Prefer small group learning. Use social media to share information and better comprehend concepts. |
| Centennials/ Generation Z | 1996-2015 | Pragmatic, want to be a part of the learning process |

Table 2: Demographics of the sample

| Variables | | Students | Teachers |
|---|---|---|---|
| Number | Pre-Clinical | 82 (64%) | 37 (59%) |
| | Clinical | 46 (36%) | 26 (41%) |
| Gender | Females | 34 (26%) | 44 (69%) |
| | Males | 94 (74%) | 19 (31%) |
| Mean Age | Pre-Clinical Students | 19.2 yrs. | <30yrs      38% |
| | Clinical Students | 21.4 yrs. | 30-40 yrs.   36% |
| | | | 40-50 yrs.   24% |
| | | | >50 yrs.      2% |

Table 3: Distribution of students and teachers with frequent use of Web 2.0 Tools

| No. | Web 2.0 Tools | Use of Web 2.0 tools more than once a day | |
| --- | --- | --- | --- |
| | | Teachers (%) | Students (%) |
| 1. | Word Processing | 15.8 | 7.1 |
| 2. | Web Presentations | 10.5 | 2.1 |
| 3. | Facebook | 57.9 | 87.4 |
| 4. | Instagram | 31.6 | 64.7 |
| 5. | Snapchat | 26.3 | 51.5 |
| 6. | Reading/Writing Blogs | 5.3 | 32.7 |
| 7. | Wikipedia | 26.3 | 48.8 |
| 8. | WhatsApp | 71.2 | 95.9 |
| 9. | YouTube | 95.9 | 91.7 |

Table 4: Distribution of Students and Teachers with their attitude towards teaching and learning

| No. | Constructs related to teaching/learning | Items | Attitude towards Teaching/Learning | |
| --- | --- | --- | --- | --- |
| | | | Teachers (%) | Students (%) |
| 1. | Best teaching/learning | Physically in classroom | 73.7 | 45.1 |
| | | Students ask questions | 47.4 | 49.4 |
| | | Students work at own pace | 26.3 | 61.3 |
| 2. | Clearing concepts effectively | Ask questions from teacher | 68.4 | 31.1 |
| | | Peer discussion | 31.6 | 44.2 |
| | | Research | 42.1 | 67.8 |
| 3. | Best research and study | Conducted by teacher | 36.8 | 31.7 |
| | | Teacher as a facilitator | 47.4 | 53.9 |
| | | Informal, collaborative | 31.6 | 45.1 |
| 4. | Useful Peer discussions | Using class notes only | 21.1 | 21.8 |
| | | Using external sources also | 42.1 | 43.6 |
| | | Discussion board | 26.3 | 30.5 |
| 5. | Best class engagement | Didactic lecture | 53.7 | 25.8 |
| | | Interactive lecture | 35.3 | 59.3 |
| | | Freedom to study at own pace | 5.8 | 45.4 |
| 6. | Good feedback practice | During class | 47.4 | 37.2 |
| | | In faculty office | 26.3 | 9.8 |
| | | Online | 31.6 | 30.1 |

Figure 1: The process of developing questionnaire for the study

Anal ze instruments used in revious similar studies

| y | | p | |
|---|---|---|---|
| Zakaria et al (2010) | Caruso et al (2004) | Kennedy et al (2007) | S. Iqbal et al (2017) |

Identify survey constructs and items → Develop questionnaire → Conduct expert validation

Enter data into SPSS, analyze results ← Administer questionnaire ← Refine items
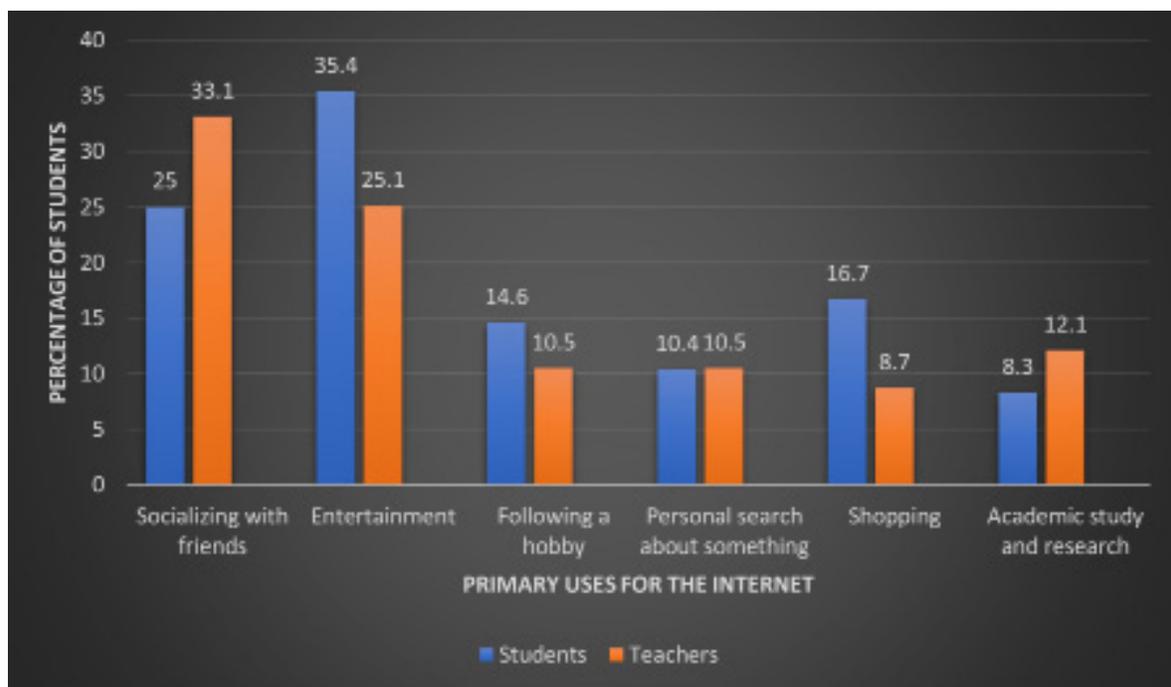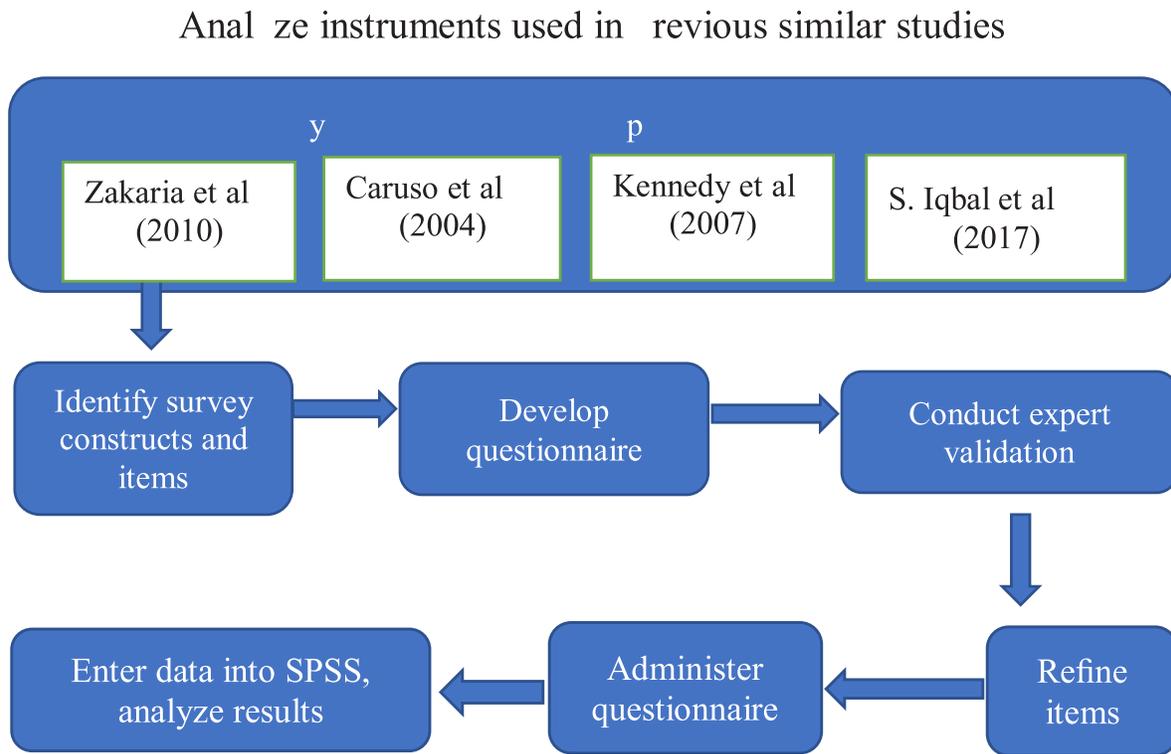


Figure 2: Distribution of students and teachers with their primary uses for the Internet
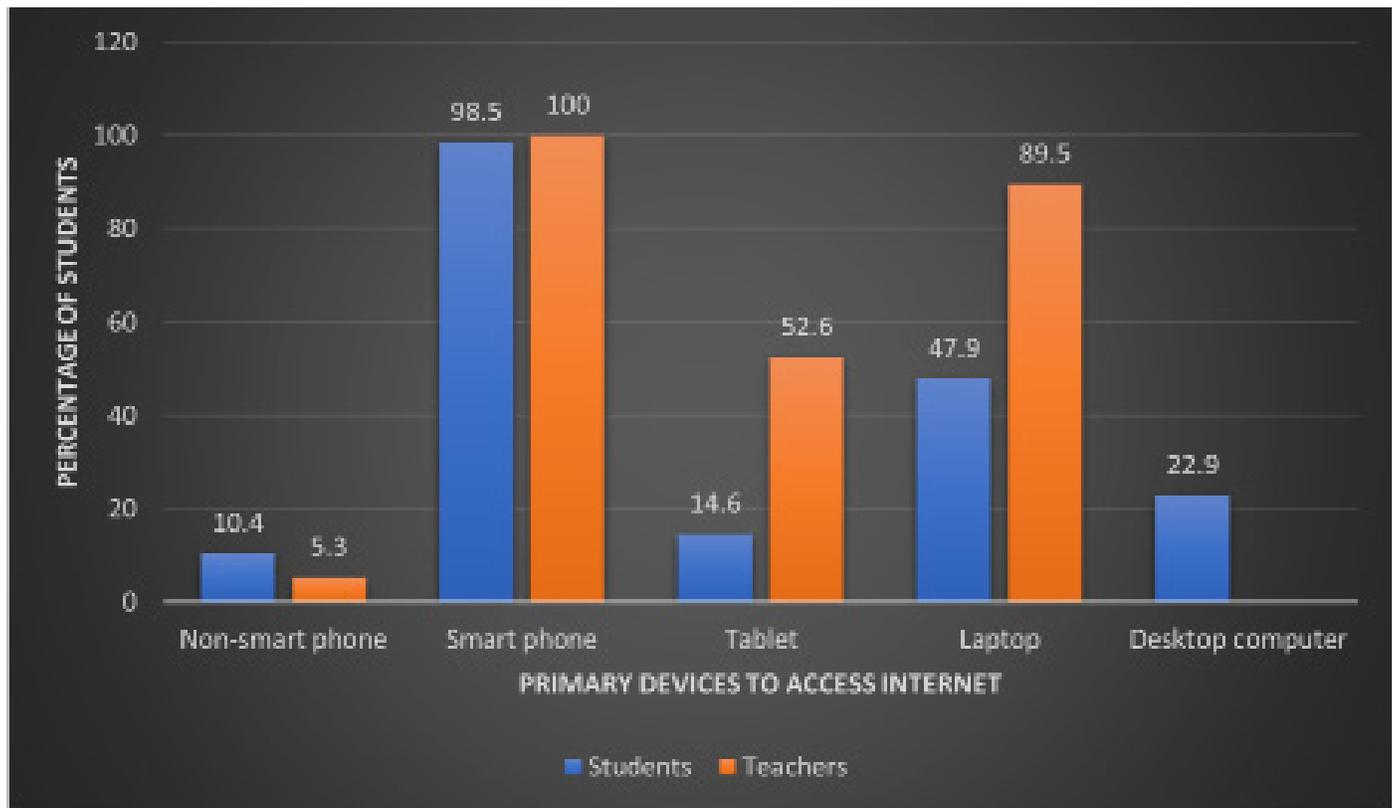
Figure 3: Distribution of students and teachers with the type of primary device to access the internet

**Discussion:** There is a paucity of literature about the use of Web 2.0 tools by the current student and teacher generations in medical education, especially in developing countries like Pakistan. In this study, the researcher provides a comprehensive assessment of the familiarity and use of these media by undergraduate medical students and teachers in a genuine educational setting using a quantitative questionnaire.

The survey has identified that for both the groups, there is overall high familiarity with Web 2.0 technologies, but less actual use for academic purposes. Medical students have both greater familiarity and use of Web 2.0 technologies, especially social media, Blogging, Wikipedia and WhatsApp. Meanwhile the use of Word Processing and Web Presentations was found to be higher in the teachers.

The results of this study revealed that most of the students and teachers used these tools primarily for entertainment and socializing with friends. The students were found to have much more presence on social networking sites compared to teachers while teachers had higher usage of Web 2.0 tools for academic and research purposes. These results are consistent with the results of a study by El Biali and Jalali (El Bialy & Jalali, 2015) which showed that the main use of social networking sites by the medical students was to chat with friends, whereas their main use by the medical teachers was to post videos and explanatory comments. Furthermore, it correlates with a study conducted in

the UK by Sandars and Schroter which found more use of Internet based tools for personal compared to educational purposes by undergraduate medical students (Sandars & Schroter, 2007). This study also identified the barriers to the use of technology for educational purposes, with learning preferences and concerns about quality of resources at the top. These studies show that social networking sites can be an effective platform to enhance teaching and learning of medical students.

The primary device to access the Internet was found to be a smart phone for both students and teachers, which almost all of them possessed. The study also found a distinction in the way different devices are used. As an example, smartphones were more likely to be used for entertainment and personal use while laptops were the devices more frequently used for educational purposes. Moreover, more teachers owned a laptop than the students. Similar studies by Gutman et al. in Germany (Gutmann et al., 2015) and Farooq Al-Tameemi in UAE (Al-Tameemy, 2017) showed high prevalence and acceptance of mobile phones in undergraduate medical students. Moreover, another study done by Iqbal et al.(Iqbal, Khan, & Malik, 2017) concluded that smartphones were the most suitable device for m-learning in undergraduate medical students as most of them possessed one and were well-familiar with its use.

Another difference in the use of technology by the students and teachers was found regarding Blogs and Wikipedia. The students

were found to be more familiar with the use of these tools. These findings are consistent with an online survey conducted in the UK by Sandars and Schroter (Sandars & Schroter, 2007). According to the findings of their study, medical students were much more familiar with blogs and Wikis compared to their teachers. Moreover, a study by Dolan showed that more students (40%) were in favor of using blogs for educational purposes compared to teachers (29%) (Dolan, 2016). By making a direct comparison between the results of this study with other similar studies, it is convincingly clear that Pakistani students are already exposed to various types of Web 2.0 tools. They have indicated a comfortable level with the use of these tools and can benefit from incorporating them in their learning.

Yet another important finding of this study was the equal familiarity and use of YouTube by both the groups. This result is consistent with the result of a UK based study by Stephanie Vie according to which majority of students and teachers were quite well-versed with the use of YouTube (Vie, 2008). This is significant as YouTube can be employed as a highly effective platform to enhance teaching and learning.

These finding have implications in student-support services and staff development. Flexible and varied approaches should be adopted to incorporate technology to enhance teaching and learning of undergraduate medical students. The use of smartphones for teaching and learning can be encouraged by having applications developed that correspond to the educational needs of students. The students could be given more autonomy to study and research at their own pace, suiting their generational learning preferences by online assignments and discussion boards. Blogs and Wikis can be used to facilitate further learning, as recommended by (Sandars, 2006). A WhatsApp group can be helpful where the students and teachers can share online links and clear their concepts regarding different disciplines. Similarly, a closed (for privacy, seriousness) Facebook community involving both the students and teachers can greatly enhance the whole process. Bahner et al have given some practical suggestions to incorporate social media into education (Bahner et al., 2012). Moreover, both students and teachers need to be trained for effective use of these media.

Our sample comprised of mostly females, hence an analysis of gender differences in familiarity and use of Web 2.0 could not be done. It would be useful to have future studies with larger representative samples, so that a comparison of the genders can be made. Moreover, the age group less than 50 years was under-represented in the teachers' sample. The results could be biased due to this disposition in the sample. Furthermore, the results of the study cannot be generalized to the whole Pakistani medical schools, being a single-centered study, it is limited to only one institute. Multi-center studies of similar nature can prove fruitful in obtaining generalizable results. The instrument developed and used in this study was not piloted to a representative sample. Similar future studies with piloting of the instrument can help in establishing the validity of the questionnaire.

**Conclusion:** The study has identified a digital divide of complex nature between the two generations. The students and teachers differed in their access and use of technology, but this difference is not straight-forward. The students are not always more digitally oriented than the teachers as the teachers have more access to personal sophisticated devices like laptops and are well-versed with the use of technology, especially regarding educational purposes like Word Processing and Web Presentations. On the other hand, the students' use of these technologies was found to be more oriented towards entertainment and socializing like Facebook, Instagram, Snapchat, WhatsApp and Blogging. However, it was also found that both the groups had the same degree of familiarity and use of YouTube.

In short, Web 2.0 technologies have the potential to revolutionize medical education. However, this potential will only be achieved if there is increased training of both students and teachers in how to use these technologies to enhance teaching and learning.

**Declaration of interest:**

The authors report no conflict of interest.

**Author's contribution:**

- Mashaal Sabqat: Conception and design of the work; & the acquisition, analysis, & interpretation of data for the work.

- Rehan Ahmed Khan: Critical Review and final approval of the version to be published

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