Article

The Usability of WeChat as a Mobile and Interactive Medium in Student-Centered Medical Teaching

Juan Wang
Furong Gao
Jiao Li
Jieping Zhang
Siguang Li
Guo-tong Xu
Lei Xu
Jianjun Chen
Lixia Lu*

From the Department of Regenerative Medicine, Tongji University School of Medicine, Shanghai, China

Biochemistry and cellular biology courses for medical students at Tongji University include the assessment that provides students with feedback to enhance their learning, which is a type of formative assessment. However, frequent instant feedback and guidance for students is often absent or inconsistently included in the teaching process. WeChat, the most popular Chinese social media, was introduced in biochemistry and cellular biology course. A WeChat official account (OA) was set up as an instant interactive platform. Over a period of two semesters, OA sent 73 push notifications. The components included course notices, preclass thought questions, after-class study materials, answer questions and feedback, simulation exercises, teacher–student interaction, and research progress relevant to the course. WeChat OA served as an active-learning teaching tool, provided more frequent feedback and guidance to students, and facilitated better student-centered communication in the teaching process. Using the WeChat OA in medical teaching emphasized interactive, interoperable, effective, engaging, adaptable, and more participatory teaching styles. As a new platform, WeChat OA was free, Internet-reliant, and easily managed. Using this new medium as a communication tool accelerated further advancement of instant feedback and improvement in teaching activities. Notifications and interactive feedback via the mobile social medium WeChat OA anytime and anywhere facilitated a student-centered teaching mode. Use of WeChat OA significantly increased the proportion of students interactively participating and resulted in a high degree of student satisfaction.
© 2017 by The International Union of Biochemistry and Molecular Biology, 00:000–000, 2017.

Keywords: *WeChat; student-centered; biochemistry and cellular biology course; medical education*

Introduction

The use of mobile interactive media such as smartphones and tablets by college students is rapidly increasing because these media are portable and instantly accessible [1]. Several medical education applications (apps) have recently become available [2–4]. However, research regarding the application and impact of these apps on college course teaching and learning is limited, especially for free or low-cost apps.

The biochemistry and cellular biology course designed for medical students at Tongji University School of Medicine integrates basic knowledge of cellular biology, biochemistry, molecular biology, and molecular genetics disciplines. This new integration-based curriculum system was implemented in 2010, and much attention has been paid to student assessment [5]. Assessment that provides students with feedback to enhance their learning (formative assessment) is performed in a spirit of "assessment for learning" rather than "assessment of learning" [6]. By providing frequent feedback and guidance to students, formative assessment has positive effects on learning and performance [7]. To facilitate self-regulated learning and informed self-assessment, instant and cost-free social medium was applied in a biochemistry and cellular biology course for a trial period of two semesters.

WeChat is one of the fastest growing mobile apps in China, with over 697 million currently active user accounts

Volume 00, Number 00, Month/Month 2017, Pages 00–00
**To whom correspondence should be addressed. Tel.: +86-21-6598-8562. E-mail: lulixia@tongji.edu.cn.*
Grant sponsor: 2015–2016 Tongji University teaching reform research and construction project; Grant number: 1500104117.
Received 10 October 2016; Revised 9 April 2017; Accepted 21 April 2017
DOI 10.1002/bmb.21065
Published online 00 Month 2017 in Wiley Online Library (wileyonlinelibrary.com)

according to a report by Tencent Inc. [8], who provided the WeChat platform, and it is the most popular platform visited daily by university students in China [9]. Every student in Tongji University School of Medicine uses WeChat according to our findings, so we can take advantage of WeChat instead of developing high-cost teaching apps. WeChat has great potential as an interactive platform for teaching–learning communication and providing formative assessment in teaching process.

The WeChat official account (OA) admin platform is an important function in WeChat and is a cooperation and promotion service launched for specified people or organizations. We set up a WeChat OA for biochemistry and cellular biology course teaching use as a verified Chinese service account. After subscribing to this OA, students could receive push messages on mobile smartphones or tablets, which are "pushed" to subscriber with no need to do anything and just receive it. The purpose of this article is to describe and qualitatively analyze a two-semester-long trial of WeChat as an instant interactive social media platform, focusing on its advantages for better student-centered teaching–learning communication.

Design and Implementation

The Teaching Mode of WeChat Combined with Course Teaching

Throughout the autumn and spring semesters of a biochemistry and cellular biology course, WeChat OA sent total 73 push notifications in seven classifications (Fig. 1*A*).

Twelve push notifications in the "course notice" classification delivered announcements about the course. For example, "the schedule for last experimental class is plasmid extraction and cell protein preparation."

Twelve push notifications in the "pre-class thought questions" classification provided students with questions related to class context before class. For example, "How can weight-reducing medicine reduce weight?" was sent before learning about "lipid metabolism." "How do animals maintain body temperature during hibernation?" was given before learning about "biological oxidation."

Twenty-two push notifications in the "after-class study materials" classification provided students with Power Point slides and other teaching materials used in lectures to help them review after class. For example, "video-How to analyses real-time PCR result?" was given after real-time PCR experiment class. Teachers also provided Chinese and English word lists to facilitate learning Medical English.

Six push notifications in the "answer question and feedback" classification were used for online questions with answers after the end of the course. These questions were especially critical for students taking the MOOC online course (http://mooc1.chaoxing.com/course/934026.html).

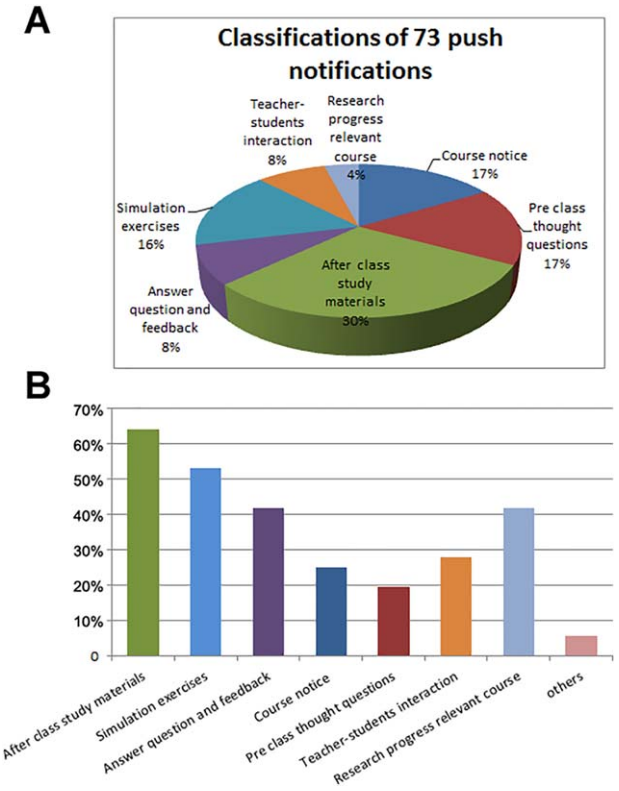

FIG 1

WeChat OA sent seventy-three push notifications over two semesters. *(A) Classifications of the 73 push notifications and (B) Students' feedback to the question "Which aspects need to be improved in this WeChat OA?" in the questionnaire survey. Y axis: the percentage of students who gave answers listed in X axis. [Color figure can be viewed at wileyonlinelibrary.com]*

Twelve push notifications in the "Simulation exercises" classification provided practice tests before final examinations to help students prepare for examination. Simulation exercise questions were multiple choice questions selected from question banks in the curriculum (with more than 500 questions available) and mimicked final examination questions. For each question, a list of answers was given and students need to choose the correct one. For example, "Among the following signaling systems, whose receptor can be self-phosphorylated? A, guanylate cyclase system; B, tyrosine protein kinase system; C, adenylate cyclase system; D, inositol phospholipid system; E, G-protein-coupled system." The next day, a brief explanation of the simulation exercises was released to students.

Six push notifications in the "teacher–student interaction" classification included questionnaire surveys to better understand the evaluation and needs from students. Sojump online survey software was used. After creating and publishing the online surveys with Sojump in only a few minutes, the questionnaire survey was published in WeChat OA to involve students and deploy the survey

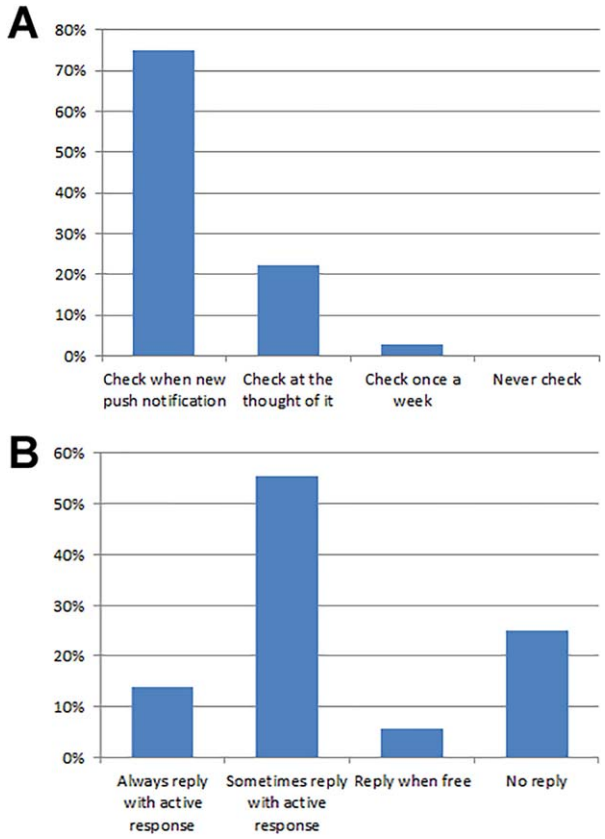

FIG 2

Frequent WeChat OA push notifications stimulated active learning and effective feedback. (A) Students' feedback to the question "How often do you check and read the push notifications?" in the questionnaire survey. (B) Students' feedback to the question "How do you act after a push notification is received?" in the questionnaire survey. Y *axis: the percentage of students who gave answers listed in* X *axis. [Color figure can be viewed at wileyonlinelibrary.com]*

efficiently. A wide range of responses could be collected and the results could be viewed graphically and in real time and analyzed statistically.

Three push notifications in the "Research progress" classification provided the latest scientific research relevant the course to stimulate interest in learning. For example, the magical world of cells was demystified with fancy pictures when cellular structure was taught. A case report on hyperlipemia and xanthoma was given when lipid metabolism was taught.

Students' Assessment

To qualitatively analyze the impact of WeChat on promoting interactive learning, student evaluation surveys were used as the main assessment. In addition, interviews with several students and group discussion approaches provided first-hand feedback and true voices of students [10]. In response to the WeChat, question "Which aspect of this WeChat OA needs improvement?" in the questionnaire survey, the four most common answers were: after-class study materials (63.89%), simulation exercises (52.78%), answer question and feedback (41.67%), and research progress relevant to the course (41.67%) (Fig. 1*B*). These data were in accordance with current numbers of students.

Scores in biochemistry and cellular biology course examination would be another strong outcome measurement. First, we compared students' final score from last year and this year, which is without and with WeChat OA application. The average score of the final examination was 81.5 before WeChat application and it promoted to 83.3 after the application. The result of the analysis by t test on the two groups showed that WeChat medium usability can cause a significant increase in scores in the biochemistry and cellular biology course final examination ($p < 0.01$). Comparison of final score between students who feed back to WeChat and those who ignore WeChat gave us a more interesting result. The students data came from "always replay with active response" students and "no reply" students in Fig. 2*B*. The average score of the final examination was 84.7 in "always replay with active response" students and 81.9 in "no reply" students ($p < 0.01$). Even in the same year and received the same classroom teaching, student who gave effective feedbacks to WeChat OA achieved a significant increase in scores in the biochemistry and cellular biology course final examination.

Advantages of this Teaching Model

Active Learning

By combining standard classroom education with delivery of interactive information via WeChat, students could learn actively at any time, both before and after class. Based on survey feedback, students checked and read with a frequency of 75% when there was a new unread push notification, 22.22% checked when they thought of it and at nonfixed frequency, and 2.78% students arranged to check notifications once a week. No students ignored the push message (Fig. 2*A*).

Effective Feedbacks

Frequent notifications allowed for periodic contact with students, which encouraged students' feedback about the course and promoted student–student and student–teacher interactions. According to the survey questionnaire, after a push notification was received, 13.89% of students always replied with active responses, 55.56% of students replied with low frequency, and 5.56% of students replied when they were free. Together, 75% of students gave effective feedback using WeChat OA (Fig. 2*B*). The feedback about classroom teaching was always positive, but students would sometimes comment on teachers or class context. Teachers adjusted in response to the most frequently received feedback.

More Teamwork

Teamwork was encouraged by WeChat with a variety of class activities beyond lectures. For example, thought questions, case files, and research-related materials which would be used for in-class learning were published 1 or 2 days before class. To prepare for this in the limited time frame, students worked in cooperative groups and incorporated ongoing assessment. A move from students studying separately to studying in groups for particular questions is beneficial, as individuals are more likely to learn effectively when they work with others than when working alone [11]. In class, the students who worked in teams performed better and displayed enhanced creative thinking skills [12].

Convenient for International Students

Lots of international students are not native Chinese speakers. They frequently have only 1–2 years of Chinese education and may not completely understand the teacher in the classroom. WeChat OA usage was especially important for them for push notifications in written form and the messages staying in mobile phones, which was very convenient for students to understand and not miss a single message.

Limitations of this Teaching Model

Lower Reliance on Classroom Attendance

Students could use WeChat as a checklist to make sure they complete the recommended study materials and notifications for each class and test and as a reference to determine if their presence in the classroom is needed.

Open Comments Privacy

"Leave message" comment function in WeChat OA encouraged users discuss the theme and promoted student–student and student–teacher interactions. To our question "Do you reply or leave comments on push notifications by WeChat OA?" in the survey questionnaire, 75% of students used the leave comments function to interact with their peers or teachers (Fig. 3*A*). Students gave feedback through the public "leave message" function in OA and the feedback was rapidly distributed to all users, but this was open and not private.

There is another "private leaving feedback" function only to the OA administrator, but these are kept open for only 72 h and are not saved. Therefore, the OA administrators could not reply to messages left more than 72 h ago and might miss the interaction.

More Expectation for Interaction

Additionally, students had increased expectations of instant and quick interactions with teacher and peer groups since WeChat OA was implemented. In response to the question, "How can improve WeChat push notifications?" in the survey questionnaire, the most frequent answer was interaction (chosen by 38.89% of students) (Fig. 3*B*).

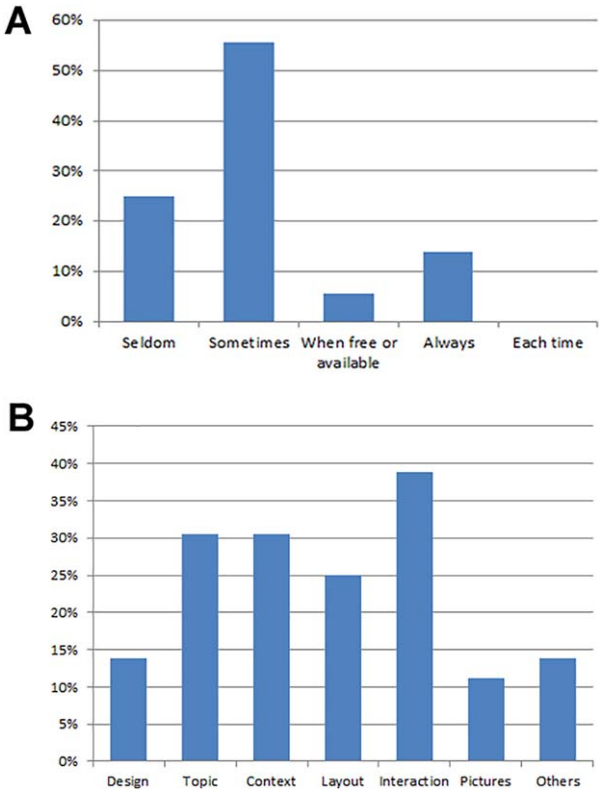

FIG 3

Frequent WeChat OA push notifications caused a privacy problem in comments and increased expectation of interaction in students. (A) Students' feedback to the question "Do you reply or leave comments on push notifications?" in the questionnaire survey. (B) Students' feedback to the question "How can we improve WeChat push notifications?" in the questionnaire survey. Y axis: the percentage of students who gave answers listed in X axis. [Color figure can be viewed at wileyonlinelibrary.com]

We tried to improve the current status of interaction opportunities and occasions in and out of class. For example, we set several WeChat groups for group discussion. Additionally, students were requested to avoid posting teaching and medical case materials on the Internet outside of their WeChat group. To discuss specific items, students could meet with the teacher from their WeChat group one-on-one in their office at an appointed time.

Conclusion

Here, we describe an active instruction delivery method using the mobile social media platform WeChat OA in medical teaching. As a new platform, WeChat OA is free, Internet-reliant and easily background managed. It emphasizes interactive, interoperable, effective, engaging, adaptable, and more participatory teaching styles. Using this new medium as a communication tool will accelerate further advancement of instant feedback and improvement in teaching activities.

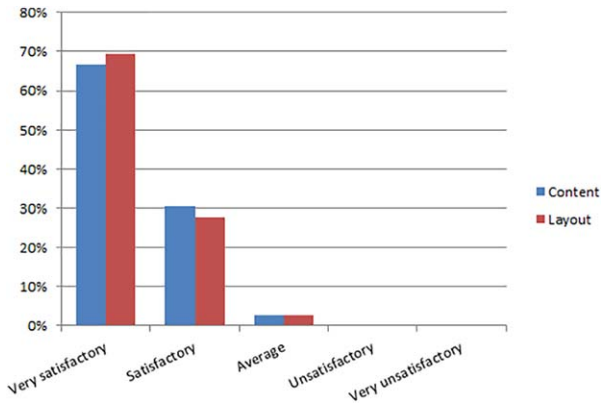

FIG 4

Students' feedback to the questions "How satisfied are you with the content of our WeChat OA push notifications?" and "How satisfied are you with the layout of our WeChat OA push notifications?" in the questionnaire survey. Y *axis: the percentage of students who gave answers listed in* X *axis. [Color figure can be viewed at wileyonlinelibrary.com]*

WeChat acts as an active-learning teaching method to move from face-to-face teaching in the classroom to more student-centered learning. Active-learning pedagogies are much more effective for information delivery than lectures. Additionally, active participation of students facilitates cooperative group work and incorporates ongoing assessment of conceptual understanding to provide feedback to both students and instructors [13].

Students were successful in preparing for and reviewing their lessons using WeChat OA instruction and were satisfied with this experience at the end of the process. The impact was assessed via a student evaluation survey, interviews with several students, group discussion approaches, and scores in biochemistry and cellular biology course examination (last year without WeChat OA application vs this year with WeChat OA application, and students who feed back to WeChat and those who ignore WeChat). The feedback from students about the approach used was excellent. To our question "How satisfied are you with the content of our WeChat OA push notifications?" 97.22% of users replied "very satisfactory" or "satisfactory." To the question "How satisfied are you with the layout of our WeChat OA push notifications?" 97.22% of users chose "very satisfactory" or "satisfactory" (Fig. 4). We were satisfied with this evaluation from the students.

We believe that with the successful development and usage of WeChat OA, apps and other mobile interactive media to facilitate a move from classroom education to the platform of smart phones can be effectively applied in medical education.

CONFLICT OF INTEREST

The author declares that there are no conflicts of interest.

REFERENCES

[1] Wang, J., Wang, Y., Wei, C., Yao, N. A., Yuan, A., Shan, Y., and Yuan, C. (2014) Smartphone interventions for long-term health management of chronic diseases: An integrative review. Telemed J E Health 20, 570–583.

[2] VonHoltz, L. A., Hypolite, K. A., Carr, B. G., Shofer, F. S., Winston, F. K., Hanson, C. W., 3rd., and Merchant, R. M. (2015) Use of mobile apps: A patient-centered approach. Acad Emerg Med 22, 765–768.

[3] Dimitrov, D. V. (2016) Medical internet of things and big data in healthcare. Healthc Inform Res 22, 156–163.

[4] Diamond, R. (2016) There's an app for that: Benefits and risks of using mobile apps for healthcare. Mich Med 115, 26–27.

[5] Jiao, L., Xiujuan, S., Juan, W., Song, J., Lei, X., Guotong, X., and Lixia, L. (2014) Comprehensive experiment-clinical biochemistry: Determination of blood glucose and triglycerides in normal and diabetic rats. Biochem Mol Biol Educ 43, 47–51.

[6] Schuwirth, L. W., and Van der Vleuten, C. P. (2011) Programmatic assessment: From assessment of learning to assessment for learning. Med Teach 33, 478–485.

[7] Jain, V., Agrawal, V., and Biswas, S. (2012) Use of formative assessment as an educational tool. J Ayub Med Coll Abbottabad 24, 68–70.

[8] Zeng, F., Deng, G., Wang, Z., and Liu, L. (2016) WeChat: A new clinical teaching tool for problem-based learning. Int J Med Educ 7, 119–121.

[9] Sun, Z. J., Zhu, L., Liang, M., Xu, T., and Lang, J. H. (2016) The usability of a WeChat-based electronic questionnaire for collecting participant-reported data in female pelvic floor disorders: A comparison with the traditional paper-administered format. Menopause 23, 856–862.

[10] Haji, F., Morin, M. P., and Parker, K. (2013) Rethinking programme evaluation in health professions education: Beyond 'did it work?'. Med Educ 47, 342–351.

[11] Modell, H. I. (2000) How to help students understand physiology? Emphasize general models. Adv Physiol Educ 23, 101–107.

[12] Krontiris-Litowitz, J. (2003) Using manipulatives to improve learning in the undergraduate neurophysiology curriculum. Adv Physiol Educ 27, 109–119.

[13] Connell, G. L., Donovan, D. A., and Chambers, T. G. (2016) Increasing the use of student-centered pedagogies from moderate to high improves student learning and attitudes about biology. CBE Life Sci Educ 15, ar3.