Relay Thinking in Design and Technology

Abstract
Relay thinking as a thinking process borrows its concept from running a relay race. This concept is then modified so that the co-operative advantages found in a 'relay' are put into group thinking projects. In 1997, eight secondary design and technology students used relay thinking to generate ideas in order to solve a pre-set problem. The objective of this study was to see the possibilities and limitations of using the process in design and technology problem solving activities. The performance of the students was noted during the thinking activities and interviews were conducted after the activities. The interviews did not aim to investigate the students' solutions to the problem, but rather their experience in using relay thinking.

In this paper, the concept of relay thinking will first be outlined. The results of the study will then be presented. Looking at these results, relay thinking provides an alternative to individual and group thinking experiences, although some modifications on the thinking activities are necessary. The results also indicate that secondary students should be provided with more opportunities to have group co-operation in problem solving activities.

Relay thinking

Relay thinking follows the pattern of a relay race. A small number of people get together to solve an assigned problem within a period of time. A member starts to think and generate ideas alone after receiving the outline of the problem. After a pre-set period of time, another member takes up the first member's duty and continues to develop the ideas, with the individual ideas passed from one to the other, with the last member proposing the final solution.

(A) Goal

In relay thinking, ideas are generated by individuals working independently at different periods of time, and idea transmission occurs between just two group members at a time. Thus, without a well-defined final target or goal, particularly in group work, misinterpretations and misunderstandings can arise (Brilhart, 1989; Prince, 1970).

(B) Individuals

"Individuals are much better at generating ideas and fresh directions," (de Bono, 1993, p. 41). Moreover, creating initial and raw ideas under group conditions takes up a lot of time in communication but not necessarily thinking (Belbin, 1993; Thigh, 1986). In contrast, individuals working on their own can look at lots of different possibilities (Smith, 1986), and there is no need to talk or to listen most of the time (de Bono, 1993). Therefore, at the beginning of the idea generation process, a group member works as the 'originator'. Once he or she receives the problem, work can begin. Students can think individually when and where they want. There is no limitation or constraint on the first member: they can start off in any direction and approach the problem using any method they like.

(C) Group co-operation

Adair's group problem solving method 'Building on Ideas' points out that when group members see an idea, they will not shoot it down. If they see some merit in it, they will build on it. The idea-generating or working environment can be compared to playing American football, with a 'touch-down' being scored at the bottom end. However, Adair's method has its limitations: each group member may not wait for the 'ball-holder' to pass the ball. Sometimes, they would expect to take the ball and touch it down in their own way (Siu, 1998). Relay thinking allows individuals to have more personal time to generate ideas without disturbance. Although students' ideas are still built on others' ideas, they are individually controlled. This organised manner does not imply the need for more constraints; quite the contrary, more freedom of elaboration and thinking is available in each individual thinking period.

(D) Ideas transition

In relay thinking, individual and traditional group thinking methods were iterated all the time (see figure 1). The main factor of a relay race is to have a 'smooth' transition and a 'proceeding' movement. When the second runner starts reaching for the baton, that is the time for him or her to start running at his or her fastest speed. The same principle applies in relay thinking. The first group member, after individually developing their ideas, tries to develop and share those

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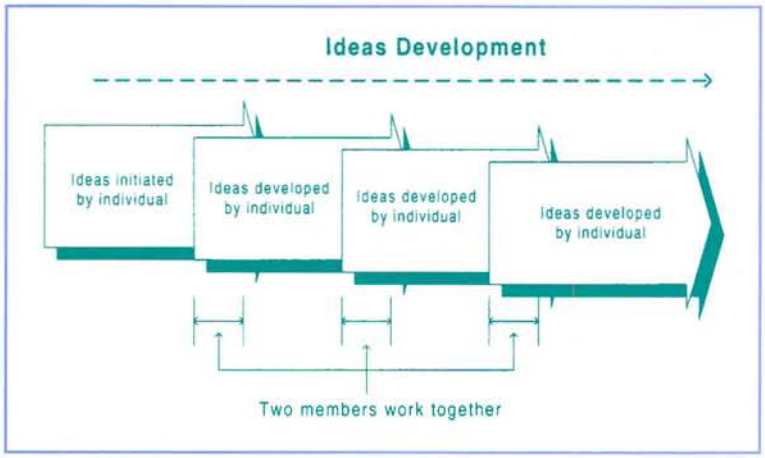

Figure 1: Relay Thinking Process

ideas with the second member in their last portion of the allotted time. At that point, neither works alone, and idea development is proceeding. However, the second member is not allowed to start their own idea generation in a new and different way, but must follow the first person's direction of thought. The main function of this transition period is to allow the second member to fully understand the developed ideas and then continue with their development. This form of transmission will continue until either the goal is met or the time limit is reached.

(E) Thinking methods

During individual idea development and thinking, group members can use their favourite method of generating ideas. It allows more time for individual idea development and a freer atmosphere and environment in which each person can start to develop their thinking at their own pace and on any occasion. The only constraint is that students are not encouraged to discuss their thought processes with anyone else until they move into the transition period.

Relay thinking activities in design and technology

In 1997, eight secondary design and technology students trom a grammar school were invited to use relay thinking to solve an identical pre-set problem. The students were divided into two groups, each consisting of four students. The students were required to think about the solutions in as detailed a way as possible and they could present their ideas in any forms. Each student was given 90 minutes for their own thinking, and 15 minutes for the transition period. In order to control the time accurately and to prevent the students taking the problem home to discuss with others, the activities were scheduled for conclusion on the same day. Rooms were provided during the ideas transition periods, and the students had to pass on their ideas in those rooms within the given period of time. While they were thinking on their own, they could use the provided rooms or any other place that they felt they could work. At the end, each group of students was gathered together and interviewed. The objective was not to evaluate the success of the design solutions, but to seek the students' comments on their experience of relay thinking.

Results and discussions

The initial intention behind asking the students to do the relay thinking task at their school was so that they would be working in a 'familiar' environment. Amongst the students, only one student did not stay in the provided classroom to do his individual thinking. Most of the students pointed out that the 'classroom' was the best place tor them to design. They also said that apart from their take-home assignments, they would normally generate ideas inside the classroom or workshops.

All of the students agreed that they preferred an environment without any 'physical' or 'psychological' pressure for them to think. They commented that it might be better if they had been able to take the problem home to conduct their individual thinking. However, the experience of one pilot study of relay thinking in 1995 came up with very different results. In that study, the students were allowed to do their individual thinking at home. The results showed evidence that the students became 'too relaxed', and were not able to concentrate on their thinking at home (Siu, 1998). In short, both studies indicated that a more relaxed and comfortable environment can benefit thinking, but some control is needed for the students to remain focused and to use their time effectively.

Although the students agreed that relay thinking was not complicated and that it was easy for them to handle, some of them experienced difficulty in understanding the process, particularly the transition period. Thus, more time could be given to the ideas transition period, particularly for students who have no experience in relay thinking.

According to observation and the students' comments, 90 minutes was too much time for individual thinking. In fact, 'time' is the most difficult factor to control in relay thinking, particularly when trying to set the correct length of time for individual thinking. The time arrangement not only depends on the concentration span of different age groups and the experience and training of the students, but also on the nature and difficulty of the problems and requirements, as well as the environment. Some students also stated that they could not concentrate on their work when there was a time limit on it. In general, a longer time will allow greater flexibility in thinking and more chances to obtain outside stimulation – but it may also result in an uncontrolled thinking environment in which students are easily distracted by other external factors. Moreover, a short period of time did not allow for students to research and collect outside data. It would also limit stimulation and the use of resources.

The students were satisfied with the size of the group. All agreed that three to five was a good group size. When asked about bringing in students from other subjects, all of them agreed that it might be useful, but some of them could not state clearly how it was important. Moreover, when the students were asked whether they minded working with people they didn't know, the students responded that they might feel a little uncomfortable. With particular reference to group work, the students thought that they might get more effective results if they worked with people they knew.

The students also pointed out that they seldom had any other kind of group thinking experience. In fact, group thinking amongst design and technology students in Hong Kong is generally limited to class discussions led by teachers (Siu, 1994). Group projects are also seldom incorporated into the design and technology curriculum, and only sometimes in extra-curricular activities (Siu, 1998). Without regular and well-planned group discussions or thinking activities, students need more time for group project activities, particularly once they reach higher levels of learning. This limitation stunts the development of their ideas when tackling design problems (Siu, 1994, 1997).

The thinking process

The originators from the two groups felt uneasy about being the first thinker in the process. They stated that they were afraid of how their colleagues would look at and comment on their ideas. It was observed that the two originators spent a lot of time getting started. They said that they felt under a lot of pressure, as they knew that they had to pass on their ideas and that their initial thinking would have a significant influence on the development of those ideas. Instead of generating many ideas for group members to make a decision on, the originators tended to develop a small nucleus of ideas for the next person to work on. They agreed that they expected to set up (or finalise) a clear direction at the beginning since they believed that once a correct direction was set, their group could stay on the right track, developing and elaborating on their ideas. Obviously, this way of thinking can eliminate distractions, but it also limits the opportunities for better exploration. However, according to continued studies of relay thinking (Siu, 1998), a concrete result can be more easily obtained if more ideas are initiated at the beginning, and then more precise and detailed thinking can be concentrated on towards the end. Moreover, a solution is not necessarily the best solution.

During idea development, most of the students followed their members' thinking direction without any argument. This phenomenon sometimes creates advantages for group work, but may sometimes limit the opportunities for better development or terminating mistakes (Jones, 1980). On the other hand, the students pointed out that they might have had more creative ideas after their individual thinking time and the transition period. However there was no opportunity for them to rejoin the relay team. This indicates that relay thinking, in some senses, does not have the advantage of traditional group discussion – it lacks ad hoc feedback and the re-direction of idea development. Moreover, just as with other thinking processes with time constraints, the final solution cannot be guaranteed.

Relay thinking aims to be a smooth transition of ideas that not only increases the efficiency of idea development but also minimises misunderstandings in ideas transmission.

Smooth transition is also the main strength of this thinking process over other individual or group thinking processes/methods. However, according to the study, the students faced problems during the transition periods, particularly passing their own 'complete' ideas to other members. The main reasons cited were that it was the first time that the students had used relay thinking, ideas were not organised well during development, creating comprehension difficulties for the others. So while we should increase opportunities for students to familiarise themselves with this thinking process, we should also help them to develop their individual thinking in the context of team spirit and co-operation, as well as communication and idea presentation.

The early understanding of the design title created problems in that it was difficult to guarantee that the students would not think about the problem before they started their duties. Once a member had thought about the problem, it was also difficult to guarantee that he would build on the previous member's ideas and start up a new one or tune the transmitted ideas back to his initial thinking.

Conclusions

Relay thinking has its limitations. This does not suggest that we should neglect it, or that it is not worth improving. To have successful relay thinking, good quality individual thinking is essential. To a certain degree, the success of individual thinking relies on a student's own experience. Therefore, in common practice, we should not put up barriers to students' thinking. Rather, we should give students greater opportunities, starting from the early stages of education, to tackle different design problems, in order to enrich their experience. When providing relay thinking activities we should make several different arrangements because students vary in their thinking experiences, backgrounds, levels of knowledge and personal characteristics.

These differences result in various requirements, expectations, and interpretations in tackling a problem. Moreover, students should try to understand their own strengths and limitations better in order to know which position suits them best in a relay team. This kind of trial and error and self-understanding experience should ideally start in early learning, with different levels of requirement and difficulty. Furthermore, more group work (but not just data collection) should be provided for school students, particularly in the normal curriculum. This experience will allow students to gain knowledge, and give them the spirit to tackle a problem as a group.

To conclude, relay thinking in design and technology teaching and learning still needs further discussion and exploration. It still needs developing before it can be put into the design and technology curriculum. While it is only an alternative thinking process that is on trial, we need to discuss it further to find out how it could be used with other thinking activities, and how more alternatives could be generated and developed.

Acknowledgements

The author would like to acknowledge the support and advice of Dr Ken Volk, the Chairman of the STEC '98.

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