Facebook as a Learning Space: An Analysis from a Community of Practice Perspective

Sitti Maesuri Patahuddin
University of Canberra
<Sitti.Patahuddin@canberra.edu.au>

Tracy Logan
University of Canberra
<Tracy.Logan@canberra.edu.au>

This study investigates the potential of Facebook as a medium and process for teachers' learning about mathematical and pedagogical knowledge. Participants' (N=117) responses towards four inter-related posts regarding division-of-fractions were captured and systematically analysed to gain insight about the participants' engagement. The results suggested the potential of Facebook to support informal teachers' learning. This was evidenced by the existence of the three main elements of community of practice (CoP): mutual engagement; negotiated joint enterprise; and development of a shared repertoire.

> Until the education community comes up with a formal means of professional development that is free, user friendly, and timely, Facebook teacher groups and similar forms of social media should be seen as an effective supplement to traditional teacher professional development (Rutherford, 2010, p. 69).

The citation above reflects the awareness of the educational potential of Facebook (FB). In fact, FB has become one of the most prominent social network sites, having 1.35 billion monthly active users worldwide as of September 2014 (Facebook, 2015). Furthermore, FB has been an object of research since 2005, one year after FB was created. Four review papers by Hew (2011), Aydin (2012), Nadkarni and Hofmann (2012), and Manca and Ranieri (2013) together informed us of; the effects of FB usage, students' attitude towards FB, educational aspects of FB, reasons for people using FB (e.g., FB as a part of a formal learning environment), and "the extent to which its pedagogical potential is actually translated into practice" (Manca & Ranieri, 2013, p. 487). Manca and Ranieri concluded "pedagogical affordances of FB have only been partially implemented and that there are still many obstacles that may prevent a full adoption of FB as a learning environment such as implicit institutional, teacher and student pedagogies, and cultural issues" (p. 487). These reviews suggest that studies on FB within the domain of mathematics education are sparse. Despite FB's popularity, most FB studies (through surveys) have not explored its potential for teachers' learning in mathematics or mathematics pedagogy.

In addition, four main studies were found that specifically highlighted FB and teacher professional development (Bissessar, 2014; Goodyear, Casey, & Kirk, 2014; Ranieri, Manca, & Fini, 2012; Rutherford, 2010). All suggested that further exploration in this area was warranted. We found no studies that specifically focused on the use of FB and teachers' mathematics learning. Therefore, there is a need to gain insight on teachers' learning through FB by analysing data from their authentic conversations about mathematics or mathematics pedagogy. This study will provide additional understanding of the potential of FB as a space and process for teacher professional development on an informal basis. This is neither a survey-based research nor an experimental design. This was not designed as a formal professional learning site. The researcher was not a teacher trainer or part of the Government body. Rather the results of this study are from simply, a part of life activities where the researcher routinely shared ideas, opinions, photographs, and web links. Therefore, we argue that FB used in this study is considered an informal site for learning. This paper considered how the FB environment contributed to a sociocultural

2015. In M. Marshman, V. Geiger, & A. Bennison (Eds.). *Mathematics education in the margins* (Proceedings of the 38th annual conference of the Mathematics Education Research Group of Australasia), pp. 485–492. Sunshine Coast: MERGA.

approach to Indonesian teachers' professional learning through the emergence of a community of practice (CoP) (Wenger, 1998). This study was guided by our research question: How does engagement within the FB environment build towards a community of practice for teachers' learning?

Theoretical Underpinnings

This paper is underpinned by a sociocultural approach to learning through investigating the emergence of a community of practice (CoP) (Wenger, 1998) within the FB environment. Wenger, McDermott and Snyder (2002, p. 4) defined CoPs as "groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis." Within a CoP, members jointly develop and share practices, learn from their collaborations with group members, and have opportunities to develop personally, professionally, and/or intellectually (Wenger, 1998). Table 1 briefly describes the three defining characteristics of CoP.

Table 1
Description of the three defining elements of Wenger's community of practice

Element	Description
Mutual engagement	**How does it function**: people are engaged in actions whose meanings they negotiate with one another, through diversity, relationships and opportunity?
Joint enterprise	**What is it about**: negotiated common interests and collective goals with mutual accountability?
Shared repertoire	**What capability has it produced**: communal resources (routines, tool, artifacts, discourse, styles, etc.) that members have developed?

Note: Adapted from Wenger, 1998.

The Context of the Study and Method

Facebook has been heavily used in various communities in Indonesia. It falls within the top five countries for FB users, with over 64 million users who actively access their accounts monthly (The Jakarta Post, 2013). Although the exact number of teachers joining this network is unknown, the identification of over 100 FB groups, created for Indonesian educators with over 50,000 members, reflects teachers' interest on FB. In addition, Indonesia is characterised by word-of-mouth communication or oral culture, and is one of the top users of mobile phones, through which FB can be accessed easily even for teachers in remote areas. It appears that teachers may find that FB is a quick solution for them to find the information they need, to report or to solve their problems, or to seek support within uncertain political situations and limited educational resources.

The data presented in this paper are drawn from a larger virtual ethnographic study (Hine, 2000) on the use of FB for Indonesian mathematics teachers' informal professional learning. This paper investigated 117 (F1-F117) Indonesian FB users' engagement with four inter-related FB posts concerning division of a whole number by a fraction, a concept often taught using the rule "invert and multiply". Of the participants, 70 were identified as teachers, 30 were not mentioned as teachers but their posts or profile reflected having

educational background or interest, and 17 with unknown educational background. Data were collected within a one-week period. Figure 1 illustrates the posts uploaded by the first author and shows a visual model for dividing a whole number by a fraction. The model has been drawn incorrectly in Post 1, with Post 2 showing the correct representation. Post 3 shows 4÷2/3 and Post 4 links the model to the rule, with the author suggesting in the red cloud in the corner that students, if given the opportunity, will often find these rules and patterns on their own.

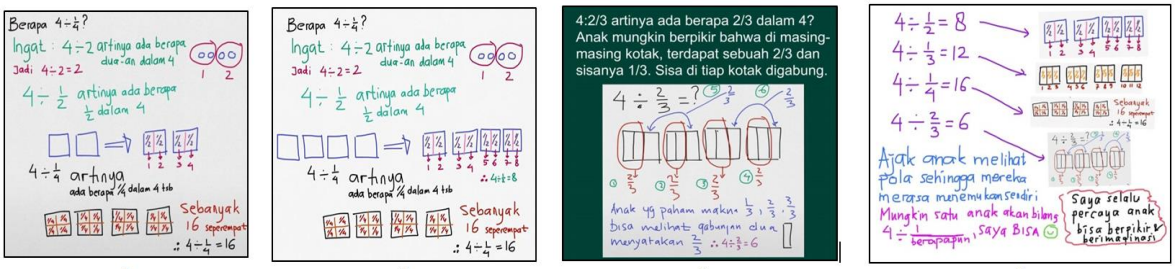

Figure 1. The four images of the inter-related FB posts

These four images were initially only posted on the first author's own FB wall. However, she shared and others in turn shared these posts to not only their own walls, but various Indonesian education FB group walls also. This resulted in comments and likes on the author's wall, as well as on other "outside" walls.

Data Analysis

A content analysis was utilised in order to identify themes of responses from the comments and shares and hence, the approach to coding the data was naturally grounded. All the responses (like, share, comments) were downloaded and imported into Microsoft Excel for descriptive statistics and NVivo where emerging themes were noted and the data coded. The coding system was continuously refined after recognising the similarities and differences since qualitative data analysis requires flexibility and open mindedness. Coding reliability measures (e.g., two coders independently coded the data) showed an initial agreement on 87% of the codes, with the remaining 13% agreed upon after discussion. Coding was simplified from 13 major codes to be only 6 main categories (see Table 2).

Table 2
Coding of the six main categories of responses to the four inter-related posts

Types	Meaning/Indicators	No. of comments
Appreciation	Comments were appreciative of the information.	56
Opening opportunities for others	Permission to share the posts; Used the facilities on FB to share to their own wall or to a group wall with or without description/message/comments; Inviting others to discuss.	85
Enriching the conversation	Attempting to correct; Asking questions related to mathematical ideas, pedagogical, and mathematical pedagogical ideas; Answering questions; Clarifying ideas/additional explanations.	70
Direct impacts	Changing opinion about mathematics; Increasing confidence; Applying the ideas in their teaching; Expecting more of these types of posts.	15
Misalignment with practice	Not being critical of the posts per se, but being critical of the existing practices of teaching and of systems.	9
Other	Comments/questions not related to the specific posts or private conversations.	18
Total		264

Mutual Engagement

Wenger (1998) suggested that certain contexts enable mutual engagement. Two main enabling factors were identified in this study: the tool (FB) and the participants. The affordances of FB itself enabled engagement, such as: the features of liking, sharing, commenting; through to the ability to upload images and video easily; and the user-friendly navigation of the features. However, the participants themselves also enabled engagement: through joining FB; developing a profile; having the time to read, respond to posts and interact with other users; and through their own network of FB friends. These subtle and underlying affordances highlight the ease with which CoP can begin to develop.

There was evidence of engagement from geographically diverse participants (89 people from 20 regions in Indonesia; 8 Indonesians in 6 other countries; 20 others with unknown locations). Table 2 shows that the four posts together gained traction in engagement in a one-week period, suggesting that this type of resource is useful to the Indonesian education community. The participants' engagement was shared among one another, where even the smallest involvement contributed to the overall conversation. People's involvement consisted of showing appreciation, or inviting others to join the conversation or to apply the ideas; while others contributed to enriching the mathematical and pedagogical discussion. Other people were directly impacted and attempted to implement the idea with students or children. Hence, a variety of different types of engagement were contributing to the discussion.

Within the data, there was evidence of negotiated actions to develop meaning within the community. For example, the themes of enriching the conversation revolves around attempting to correct mistakes; asking questions or prompts of both the posts and of the conversation; answering questions posed by others; and clarifying understanding and

thinking. Interestingly, the first post accidentally contained an incorrect representation, where the first author intended to model 4÷1/2 using 4 boxes, but only drew 2 boxes. As a result, the comments suggested: "It seems two boxes missing because the result should be 8." Another suggested: "Maybe, [author's name] meant to write 2÷1/2 because there are two boxes." Some people informed other people that this was actually the incorrect representation and gave links to the second post, which had the correct representation.

The following examples illustrate the mutual engagement and highlights that responses were thoughtful and enriching.

> Thank you very much for your explanation. It is very important to teach children about concepts. If they already understand, what is next? For example for 4÷2/3, how many 2/3 are there. And they found 6 2/3 [there were 6 two thirds]. Now, Can we then direct them to 4×3/2? [Post 2-IN; F102]

> Can the method be applied to large numbers such as 5÷12/13? [Post 4-OUT; F107]

The teachers asked questions and contributed ideas such as in relation to the representation and explanation of 4÷1/2 = 8 and 4÷8 = 1/2 as presented below.

> Can you please show this with pictures, the difference between 4÷1/2 = 8 and 4÷8 = 1/2. [Post 4-OUT; F89]

Some of the questions asked in the discussion were explicitly answered. The transcript below highlights the interactive nature of the discussion:

> **Question**: May I share this Mam? The explanation is very clear. But how should I explain 4÷1/4 = 4×4/1? [Post 2-IN; F102]
>
> **Answer**: F102, it would be better if the children can find the patterns themselves. Because we give them many rules without meaning, any child can be wrong in remembering the rules. Through many examples and having mental images as the models above, the child can understand why an integer divided by a fraction gives a greater result. In the picture the child can see the number of ¼ box is 4×4 = 4 + 4 + 4 + 4. [Post 2-IN; F93]

The notion of mutual engagement as defined by Wenger is shaped here by the people themselves and the affordances of the FB environment. There is a dynamic interaction in this community, and it involved people from very different contexts and with different expertise. This virtual community evolved naturally over a short period of time and with further stimulation, has potential for greater impact.

Joint Enterprise

The joint enterprise is the common focus of the community. The initial enterprise proposed by the author was an approach to help children understand fractions without forcing them to use a rule that may not make sense. It shows the connection between the idea of dividing a whole number by a whole number, "how many [divisor] within [dividend]?" and dividing a whole number by a fraction. For example 4÷2 means "how many twos in the four?" Similarly 4÷1/2 means "how many halves are there in a four?" This differs from the general accepted notion of "dividing means equal distribution", namely "share the four equally to two people, and how many does each person get?"

The four inter-related posts became a joint object of conversations about mathematics and teachers' own pedagogical practice and their own mathematics understanding in an informal and less confronting space. 70 comments were coded under the enriching the conversation category with many of these comments related to mathematical ideas, pedagogical, and mathematical pedagogical ideas. These became the joint enterprise through which the participants engaged with these ideas.

For example, with regard to mathematical knowledge, participant F105, wrote the following thought-provoking post. The question posed by this participant was outside of the examples given in the four posts, which indicated that this person had thought about the model and tried to apply it to their own example:

> This is very inspiring…….. By the way, I tried to solve 4÷3/4. [using the model method] and I found 5+1/4. But when I solved it using the instant method 4÷3/4 = 4×4/3, the result was 5+1/3. Please give advice on this. [Post 4-IN; F105]

To demonstrate that the enterprise was jointly constructed, F2 responded:

> F105, if you use the method of dividing the 4 bars with 3/4, the results are the same. If you do, you will be able to find 5 with the rest of the log would be a quarter. But the quarter itself is a third of three quarters. So the answer is still 5+1/3. [Post 4-IN; F2]

This illustrates how the mathematical idea of dividing by fractions can be challenging and not always as simple as the examples in the four posts. This conversation above shows how a deeper understanding of mathematical knowledge is often needed to solve similar problems. As mentioned in F2's response, there is a need to understand that the remaining part is 1/4 of the original whole, yet only 1/3 of the new unit (3/4).

Some comments were quite general and therefore they were categorised as general pedagogy, that is, general ideas about teaching and learning. For example:

> Concepts should be learned by learners before introducing them the procedure or technique to make the learning process as meaningful as possible. [Post 4-IN; F43]

> Come on lovely teachers, cultivate the process in the teaching and learning and do not always give students smart solutions. Let them find their own smart solutions. [Post 4-OUT; F2]

The most critical ideas were categorised as pedagogical mathematical knowledge. These comments were related to how to teach mathematics and addressed particular student mathematical difficulties.

> Fractions in the early elementary school stage should start with a concrete => picture => symbol. Most teaching directly goes to the symbol, they cannot wait… even though the children do not understand yet. As a result, many still think that 1/3+1/2 = 2/5 [Post 4-OUT; F90]

One teacher shared his teaching experience following on from a comment from another teacher's findings about students' difficulties in adding fractions.

> I also adopted this method for my vocational students as you wrote above. [many students did 1/3+1/2 = 2/5]. As a result, I kindly taught them using "biting" [manipulatives], I prefer this than having complaints from my school principal. [Post 4-OUT; F76]

One teacher prompted others to explain a method of teaching 4÷1/2 and 4÷8. Two teachers replied:

> You can draw half a kilogram of sugar for 4÷1/2 … For 4÷8, prepare 4 "biting" and share them to eight children ….Welcome for any suggestions. [Post 4-OUT; F76]

> 4÷8 can be described as 4 apples for eight children, so it can be 1/2. But if it is 4÷1/2, this is difficult to teach to students (perhaps: half those 4 apples, so there are 8), welcome for any corrections. [Post 4-OUT; F89]

The evidence from the comments and ideas supports the emergence of joint enterprise within the discussion. The participants themselves developed these ideas through their explicit engagement and own expertise, practices and experiences. The production of the joint enterprise has led to a shared repertoire among the participants.

Shared Repertoire

The affordances of FB allow the notion of a shared repertoire to evolve naturally. The design of FB encourages the sharing of ideas and resources. As a result, there is the potential to reach many people with one post even though the original poster may not know it. Facebook affords to document all the conversations that can be found/revisited by FB friends anytime. Furthermore, the content of the posts becomes a shared resource and becomes part of the community's shared repertoire. Since the joint enterprise was related to the mathematics knowledge, general pedagogy and mathematical pedagogical content knowledge, the model and the associated processes of teaching and learning also become part of the shared repertoire associated with that joint enterprise as reflected by the comments: "*I am very happy to have this knowledge. I have kept all the images that you uploaded. Thanks Mam*."

Further evidence was a message received from a primary teacher six weeks after the fourth post was uploaded, who exhibited no engagement during the one-week data collection. She expressed her strong interest in the posts and reported challenges from her further explorations on the modelling idea of division of fractions. She even stated that she had tried to solve 1/6÷1/3 and had thought about it for three days:

> Mam, I always take a chance to read your FB wall because there many lessons that I could have, many of your pictures I have downloaded and kept for my learning and to give to my students at school. One point, it is interesting to explain mathematical concepts to kids using pictures. The lesson of fraction division you gave is very interesting. But now I find it difficult … when I have to explain a fraction division, where the divisor is greater than the number divided, for example a sixth divided by a third. I have been working on this for 3 days, trying to find the solution but I haven't been able to solve it.

Although some people may not have been identified as participants in terms of the initial data collection, we cannot assume that their lack of response meant that there was no interest or no wider learning occurring from the four-post conversations. This is further evidenced by a teacher posting their own videos of their method and explanation of solving the problem visually and symbolically on a teacher group wall. This attracted many comments, likes and shares. Hence, the response of the teacher was "public" in the FB world and became a shared resource for others to use, learn from and implement in their own classrooms.

We argue that the use of the model to illustrate the division of fractions became a shared repertoire since this seemed logical and easy to follow for many people compared to a rule-based teaching "invert then multiply"; it stimulated discussions and was widely shared and encouraged to be utilised by the community or participants. In this case, FB as a social networking site mediates the knowledge building within the community.

Unlike other studies (Bissessar, 2014; Rutherford, 2010), the professional learning identified in this study was not created for a specific purpose, the participants in this study engaged actively and willingly in shaping this informal CoP. However, it is difficult to pinpoint the most determinant factor for why they engaged with the posts. It could be related to: (a) the type of posts, that is, the mathematical content of the posts; (b) how the content is misaligned to the current context of mathematics teaching; (c) the types of comments on these posts which stimulated further conversations; or (d) the reputation of the person who initially posted them. Alternatively, it could be that this sort of environment is seen as a safe space for people to ask questions, contribute ideas and learn from each other without being attacked or ridiculed. Understanding about such factors is an area for further research.

Conclusions and Implications

This study identifies that the beginnings of a CoP emerged through the online interactions in Facebook via the four inter-related posts. The mutual engagement and interactions of the participants are apparent. The shared enterprise was developed through insightful discussions on mathematical knowledge and mathematical pedagogical knowledge, which were captured in a relatively short timeframe and a variety of resources, both concrete and intellectual, were jointly developed. The four inter-related posts were not designed to be a CoP. It was a part of the first author's routine to share experiences and ideas through FB. However, the systematic analysis of these posts provided opportunities to gain insight about the potential of FB for teachers' learning or even to communicate mathematics to wider audience. This adds another perspective on research about FB where the previous studies were dominated by their finding of FB as mainly for social networking (Nadkarni & Hofmann, 2012).

An implication for further research could be the use of CoP as a theoretical framework to analyse the potential of FB, as not only a medium for engagement but also to understand the process of teachers' professional learning. That is, developing a better understanding about FB as a virtual space for professional learning and how the CoP framework, along with the space itself, can facilitate such teacher learning processes. CoP is also a promising framework to help us to optimise FB as a tool. This potentially gives us opportunities to address issues regarding the structure and sustainability of teachers' learning in this new connected digital world.

References

Aydin, S. (2012). A review of research on Facebook as an educational environment. *Educational Technology Research and Development, 60*(6), 1093-1106.

Bissessar, C. S. (2014). Facebook as an informal teacher professional development tool. *Australian Journal of Teacher Education, 39*(2), 9.

Facebook. (2015). Company Info | Facebook Newsroom. Retrieved 19 January, from http://newsroom.fb.com/company-info/

Goodyear, V. A., Casey, A., & Kirk, D. (2014). Tweet me, message me, like me: using social media to facilitate pedagogical change within an emerging community of practice. *Sport, Education and Society, 19*(7), 927-943.

Hew, K. F. (2011). Students' and teachers' use of Facebook. *Computers in Human Behavior, 27*(2), 662-676.

Hine, C. (2000). *Virtual ethnography*. London: Sage Publocations.

Manca, S., & Ranieri, M. (2013). Is it a tool suitable for learning? A critical review of the literature on Facebook as a technology-enhanced learning environment. *Journal of Computer Assisted Learning, 29*(6), 487-504.

Nadkarni, A., & Hofmann, S. G. (2012). Why do people use Facebook? *Personality and Individual Differences, 52*(3), 243-249.

Ranieri, M., Manca, S., & Fini, A. (2012). Why (and how) do teachers engage in social networks? An exploratory study of professional use of Facebook and its implications for lifelong learning. *British Journal of Educational Technology, 43*(5), 754-769.

Rutherford, C. (2010). Facebook as a source of informal teacher professional development. *In education.* Retrieved October 3, 2014, from http://ined.uregina.ca/ineducation/article/view/76/513

The Jakarta Post. (2013). Facebook has 64m active Indonesian users. Retrieved March 18, 2015, from http://www.thejakartapost.com/news/2013/06/18/facebook-has-64m-active-indonesian-users.html

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*: Cambridge university press.

Wenger, E., McDermott, R. A., & Snyder, W. (2002). *Cultivating communities of practice: A guide to managing knowledge*. Harvard Business Press.