

# A Study of the Crossroad Game for Improving the Teamwork of Students

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**Abstract.** The Crossroad game is a social game that is used for learning to deal effectively with difficult situations such as conflicts in teamwork. This paper investigates the characteristics of questions to be used when the Crossroad game is applied to teamwork scenarios. The questions were collected by using questionnaires and dividing them into three groups, high-agreement, low-agreement, and middle-agreement groups using the chi-square method. Results are obtained from students in Japan and the UK, and it is shown that the attitude toward a dilemma within teamwork depended on the background of the students.

**Keywords:** Teamwork, media biotope, agreement with others.

## 1 Introduction

The authors are studying the concept of Media biotope (Mizukoshi, 2005) and its applications for vitalizing local communities. Media Biotope refers to small media such as cable television, free papers, community FM radio, and the communities which are created with these small media. The aim is to support such communities in forming networks, so that they can prosper through their interactions. As examples of communication media, which are based on this concept, we have proposed several systems (Suto, 2011, Suto and Sakamoto, 2011).

A supporting system for teamwork of students is another application based on the media biotope idea. Members of a group in a practice class have to communicate with other members. In many cases, it is difficult for the students to maintain appropriate communication with those members. In addition, they rarely communicate with members of other teams. The objective of the system is to vitalize the communication among members in a group by introducing inter-group communication and forming a structure of a media biotope.

The system implements a social game called Crossroad (Yamori, et al. 2005) as a basis for inter-group communication. In this game, team members discuss several questions related to team relationships which can be answered by *yes* or *no*. The induced discussion is based on the characteristics of these questions.

Especially, whether the players can agree with an answer to the question is important, because controversial discussions would be expected, when the opinions of the players contradict each other.

Hence, this question characteristic is discussed as it has been used in the Crossroad study. The results of the experiments are shown and effects based on the differences between the various backgrounds of the participants are discussed.

## 2 Crossroad Game

The Crossroad game was invented for considering a wide spectrum of opinions in disaster responses. However it is also useful in other areas that involve communication, such as fostering team relationships. The game involves a facilitator and several players. The facilitator has a stack of cards with questions that are often cast as dilemmas suggesting a particular course of action. Each player has two stacks of cards showing either the word *yes* or the word *no*. The facilitator starts the game by showing the first question from his stack. Each player selects either a *yes* or a *no* card indicating his opinion that the course of action will find a majority support or not. In this way, a given player becomes a member either of a majority of voters or of a minority. If he is a member of the majority, he scores one points. If he forms a minority and he is the only member of that minority, he scores two points and the majority voters score zero points. After each vote, a brief discussion highlights, why the players voted as they did. The player with the highest number of points is declared a winner. However, the exchange of views during the discussion and becoming aware of different opinions are important. It should also be noted that the players are not voting for the best solution, as this could create conflicts. They just predict what solution would attract a majority vote. Therefore the potential for conflicts among players is low. In the teamwork context the Crossroad game is used with reference to inter-personal conflicts in teams to increase inter-team coherence.

## 3 Question Characteristic

The question classification was based on the chi-square statistics.

It can be assumed that the number of answers to questions, which have the lowest agreement and potentially two alternative answers, are equally divided. Thus, the null hypothesis is that both of the expected values of “*yes* is selected” and “*no* is selected” are 0.5. If the null hypothesis was rejected, the question could be classified into the “high agreement question” group. Therefore the following procedure for classifying the questions was applied:

1. Prepare a question set for the crossroad game.
2. Let the participants answer the questions of the crossroad game.
3. Classify the questions into 3 groups by using Pearson’s chi-square test.

(The data are numbers of *yes* and *no* predictions and therefore are nominal.)

The null hypothesis (N0):  $P_Y = P_N = 0.5$ .

Here for a given question,  $P_Y$  means the probability that *yes* has been selected as answer and  $P_N$  means the probability that *no* has been selected as answer to that question. The expected values of the numbers of  $Y$  and  $N$  are  $Y : E_Y = (N \times 0.5)$  and  $N : E_N = (N \times 0.5)$ . In this condition,  $\chi_0^2$  is calculated as follows:

$$\chi_0^2 = \frac{(O_Y - E_Y)^2 + (O_N - E_N)^2}{N/2} \quad (1)$$

$O_Y$  and  $O_N$  represent the observation values for the numbers of  $Y$  and  $N$  respectively.  $\chi_0^2$  fits the  $\chi^2$  distribution with a degree of freedom of 1.

The significance probability  $P$  is defined as  $P = Pr\{\chi^2 \geq \chi_0^2\}$ . If  $P$  is less than 0.01 ( $\chi_0^2 \geq 6.63$ ), the null hypothesis is strongly rejected and the question is classified as ‘‘H: high agreement group.’’ If  $P$  is equal to or greater than 0.01 and less than 0.05 ( $6.63 > \chi_0^2 \geq 3.84$ ), the null hypothesis is weakly rejected and the question is classified as ‘‘M: middle agreement group.’’ If  $P$  is equal to or greater than 0.05 ( $3.84 > \chi_0^2$ ), the null hypothesis is accepted and the question is classified as ‘‘L: low agreement group.’’

## 4 Experiments

### 4.1 Collecting and Grouping Questions

A questionnaire has been developed in order to collect questions for the Cross-road game. 56 questions were collected. Incomplete questions were then eliminated and questions with same meaning were merged. As a result, 35 questions were acquired.

The 35 questions are divided into 6 groups; leadership, health trouble, sense of responsibility, personal matter, communication with others, and commitment to the team.

(Group A) Leadership: Questions related to the participant’s leadership experience. (Group B) Personal matter: Questions about dilemmas between demands caused by health issues and teamwork commitments. (Group C) Sense of responsibility: Questions about the responsibility the participant feels for the team and for the result of the teamwork. (Group D) Personal matter: Questions about dilemmas between the demands of the participant’s personal life and the demands of the teamwork are involved. (Group E) Communication: Questions about communication strategies for resolving intra-team problems. (Group F) commitment: Questions about the commitment of a participant in solving intra-team problems.

### 4.2 Results and Discussion

The experiments were conducted to investigate the agreements with the obtained questions. Each question was shown to the participants, and they were asked to select *yes* or *no* depending on their own decision. The participants were (I)

students of an IT course in the UK (28 males and 5 females), (II) students of an IT course in Japan (33 males and 4 females) and (III) students of a design course in Japan (66 females). The 40 questions have been classified into the 3 groups, H, M and L, described above, in accordance with the results of the experiments.

**(A) Leadership.** The following six questions are included in this group.

- A-1** You are the leader of a team. You have organized many meetings for the team. But one member does not come to any meetings. He also has not contributed at all. Do you discuss the situation with him?
- A-2** You are the leader of a team. A team member has not done any work and the deadline is already approaching. Do you ask the lecturer to remove that team member from the project?
- A-3** You are the leader of a team. Your team has to submit the assignment tomorrow morning, and you have already finished your parts. However the other members have not done theirs yet, and they highly rely on your help. But you have an important examination tomorrow afternoon. Do you help your members?
- A-4** You are the leader of a team. You noticed that one member of the team has not given you his part of the assignment yet. The deadline is the next day. You do not know his e-mail address and telephone number. Do you try to ask your lecturer to resolve this situation?
- A-5** You are a member of a team. Your team leader has been involved in an accident and suffered a broken leg. The team has to finish the project the next week. Do you manage your team instead of him?

**Table 1.** Results of Leadership

	I	II	III		I	II	III
A-1	H (90%)	M (70%)	H (80%)	A-4	H (84%)	L (51%)	H (86%)
A-2	H (72%)	H (10%)	H (31%)	A-5	H (84%)	L (64%)	M (62%)
A-3	L (54%)	H (27%)	H (27%)				

The results of Situation A-2 show that the students of each group could agree with other members' opinion, but the opinion is exactly the opposite. It is expected that Japanese students do not want to remove other members or they do not want to talk about it with a lecturer. In the Situation A-3, Japanese students could agree with other members' opinion of no, but the UK students could not agree. From this results, it is expected that the Japanese students do not want to help others in completing their chores even if they were the leader. In the Situation A-4, only the students of an IT course in Japan could not agree with the other members' opinion of *yes*. It is expected that they do not want to handle other members' personal data. From the results of Situation A-5, it can be seen that the Japanese students tend to hesitate to become a leader.

**(B) Health Troubles.** The following five questions are included in the group.

- B-1** You are a member of a team. You have caught a light cold. You have a doctor's appointment, but your team wants to finish the project because the deadline is the next day. Do you go to see the doctor?
- B-2** You are a member of a team. You are very sick. If you do not attend the team meeting, the remainder of your team might fail. But you can pass the module because you get an extension due to your illness. Do you attend the project meeting?
- B-3** You are the leader of a team. You are feeling ill and do not want to go to a group meeting. If you do not appear, the other team members are not able to make any decisions. Do you go to the meeting?
- B-4** You are a member of a team. You feel tired because you work hard in a part time job. You are considering leaving your task of the project for tomorrow. But your team can not progress until you have completed your part, and they do not want to fall behind. Do you go to bed?

**Table 2.** Results of health troubles

	I	II	III		I	II	III
B-1	L (39%)	H (21%)	H (22%)	B-3	H (78%)	H (86%)	H (89%)
B-2	L (54%)	H (75%)	H (81%)	B-4	L (33%)	H (16%)	H (16%)

The results of the Situations B-1 and B-2 indicate that Japanese students tend to hesitate to go to see a doctor when they have a team meeting even if they have medical problems. The result of Situation B-4 also shows that the Japanese students tend to hesitate to rest even when they have medical problems. The students of an IT course in the UK could agree with the opinion of *yes* in the Situation B-3 despite being unable to agree with the opinion of *yes* in the Situations B-1 and B-2. One of the most important differences between them is the role of the participant who makes the prediction; in Situation B-3 the participant is the leader and in the Situations B-1 and B-2 the participant is a member. Thus it is expected that they change their attitudes depending on their role.

**(C) Sense of Responsibility.** The following three questions are included

- C-1** You are a member of a team. You have to hand in your team report on a CD. On the way to the student office, accidentally you lost the CD. The deadline is today. Immediately after the submission time, you have another appointment. Do you go home to produce a new CD?
- C-2** You are a member of a team. You have to submit the outcome of the project. It is required that all data is recorded on a CD-R disk. However, you have run out blank CD-Rs. Do you buy some new blank CD-Rs for the project?
- C-3** You are a member of a team. You have a lot of jobs to do for your employer as a freelance employee at home. You found that the assignment that you were supposed to hand in next week is left and none of the team members did their own part. Will you contact them and try to do the assignment?

In the category "sense of responsibility," the students of the courses agreed with positive opinions in all questions. Thus this kind of question can be classified as a common high-agreement question.

**Table 3.** Results of sense of responsibility

	I	II	III		I	II	III
C-1	H (93%)	H (100%)	H (89%)	C-3	H (87%)	H (97%)	H (95%)
C-2	H (96%)	H (89%)	H (86%)				

**(D) Personal Matters.** Personal matters can further be divided into four types; D1: Private events vs. group work, D2: pleasure vs. group work, D3: friendship vs. group work, and D4: other lectures vs. group work.

*D1: Private events vs. group work.*

**D1-1** You are a member of a team. You are looking for a flat. You have an appointment for viewing a house; but your group members need to meet and finish the report at exactly the time of the house viewing. Do you go to view the house?

**D1-2** You are a member of a team. You have been invited to an event that you wanted to join today. You also have an assignment which has to be completed by tomorrow noon. If you do not finish it, your team cannot submit the report. Do you attend the event?

**D1-3** You are a member of a team. Your family is invited to your aunt’s house tonight for dinner because it is her birthday, but you did not manage to finish your tasks yet. Your team has to submit the assignment tomorrow morning and they will work hard tonight. Do you go to your aunt’s house?

**D1-4** You are the leader of a team. You have been invited to a free training course event. This course will affect your future work experience and will include the certification by a big company. You have to hand in a report detailing the results of the project on the same day. The other team members either cannot or do not want to come to the University. Do you go to the event?

**Table 4.** Results of private events vs. group work

	I	II	III		I	II	III
D1-1	L (48%)	L (37%)	H (24%)	D1-3	H (18%)	H (24%)	H (12%)
D1-2	H (18%)	L (35%)	M (34%)	D1-4	H (75%)	H (91%)	H (84%)

In Situation D1-2, the Japanese student could not agree with the opinion of other members. But students of an IT course in the UK could agree with the opinion of no. It is expected that the UK students tend to choose their team work over their own private events.

Both situations of D1-3 and D1-4 ask about the dilemma between group work and other private events. However, the result is exactly the opposite. The event in Situation D1-3 is a family event but the event in Situation D1-4 is of importance for the respondentfs career. Thus it could be said that they tend to choose the private event when it has some relevance for their development.

*D2: Pleasure vs. Group Work.*

- D2-1** You are a member of a team. A close friend invites you and some other friends to the bar for a drink. However your assignment is due tomorrow. Your team wants you to work on the assignment today until it is completed. Do you go to the bar with your close friend?
- D2-2** You are a member of a team. A new online multi player game that you wanted to play has come out. Your team has to write a report which is worth 70% of the module. Your team wants to start writing the report tonight. Do you play the game online now?
- D2-3** You are a member of a team. Your team members make arrangements to meet in two consecutive days to finish the project. Your friend invites you to an all-night party. Do you go to the party?

**Table 5.** Results of pleasure vs. group work

	I	II	III		I	II	III
D2-1	H (15%)	H (8%)	H (6%)	D2-3	H (12%)	H (8%)	H (7%)
D2-2	H (6%)	H (5%)	H (3%)				

These results show that all students chose the group work over their pleasure. Thus this kind of questions can also be classified as a common high-agreement question.

*D3: Friendships vs. Group Work.*

- D3-1** You are a member of a team. Your friend is coming to London after 4 years of absence, but the assignment deadline is tomorrow. He is arriving today at 3pm. Do you go to visit him?
- D3-2** You are a member of a team. You forgot the appointment with a friend that was scheduled at the same time as a meeting with your team. Do you go to the meeting with your team?
- D3-3** You are a member of a team. Your friend broke his leg playing football. He lives in his flat alone. He asked you to visit him, but your team has to present some work tomorrow, and you need to finish the presentation. Do you go and visit your friend?
- D3-4** You are a member of a team. There is a team meeting in the afternoon. You are on the way to the University. A team member informs you that he will come later because the train is delayed. The meeting couldn't be started until the member will arrive. You have an appointment with your close friend after the meeting. Do you leave the team meeting earlier to go to the meeting with your friend?

**Table 6.** Results of friendship vs. group work

	I	II	III		I	II	III
D3-1	L (57%)	L (43%)	L (40%)	D3-3	L (51%)	L (35%)	H (33%)
D3-2	H (84%)	H (94%)	H (77%)	D3-4	L (36%)	L (40%)	L (45%)

It can be seen that it is difficult for participants to agree with each other's opinions in the situations of D3-1, D3-2, and D3-4. In the situations in this group,

the protagonists have severe reasons to see their friend except in Situation D3-3. Hence, it is expected that a dilemma of friendship vs. group work is difficult for them, and such questions can be considered as common low-agreement questions.

*D4: Other Lectures vs. Group Work.*

- D4-1** You are a member of a team. You have a very important lecture but at the same time you have to meet with your group to finish the course work, which is due the very same day. Do you go to the lecture?
- D4-2** You are a member of a team. You have to meet with your group to finish the project this evening. You have another assignment and the deadline is tomorrow. Do you go to the meeting with your team?
- D4-3** You are a member of a team. You have an assignment in another lecture which has to be handed in tomorrow. You also have to work with your team this afternoon. Do you work with your team members?

**Table 7.** Results of Lecture vs. group works

	I	II	III		I	II	III
D4-1	L (36%)	H (97%)	H (92%)	D4-3	L (48%)	H (81%)	H (31%)
D4-2	L (63%)	H (75%)	H (28%)				

The results of Situation (D4-1) show that many Japanese students agreed with the opinion of choosing the lectures over working with other members. Thus it could be said that the Japanese students are keen to attend lectures. For the situations of (D4-2) and (D4-3), students of each course showed different attitudes. Many students of an IT course in the UK could not agree with the other members whereas many students in Japan could agree. However, the results of (II) and (III) show exactly the opposite result. Central theories in social psychology suggest that group entitativity, i.e. the degree to which a collection of persons is perceived as being bonded together in a coherent unit, depends on common goals (Campbell, 1958) and common social categories (Tajfel and Turner, 1986). A superficial prediction would therefore be that all students should give priority to their group work because they share goals and form a social category. But a closer look would include other social categories such as their family and Lickel, et al. (2000) have shown that intimacy is a strong predictor for entitativity. So the Japanese students would follow the demands of their family rather than those of their team and attend the lecture. The UK students are not very different, but their course has neither a formal requirement nor a formal reward for attending a lecture. It is rather the successful team work that is rewarded with higher scores. Therefore by the same token as the Japanese students, the UK students follow demands of their intimate social context but prioritize the team work. Hence it is expected that the attitude toward a dilemma of teamwork vs. their own assignments depends on their particular study environment and its requirements.



**E: Communication with Others.** The following five questions are included.

- E-1** You are a member of a team. Your relationship to the other team members is not very good. Your printer breaks and the assignment is due tomorrow. Do you ask a team member to print it out?
- E-2** You are a member of a team. One group member dominates the group meetings. Do you raise this issue?
- E-3** You are a member of a team. In your group, the other members like to do their work in the last minute but you prefer to get started ASAP. Do you talk about it with the other members?
- E-4** You are a member of a team. You are aiming for a high mark, but the other team members are satisfied when they just pass the module. Do you talk about it to the other members?
- E-5** You are a member of a team. You don't like to talk a lot in front of others. You always agree what others said. You have a great idea that can improve your project. Do you talk to the other team members about your idea?

**Table 8.** Results of communication with others

	I	II	III		I	II	III
E-1	H (84%)	M (70%)	H (83%)	E-4	H (90%)	M (32%)	M (37%)
E-2	L (54%)	L (62%)	H (69%)	E-5	H (93%)	H (86%)	H (89%)
E-3	H (93%)	M (70%)	H (87%)				

The results of Situation (E-2) show that only the students of a design course agreed with the opinion of *yes*. The reason for this could be that they have received training in expressing themselves. The results of Situation (E-4) indicate that only the students of an IT course in the UK could agree with the opinion of *yes*. It is expected that the students in Japan did not wish to discuss their scores with others.

*F: Commitment to the Team.*

- F-1** You are a member of a team. Your team has to complete a report. The deadline is the next day. One of the team members said that he doesn't want to work tonight. If the report is not finished on time, the team will fail. Do you do the work in his place?
- F-2** You are a member of a team. A team member's mother is in the hospital with a severe injury. He feels that he should go to the hospital. However, an assignment is due the next day and he still has a lot of work to do. Your team cannot submit the report until the work is finished. Do you do the work for him?
- F-3** You are a member of a team. One of your team members has dropped out. His sections of the presentation must be done by someone else. The rest of your team members are not confident presenters. Do you do the presentation instead of him?
- F-4** You are the leader of a team. The day before the deadline you realize that the team assignment involves an additional task that nobody in the team was aware of. Moreover, the other team members have not finished the tasks that were assigned to them earlier. Do you do this new task yourself?

**Table 9.** Results of commitment for the team

	I	II	III		I	II	III
F-1	H (84%)	H (89%)	H (89%)	F-3	H (87%)	M (70%)	L (57%)
F-2	H (90%)	H (100%)	H (93%)	F-4	M (69%)	H (81%)	H (72%)

The results show that the participants tend to choose the opinion *yes* indicating a preference for commitment to their team, except in the case of the design students in Japan in Situation (F-3). Generally, a student presentation is one of the most important events in that Japanese design course. Thus they might hesitate to make such a presentation because of the high pressure that is associated with that task.

## 5 Conclusion

In this paper, question characteristics have been investigated for the Crossroad game. The questions were collected by using questionnaires and dividing them into three groups, high-agreement, low-agreement, and middle-agreement using the chi-square method.

The results highlighted that both, the UK students and Japanese students, tend to agree with the opinion of *yes* to questions involving a sense of responsibility or a dilemma between pleasure and demands of the team work or the commitment to the team. By contrast, both, the UK students and Japanese students, could not agree with each other about a dilemma between friendship and team work. Furthermore, the attitude toward a dilemma between teamwork and their own assignments depended on the background of the student. Thus it is expected that discussions in the Crossroad game can be enhanced by adding questions related to dilemmas between friendship and team work or between their own assignments and team work.

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