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# The Effects of Communication Problems of Interdisciplinary Team on Teamwork Quality of Mobile Game Development

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**Abstract:** Any interdisciplinary team should use good division of labor and effective communication to achieve the team's goals. Since the team members come from different disciplines, it often leads to communication problems and poor results. An empirical study was done with 72 college students from three courses related to mobile game design within a period of 18 weeks. The study focused on what communication problems affected the quality of the resulted games. The results show that the effectiveness of communication and teamwork quality were highly correlated. The factors affecting the quality of the resulted games included developing time, personal skills and work planning. This study found out that the interdisciplinary members of a team lacked a common language, leading to communication problems. It is recommended that such teams need to establish clear goals and learn to solve the problems.

**Keywords:** game production team, communication effect, interdisciplinary team, teamwork quality

## 1. Introduction

### *1.1 Research background and motivation*

Any interdisciplinary team should use good division of labor and effective communication to achieve the team's goals. A good team needs to consider more diverse ideas before they can converge to a good idea. Interdisciplinary team can solve these problems better than a team with members of the same background, especially in a game development context (Brainard, 2002). To develop a successful video/mobile game, the team need to use knowledge of various disciplines, such as programming, art, planning, audio, and marketing. It is difficult to found a developer who have the knowledge of all needed disciplines, so mobile games are often done by teamwork (Jesse, 2014).

During cooperation, the team members often need to work with people with different backgrounds. However, the terminologies of different disciplines will lead to misunderstandings of communication and poor cooperation. So an interdisciplinary team need to establish a common communication language to avoid misunderstandings (Yang & Lin, 2015). In a mature game team, the game designer usually responsible for the tasks of mediation and communication. The members of the team will work together for a clear team goal (Jesse, 2014). In an interdisciplinary team of students, they may not have sufficient understanding or relevant experience to understand members from other disciplines. A student team might have more communication problems. In an interdisciplinary team, how to effectively cooperate is a problem that need to be solved. As Knight (1999) mentioned, interdisciplinary members would have more misunderstanding problems. Moreover, students also lack professional experiences and the conflicts of communication may led to poor results of the team work.

*Research purpose and problem*

In this study, students from the department of digital media and that of engineering formed teams to design and develop mobile games. The following are the research questions.

1. To explore the influence of communication effectiveness on teamwork quality among student team members.
2. To explore the influence of communication effectiveness and teamwork quality on the final projects' score.
3. To find out the problems of communication in interdisciplinary teams.

## 2. Literature Review

### *2.1 Interdisciplinary team*

A group consists of two or more members and each one may influence the others (Paulus, 1989；Forsythe, 1999). A team is a group of member working together to achieve a common goal (Cohen & Bailey, 1997；Hackman, 1987). An interdisciplinary team consists of a number of members with complementary skills, cooperating on a common task, goal, and plan (Jason, 2000).

Interdisciplinary teams should be more effective in solving the problems than a team with members from the same discipline (Brainard, 2002). In an interdisciplinary team, the members have different professional skills, and can provide different perspectives in discussion. Parker (1996) believes that interdisciplinary team will have the opportunity to enhance the ability to solve complex problems by combining different skills. This type of cooperation between the team will effectively enhance the effectiveness of innovative research and development.

### *2.2 Communication effect*

In a group design process, people often communicate to exchange views and build mutual understanding. When communicating, people convey their feelings, attitudes and knowledge to help others understand their ideas, persuading others to accept their own ideas, and further expressing their understanding of the ideas of others. In this way, the team communicate to solve problems or stimulate creativity in the process of project development (Albrecht & Ropp, 1984; Nemiro, 2005).

Shannon and Weaver (1949) proposed that communication emphasizes the process of a series of social behavior, with persistent, interactive and dynamic efforts. The speaker is not only to convey the information to the other members but also hope the receiver understand the message, and then provide feedbacks. This cycle is repeatedly carried out. The quality of team communication is mainly determined by the willingness and ability to exchange information between members.

Knight (1999) suggested that the interdisciplinary team members often misunderstood each other. People with different professional backgrounds will have different reactions when encountering a problem. When they failed to convey their messages to others, conflict will arise. Communication is very important in team work. One needs to get their messages across to others and also understand the messages from others. This task is more difficult to achieve in an interdisciplinary team. In different areas of expertise, the different technical jargons are used. How to make interdisciplinary members understand each other? An interdisciplinary team needs to give priority to solve the problem.

### *2.3 Teamwork quality*

Hoegl and gemuenden (2001) suggested six constructs to evaluate teamwork quality, including communication, coordination, balances of member contributions, mutual support, efforts, and cohesion. The six constructs were used to develop a scale on teamwork quality.

Good teamwork quality depends on the effectiveness of team communication. However, communication inevitably produces conflicts. Knight (1999) defined team conflict in two aspects, emotional conflict and task conflict. Emotional conflict affects interpersonal relationship. Common

emotional behavior includes anger and frustration. Emotional conflict is easier to produce in face to face communication. Task conflict means team members are unable to reach a consensus in a task. Emotional conflicts have negative effects on teamwork quality (Sarason, 1984).

From the above literature review, it is clear that the effectiveness of communication affects the teamwork quality. A game production team includes members of game designer, artist, and programmer. Good communication and cooperation are needed. This study is to investigate communication problems in students' teams and their effects on teamwork quality.

## 3. Methodology

### *Research Method*

This study adopts Questionnaire Survey. In this study, the subjects were college students study game who formed teams to develop mobile games for their term projects. A questionnaire was filled out by the subjects for data collection and statistical analysis. There were three research variables in this study, including team communication effectiveness, teamwork quality, and the score of the final project. This study proposes the following two hypotheses:

$H_1$: Team communication effectiveness is positively correlated with the quality of teamwork.

$H_2$: Team communication effectiveness and teamwork quality is positively correlated with the score of the final project score.

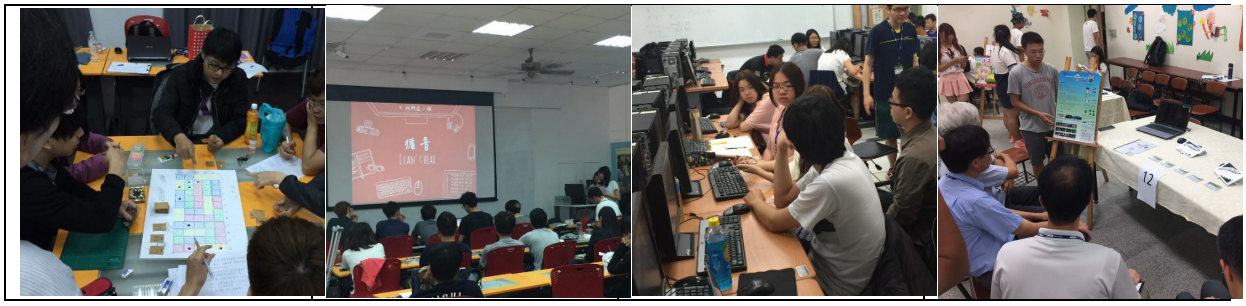
### *Research subjects*

The research subjects consisted of 72 students, including 23 students from the department of digital media in a university of science and technology; 32 students from department of electronic engineering; 17 students from department of digital design in another university. The study began in February 2016. Twenty three students were taking a "game planning" course of the department of digital media. The course lasted for 18 weeks with 54 hours of classes. The course content was about game planning, and the students were trained by designing game plans. Thirty two students were taking a "mobile application design" course of the department of electronic engineering. In the course, the students learned how to develop games for mobile devices with the game engine Unity. Seventeen students were taking a "digital media integration" course by department of digital design. The course lasted for 18 weeks with 72 hours of classes. In the course, the students learned about game production, game planning, and developing game prototypes.

Traditionally, the three courses were taught in their own department with no collaboration with students from outside the department. For 18 weeks, the students formed 13 groups to develop mobile games as their term projects. Each team needed students from at least two departments. The team needed to have roles of programmer, artist, and game designer. A workshop was held once a month including a final project presentation (Table 1).

Table 1: Workshops and Final project presentation

| First workshop | Second workshop | Third workshop | Final project presentation |
|---|---|---|---|
| Game prototype production and team formation | A game plan was presented by each group.<br>Discussion and game production | Progress report was presented by each group<br>Discussion and game production | Game was presented by each group<br>Grading by experts and peer assessment |



The final projects were graded by six experts and peer assessment was also done. Students filled out a questionnaire which were about communication effectiveness and teamwork quality. Finally, individual interviews were conducted for a member of each group.

The game platform were all Android smartphones and tablets. The game engine was Unity, and game art software included Maya, 3D MAX, Photoshop, and so on. Among the 13 games, 6 were puzzle games, 4 teams were action games, and the rest were a shooting game, a music game, and an adventure game.

*Research instruments*

The research instruments included questionnaires, expert score and interviews. The "communication effect and teamwork quality questionnaire" was designed by the authors (appendix).
A 6-point Likert scale was used ranging from 1 to 6, 1 means strongly disagree; 2 means disagree; 3 means disagree somewhat; 4 means agree somewhat; 5 means agree; 6 means strongly agree. The questions were categorized in two dimensions:

(1) "Communication effectiveness": to find out whether students can understand the problems of different professional fields, and whether the team members can achieve consensus. There were 9 items for this dimension.
(2) "Teamwork quality": to find out whether the members trust each other, whether team interaction was good. There were 8 items for this dimension.

There were six experts to grade the final projects on five major items, including game fun, innovation, art design, creativity, and market potential. The weighting of each item was 20%.

Interviews were also done for 11 students. Questions included which tools (e.g. Line) were used for communication; how was the atmosphere of the communication; whether misunderstanding occurred due to background differences. There were 8 questions and each interview lasted about 5~8 minutes.

## 4. Research results and Discussion

This study used SPSS 18.0 to analyze the data. Pearson correlation coefficient and regression were used. Among the 72 questionnaires sent out, only 66 were valid ones. The results of the analysis was reported next.

*Results of questionnaire*

*Results of team communication effectiveness*

There were 9 items about team communication effectiveness. The average of the item "I can listen to the opinions of members from different backgrounds" is the highest (average 5.14). About 85% students responded with levels 6 and 5 (strongly agree and agree). The average of the item "I can understand the professional language used by members of different professional backgrounds" was the lowest in the study (average 4.47). 44% responded strongly agree and agree. 43.9% responded slightly agree. Second to lowest was the average for the item "During discussion with members from different professional backgrounds, I can give feedback in a timely manner" (average of 4.67). 56.1% students strongly agreed or agreed; 39.4% students only slightly agreed. The third lowest average was from the item "I can use effective communication tools (e.g. Line) to facilitate the communication

between the members of different professional backgrounds" (average 4.7). 61.1% students strongly agreed or agreed. The results of communication effectiveness are summarized: (1). There were problems in understanding professional terminology among interdisciplinary students; (2). There were problems in providing feedbacks in interdisciplinary discussion; (3). There were problems in using effective tools to promote communication.

### *4.1.2 Results of student teamwork quality*

There were 7 items about teamwork quality. The average of the item "I think that cooperation with students of different professional backgrounds will help to make the game better" is the highest (average 5.3). 51.5% of students strongly agree with this item. The average of the second highest item was "I think game results depends on a clear team goal" (average 5.15). 80.3% strongly agreed or agreed. The lowest average was that of the item "I think the team members are able to make the same contribution to each other" is the lowest in the study (average 4.94). 71.2% of students strongly agreed, agreed or slightly agreed. On the other hand, 28.8% responded negatively. This showed that the equal distribution of the load of teamwork was questionable.

### *The relationship between communication effectiveness and teamwork quality*

Table 2 showed that the positive correlation between communication effectiveness and teamwork quality was significant ($p$<0.05). The coefficient of Pearson correlation was 0.686. Like the result suggested by Hoegl and gemuenden (2001), if communication problems occur, they will affect the teamwork quality.

Table 2: Pearson correlation analysis of communication effect and teamwork quality

| | | teamwork quality |
|---|---|---|
| Communication effect | Pearson Correlation | .686** |
| | P-value | .000 |

### *The relationship between communication effectiveness and teamwork quality on the score of the final project*

Table 3 shows that communication effectiveness and teamwork quality were not correlated with the score of the final project ($p$ < 0.05). The corresponding Pearson correlation coefficients were respectively 0.048 and 0.137

Table 3: Pearson correlation analysis of communication effect, teamwork quality and the score of final project

| | | Final projects' scores |
|---|---|---|
| Communication effect | Pearson Correlation | .048 |
| | P-value | .701 |
| Teamwork quality | Pearson Correlation | .137 |
| | P-value | .268 |

### *The relationship between peer assessment and the score of final game*

Table 4 shows that the positive correlation between peer assessment and the score of the final project graded by experts was significant ($p$ < 0.05). The Pearson correlation coefficient was 0.461.

Table 4: Pearson correlation analysis of peer assessment and final projects' scores

| | | Final projects' scores |
|---|---|---|
| Peer assessment | Pearson Correlation | .461** |
| | P value | .000 |

*Interview content analysis*

In this study, 11 students were interviewed. S1 represents the first student, S2 represents the second student, and so on. The purpose of the interview was to survey the details of team communication. First the researchers tried to understand "whether there are communication problems among the members of each group". The following were sample responses:

*S1: Well, there's a solution to some problem at the face-to-face meeting.*

*S3: I feel quite good. The atmosphere is very harmonious. Some problem also can get a solution.*

*S4: Not particularly warm, but can still get the solution.*

*S8: Everyone were friendly at first. However when deadline was approaching, the atmosphere in the team obviously became bad and conflicts occurred.*

According to the above responses, the discussion atmosphere of each group was different. It seemed problems were solved in general.

The researchers also tried to understand "what communication problems might occur among members from different disciplines." The following are sample responses:

*S2: I am the game designer in this team. I have similar cooperation experiences. So, I understand some knowledge about programming and art. Therefore we got fewer misunderstandings.*

*S5: Sometime programmer got problems. The game designer asked the programmer to implement a desired function. However the programmer made a mistake, so the production was delayed sometimes.*

*S6: Our communication have some misunderstanding, but finally we overcame these problems. More communication may confirm the needs of the game's function.*

*S8: There were misunderstandings. We presented an example provided by artists, and then communicated with the programmer. The programmer completed some of the functions and discussed with the other team members and confirmed whether the function is correct.*

*S10: We have less misunderstanding. We would confirm whether this function can be made. Moreover game designer didn't learn much about programming, so we got less misunderstandings in communication.*

There were problems of misunderstandings in almost all groups, but most of the problems were solved. Team members may use other ways to explain, such as providing examples or a sketch of the game design. If the person has a basic knowledge of other professional fields, there would be less misunderstanding.

Then, we got interviews after each group finished their projects. The following is the content of the interview:

*S1: I think our mobile game is a bit simple. Because this is the first time for the programmer in our team to make games. We did not understand game planning well, so we made a simple game finally. If our skills were good enough, maybe like the other group we would have done a more complex game.*

*S4: Overall our game is good, but some function still can be improved. Because we did not play a lot of games, so we don't know whether the game is fun or not.*

*S9: We did not make good progress, so we did not do very well in the final result. However we are still learning something.*

*S10: Time is not enough. We finished 70~80% of the whole game.*

*S11: I think our game got only 60% in my standard. We finally did not finish. But I think that we have done our best.*

As the above interviews show, many teams did not complete the development of their game due to lack of time, not-so-good planning, and insufficient personal skills.

*Discussion*

Research results showed that communication effectiveness and teamwork quality were positively correlated. Communication effectiveness, teamwork quality were lowly correlated with the final project scores. This was supported by the data that showed some teams had high communication

effectiveness and teamwork quality but got low scores for their final projects. According to the interview we know, the factor of affect the final project include: (1) the lack of time; (2) not-so-good game design; (3) the lack of professional skills. If a team had the good communication effectiveness, but lack the other two factors, the final project might get a low score. In addition, since the student peer assessment and final projects' score were moderately correlated, the students were very aware of the quality of the final projects.

Results also showed that communication problems occurred in interdisciplinary teams: (1) students did not understand the professional terminology of another discipline; (2) students did not provide feedback to interdisciplinary members; (3) students did not use effective communication tools.

## 5. Conclusion

This study focused on investigating the relationship between communication effectiveness and teamwork quality. Results confirmed the communication effectiveness among team members will affect the teamwork quality. Some communication problems were found among the students in team cooperation. The biggest problem was that students did not understand professional terminology of another discipline.

According to these results, we suggest that instructors can first teach students the concepts and language of the needed disciplines before starting their projects. Moreover, instructors can train students to solve the difficulties they might encounter during team cooperation on the project. For example, students should be trained to establish clear team goals and learn about the difficult problems in mobile game development.

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## Appendix

Communication effect and teamwork quality questionnaire

| | SD | D | DS | AS | A | SA |
|---|---|---|---|---|---|---|
| **Communication Effect** | | | | | | |
| 1. I can listen to the opinions of members from different backgrounds. | | | | | | |
| 2. I can understand the professional language used by members of different professional backgrounds. | | | | | | |
| 3. When discussing with students of different professional backgrounds, I can understand the focus of the discussion. | | | | | | |
| 4. During discussion with members from different professional backgrounds, I can give feedback in a timely manner. | | | | | | |
| 5. I can use effective communication tools (e.g. Line) to facilitate the communication between the members of different professional backgrounds | | | | | | |
| 6. In the process of cooperation in the development of the game, I think there is a good communication between the team members. | | | | | | |
| 7. In the process of cooperation in the development of the game, I think the team can reach a consensus, establish a team goal. | | | | | | |
| 8. In the process of cooperation in the development of the game, I think the team members to maintain a positive view of each other's professional background. | | | | | | |
| 9. In the process of cooperation in the development of the game, I think the team members can actively put forward ideas. | | | | | | |
| **Teamwork Quality** | | | | | | |
| 1. I am very pleased with the outcome of the game that our team members have finally produced. | | | | | | |
| 2. I think the outcome of the game depends on good communication between the team members. | | | | | | |
| 3. I think game results depends on a clear team goal. | | | | | | |
| 4. I think that cooperation with students of different professional backgrounds will help to make the game better. | | | | | | |
| 5. I think the team members are able to make the same contribution to each other. | | | | | | |
| 6. I am very pleased with the idea proposed by the team members. | | | | | | |
| 7. I am very satisfied with the mode of communication between the team members. | | | | | | |
| 8. I am very satisfied with the decision-making process between the team members. | | | | | | |
| Note: SD- Strongly Disagree; D- Disagree; DS- Disagree Somewhat; AS- Agree Somewhat; A- Agree; SA- Strongly Agree | | | | | | |