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A Formative Intervention on Mobile Learning Community

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Abstract

The purpose of this study was to develop a mobile learning community through formative intervention. As results, four components of mobile learning community were human factors, learning subjects, mobile technological supporting systems, and human supporting systems. Mobile learning processes were categorized to individual reflective practice in an authentic context and participation in the mobile learning community. As Profile Analysis results showed significantly different in score of sense of learning community between groups ($\lambda = .77$, $F(6, 150) = 3.56$, $p = .03$, $\eta^2 = .07$) and levels of reflective practice between groups were ($\lambda = .58$, $F(6, 150) = 5.33$, $p = .00$, $\eta^2 = .18$). That confirmed the intervention were appropriate. It had a significant in design research methodology to participant learners and instructors of mobile learning and to adopt multiple simultaneous design, implementation and validation

Keywords: mobile learning, learning community, formative intervention, design research

1. Introduction

Mobile learning is “the processes of coming to know through conversations across multiple contexts among people and personal interactive technologies (Sharples, Taylor & Vavoula, 2007)”. Learners of mobile learning come from different contexts and different learning intentions. So they need different things for learning and they want to participate in mobile learning community in different levels and ways. Mobile learning should give multiple paths to learners such as organizing a course, a meeting and conversation or anything else. This approach creates learning context without boundaries. It is similar with a social learning. It likes “runaway object” of which is “very poorly controlled and has the capability of expanding beyond and anticipated limits or boundaries, often to global scale (Engeström, 2007)”. It means rhizomatic learning approach (Comier, 2001). A rhizomatic structure can be

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explain as Lian (2004). A rhizomatic structure contains components where each and every component is connected to each and every other component of the (living and potentially infinite) structure. In a learning structure it means that learners are able to connect from any activity or information point to any other activity or information point according to perceived need. A rhizomatic structure should not be thought of as chaotic but rather as a self-regulating structure responsive to the learners’ needs as determined by the mechanisms in place (human or otherwise) for determining such needs. Mobile Learning community is a new form of learning environment to accept rhizomatic learning approach. It leads learners share daily practice to exchange collaborative reflection via mobile networks. Learners who have memberships can improve their levels of reflective practices based on situated learning theory. They develop social product extend beyond individual project. Mobile learning community is less bounded than community of practice proposed by Lave & Wenger (1991). However, there are uncertainties and complexities to expect learning outcomes because different learner makes emergent collaboration. It may not possible nor desirable to know what changes are. Naturally occurring mobile learning communities could not spontaneously generated from nothing. Formative intervention was needed to adopt instructional designs that facilitate mobile community activities and individual reflective practices. Those designs change the ways of social and cognitive interaction by using a culture and technology of mobile environment. The purpose of this study is to develop a Mobile Learning Community through formative intervention. Formative intervention was needed to adopt instructional designs that facilitate mobile community activities and individual reflective practices. Those designs change the ways of social and cognitive interaction by using a culture and technology of mobile environment.

2. Theoretical Framework

2.1. Double stimulation

Vygotsky invented “double stimulus method” to explain the mechanism of conceptual leaning within the zone of proximal development (ZPD). ZPD is “the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers (Vygotsky, 1987; as cited in Engeström & Sannino, 2012). Through the process of double stimulus learners develop a concept in two ways: One is concept formation to accept new things and The other is conceptual change (Engeström & Sannino, 2012). Learners explore surrounding environments to solve the problem in First stimulus, then they get some hints from artifacts of environments and finally they invent the solution to solve the problem and apply in second stimulus. Artifacts in double stimuli are originally neutral stimulation which is not involved to problem solving. However, they temporarily associated with problem and become meaning to solve the problem. It is called second stimuli. So, it needs to explain the cultural influences and stimulus effect mechanism on learning. Double stimulus explain the path of cognitive tool generation and translation those through tracking (Vygotsky, 1987 as cited in sung, 2004).

2.2. Formative Intervention

Engeström (2004) insisted that intervention approach is better than the treatment approach for social production, because there is emerging interaction in social communities. To design a course and to develop learning environments should be changed from completed prescription for passive learner to modified participation of supporting for individual learner or groups who have different identities (Slavin, 2004). Formative intervention is a alternative instructional design method invented by Engeström. It applies double stimulus to develop a learning environments and materials instead of cognitive tool for solving problem in structured situation (Van der Veer & Valsiner, 1991; as cited in Engeström, 2011). It helps to improve the existent leaning model or develop a new model such as mobile learning community (Pierroux, 2007). It is already used in developing learning organization by determine the structure of learning activities and restructuring them when emerging from participant’s articulation of actual problem in practice (Kerosuo, Engeström, & Kajamaa, 2010; Meyers, 2007; Meyer, 2007; Virkkunen & Ahonen, 2011). It also applied in designing museum education (Pierroux, Krange & Sem, 2011). Formative intervention has the following features. First, it is field-oriented design and simultaneous design. It is opposed to the traditional design approach which has sequential progression of analysis, design, development, implementation and
evaluation based on theoretical review. Because it is impossible to fully performed each step and then proceed to next step. Second, it applies sociological intervention approach to educational design. Social intervention is a method to change a person or organization. Because social relationship is begins form taking notice of existence of identities not mechanical interaction ignoring others identities.

When design mobile learning community, physical and cultural environment are more carefully considered. The feature of mobility generates a new experience and new learning paradigm that is supports across context and life transaction but we should have to relocate our thinking in the familiarity of equipment of old media (Laurillard, 2009; Pierroux, Krange, & Sem, 2011). It is powerful combination of several traditional technologies such as phone, book, paper, pencil, camera, and computer. This phenomenon is determine of current level of the model (Virkkunen & Ahonen, 2011). Learning phenomena by adopting mobile tool let us to face the current state of current status and give us a chance to develop and elaborate a model. Contrary, model helps us to organize learning structure with leaning tool and artifacts of environments. Also, the current model is reflecting the fast and it give us foundation that we can imagine the future model. Therefore, any attempt, no matter how flimsy, new learning activities should be carefully monitored, organized to a model and then applies as a learning tool. This process is most efficient way of model development and application simultaneously.

3. Method

In order to achieve the goal of this study, a design research and experimental research were used as follows. The first phase was to find components and activities of mobile learning community from a field study. This study collected qualitative data of learning outputs and communication data from twenty two mobile learning communities comprised of 118 preservice teachers. The second phase was to design a support system for mobile learning community by formative intervention. The third phase was an experimental study to validate the design output of formative intervention from the second phase. Test scores of sense of learning community and levels of reflective practice were analyzed with repeated ANOVA (profile analysis). Eighty learners of the first and the second phases participated in the experiment (see Table 1). Finally, results of the experiment were reflected on validation and screening of appropriate intervention.

| Type of mobile learning community | Ssti-MC | Ssti-RA | Fsti |
|----------------------------------|--------|--------|-----|
| Collaboration environments to maximize interaction | Experimental | Collaboration environments to maximize reflective practice | Control |

25(5teams) | 28(6 teams) | 27(5teams)

4. Results

4.1. Growth Mobile learning communities

- First Intervention
  First prototype was developed for field study. It is implemented “Springnote(http://www.springnote.com)” which is Wikimedia site for co-authoring and it support mobile service. I had no choice because there were few mobile collaborations tools from 2010 to 2011 when the first intervention was taken. Instead of providing mobile learning tools, I allowed the learner to use cell phone and SNS. Information and examples to collaborate by using mobile technology were given periodically. Those were not well done both of individual reality project and mobile learning communities. The reasons were chaos caused by the cognitive incongruity. One was that mobile learning system did not support to interact freely and to solve problems. The other there were not rules and culture to collaborating as learning community such as agreement channel and debate space. To summaries, some learners felt to become isolate in different context and difficulties in handling the data which were distributed in on and offline. Therefore,
several features had been added to the first prototype such as supporting to decide role taking, to share learning objectives, to publish communication rules and to represent communication space.

- Second Intervention
Second prototype implemented note application-“Evernote application (http://www.evernote.com)” to wikimedia. Evernote is clouding memo application through synchronizing smart phone, tablet and computer. It helped collect information from anywhere into a “note” from text notes to web pages to files to snapshots. Note could be grouped in the form of “notebook”. It was also easy to revise and to edit the note. The note could be share among community members when learners set permissions to share. And the member who allowed could read and revise the note.

Learners welcomed the new feature of note taking and sharing, but there were several chaos. These because the learners were not familiar with the interface to create and to share the notebook. The interface was slightly different with Face book which is Famous SNS. Several orientation and individual supporting service were needed to overcome the cognitive confusion. These phenomena were analyzed with activity system. One was a conflict among tool-subject-objective. Learning environment should design instinctively to share the idea between team members. Another is a conflict among subject-rule-community. It was confused by the use of other SNS. The other was a conflict among tool-rule-community. It was lack of customized service individual learning community. However, there were few difficulties in data collection and sharing.

4.2. Validation of mobile learning communities

The validation of instructional design of mobile learning community was done with the results of profile analysis on test scores of sense of learning community and levels of reflective practice.

- Effects on Sense of learning community

Table 2 shows mean and standard deviation of sense of learning community between groups. Profile graph was drawn to identify trends of sense of communities. There was a difference between the trends of three groups(Fig 2). The slopes of Ssti-MC, Ssti-RA and Fsti were different.
Table 2. Descriptive statistics of community membership

| Source  | Case | 1st Test | 2nd Test | 3rd Test | 4th Test | Mean |
|---------|------|----------|----------|----------|----------|------|
| Experimental | Ssti-MC | 25 | 2.99(.73) | 3.68(.59) | 4.13(.50) | 4.31(.49) | 3.82 |
|         | Ssti-RA | 28 | 2.74(.74) | 3.39(.62) | 4.09(.49) | 4.20(.61) | 3.60 |
| Control | Fsti | 27 | 3.25(.42) | 3.56(.31) | 3.83(.49) | 3.92(.45) | 3.64 |
| Total   |     | 80 | 2.99(.67) | 3.54(.53) | 4.13(.50) | 4.14(.54) | 3.69 |

Fig. 2. Profile graph of community membership

To exam the difference among the groups, multivariate tests was conducted according to Wilks’ Lambda (λ). The results of sense of learning community showed significant validity of instructional design of mobile learning community (Table 3). The overall scores of sense of learning community between groups were significantly different (λ = .77, F(6, 150) = 3.56, p = .03, η² = .07). This confirmed that the interventions before the forth test were appropriate. To exam the difference among the test, univariate analysis was conducted. There was significant different between 1st test (F(2, 77) = 4.19, p = .02, η² = .10) and 4th test after finishing the formative intervention (F(2, 77) = 3.96, p = .02, η² = .09)(see Table 4). However, There was not significant different after value adjusted by BonFerroni.

Table 3. Multivariate tests of community membership

| Value     | F      | p      | df1 | df2 | η² |
|-----------|--------|--------|-----|-----|----|
| Pillai’s Trace | .24    | 3.47   | .03 | 6   | 152 | .06 |
| Wilks’ Lambda  | .77    | 3.56   | .03 | 6   | 150 | .59 |
| Hotelling’s Trace | .30    | 3.65   | .02 | 6   | 148 | .09 |
| Roy’s Largest Root | .26    | 6.65   | .00 | 3   | 76  | .07 |
Table 4. Univariate tests of community membership

| Source     | Defendant Variables | ss  | df  | MS  | F    | P    | $\eta^2$ |
|------------|---------------------|-----|-----|-----|------|------|---------|
| Between Group | 1st Test           | 3.52| 2   | 1.76| 4.19 | .02  | .10     |
|            | 2nd Test            | 1.16| 2   | .58 | 2.12 | .13  | .05     |
|            | 3rd Test            | 1.44| 2   | .72 | 2.98 | .06  | .07     |
|            | 4th Test            | 2.16| 2   | 1.08| 3.96 | .02  | .09     |
| Within Group | 1st Test           | 32.35| 77  | .42 |      |      |         |
|            | 2nd Test            | 20.98| 77  | .27 |      |      |         |
|            | 3rd Test            | 18.61| 77  | .24 |      |      |         |
|            | 4th Test            | 21.04| 77  | .27 |      |      |         |
| Total      | 1st Test            | 751.20| 80  |     |      |      |         |
|            | 2nd Test            | 1022.54| 80  |     |      |      |         |
|            | 3rd Test            | 1308.39| 80  |     |      |      |         |
|            | 4th Test            | 1393.80| 80  |     |      |      |         |

Based on these results, this study suggested design principles for components of mobile learning community to develop a mobile learning community. First, human factors should be able to form a learning culture by designating rules and communication methods to carry out tasks. Secondly, learning tasks include the processes of presentation and evaluation of learning outcome between mobile learning communities. These connect of the members and the learning outcome. Thirdly, mobile technological supporting systems should provide note-taking and sharing functions to capture their daily practice and chatting functions to support communication between members of mobile learning communities. Fourthly, human supporting systems should provide instructional support to offer examples and scaffolding.

- Effects on reflective practice

Table 5 shows mean and standard deviation of reflective practice. Profile graph was drawn to identify trends of sense of communities. There was a difference between the trends of three groups (Fig 3). The slopes of Ssti-MC, Ssti-RA and Fsti were different. Until 2nd test, the slopes of three groups looked similar, but, slope of 3rd test and 4th test were different. Slopes of experimental groups (Ssti-MC and Ssti-RA) were more sharp than control group (Fsti). In other words, reflective practice of experimental group were improved more than control group.

Table 5. Descriptive statistics of reflective practice

| Source     | Case | 1st Test | 2nd Test | 3rd Test | 4th Test | Mean |
|------------|------|----------|----------|----------|----------|------|
| Experimental | Ssti-MC | 25  | 1.04(.79) | 1.52(.87) | 4.44(1.26) | 5.76(1.17) | 3.19 |
|            | Ssti-RA | 28 | 1.00(1.02) | 1.57(.84) | 4.14(1.30) | 5.36(1.19) | 3.02 |
| Control    | Fsti  | 27 | 1.00(.86) | 1.48(.80) | 3.15(.82) | 4.33(.96) | 2.49 |
| Total      | 80   | 1.01(.83) | 1.52(.83) | 3.90(.82) | 5.14(1.25) | 2.89 |
To examine the difference among the groups, multivariate tests were conducted according to Wilks’ Lambda (λ). The results of reflective practice showed significant validity of instructional design of mobile learning community (Table 6). The overall scores of levels of reflective practice between groups were significantly different (λ = .58, F(6, 150) = 5.33, p = .00, η² = .18). In particular, the test scores of the third test and fourth test were significantly different (Third test: F(2, 80) = 9.23, p = .00, η² = .19; Forth test: F(2, 80) = 11.55, p = .00, η² = .23) (see Table 7). This confirmed that the interventions before the third test and the forth test were appropriate.

Table 6. Multivariate tests of reflective practice

| Source                | Value | F    | p     | df1 | df2 | η²  |
|-----------------------|-------|------|-------|-----|-----|-----|
| Pillai’s Trace        | .95   | 482.23 | 3 | 75 | .00 | .95 |
| Wilks’ Lambda         | .05   | 482.23 | 3 | 75 | .00 | .95 |
| Hotelling’s Trace     | 19.29 | 482.23 | 3 | 75 | .00 | .95 |
| Roy’s Largest Root    | 19.29 | 482.23 | 3 | 75 | .00 | .95 |

Table 7. Univariate tests of reflective practice

| Source     | Defendant Variables | ss  | df  | MS   | F    | P     | η²  |
|------------|---------------------|-----|-----|------|------|-------|-----|
| Between Group | 1st Test       | .03 | 2   | .01  | .02  | .98   | .00 |
|            | 2nd Test        | .11 | 2   | .06  | .09  | .92   | .00 |
|            | 3rd Test        | 24.02 | 2   | 12.10 | 9.23 | .00   | .19 |
|            | 4th Test        | 28.50 | 2   | 14.25 | 11.55 | .00   | .23 |
|            | 1st Test        | 58.96 | 77  | .77  |      |       |     |
|            | 2nd Test        | 53.84 | 77  | .70  |      |       |     |
|            | 3rd Test        | 101.00 | 77  | 1.31 |      |       |     |
|            | 4th Test        | 94.999 | 77  | 1.23 |      |       |     |
| Total      | 1st Test        | 141.00 | 80  |      |      |       |     |
These results of this validation leaded to design principles for components of mobile learning community to develop individual reflective practices. First, individual learners should create a learning culture that the members care for others' practice and offer feedback to each other. Secondly, learning tasks should link between individual learner's practice and tasks for the learning community. Thirdly, mobile technology supporting systems should provide note-taking and sharing functions while the learners engage in individual practice. Fourthly, human supporting systems should provide feedback and suggest a further task about individual reflective practices.

4.3. Design Components of mobile learning communities

Four components of mobile learning community came after refining process. They are human factors, learning subjects, mobile technological supporting systems, and human supporting systems. Human factors act as a subject of learning. The learners perform individual reflective practices and precipitated in mobile learning communities. The leaning subjects, as the second component, are a driving force of the mobile learning community activities. These make a connection between individual daily practice and mobile learning community activities. Moreover, mobile technological supporting systems play a role of as a medium that invites the learners and connect them. Also, these systems provide guidance to solve problems involved in the learning process. Furthermore, human supporting systems complement technological supporting systems to encourage the learners to participate in a mobile learning community environment. They also solve problems that technological supporting systems cannot solve. In addition, communities of academics and practice operate as infrastructures that initiate mobile learning community.

These processes are categorized to individual reflective practice in an authentic context and participation in the mobile learning community. Individual reflective practice has three phases of recognition of a context, interpretation of the context, and participation in the context. Also, participation in the mobile learning community has five phases of integration of common goals, problem statement, generation of problem solving strategies, problem solving, and sharing the results of problem solving. All processes of mobile learning communities need collective reflections.

5. Conclusion

In conclusion, this study shows meaningful findings as follows: first, it conceptualized situated learning property of mobile learning. It adopts both of theoretical approach and field study for validation. Second, it developed a mobile learning model by aligning and integrating of cognitive and social activities based on formative intervention. Third, it gives new design research methodology to participate learners and instructors of mobile learning and to adopt multiple simultaneous design, implementation and validation. Forth, it shows learning patterns of mobile learning communities.

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