

Effects of Group Composition on Individual Learning/Performance in Design and Technology: A Case Study Approach

Abstract

It is a commonly held view amongst teachers that children of lower attainment achieve greater success in design and technology when they are working as part of a group alongside more able pupils. Personal experience of one of the authors suggested that this might not always be the case. Case study material based on observations of two pupils working in a variety of group situations was gathered. The outcomes from this case study support the case that some children, far from being helped by working in groups with their more able or more assertive peers, may be inhibited from showing what they know and from developing their skills, whereas they may be more encouraged by being enabled to work with children who they themselves can help.

Introduction

This study was undertaken in a small village primary school, comprising four classes each of which spans an age range of two years. With such a small staff there is little expertise in design and technology. Until recently, the head teacher took responsibility for design and technology, concentrating mainly on the older pupils. A recent change of head, however, led to the author [SB] being given this responsibility.

The research question

We tend to group children for design and technology and set them a task. The children discuss the assignment, plan together and make their model. The teacher moves around, talking to groups, offering advice and encouraging evaluation and modification. With this approach there may be some children who rarely experience new practical skills as there are always those more able to do them. The fundamental importance of first-hand experience as a basis for learning has been a central tenet of educational theory since the pioneering work of Piaget. Clearly there is a problem if grouping prevents some pupils from gaining such experience. They may learn valuable group working skills, but never come fully to grips with aspects of the technical understanding required for the subject, or with the making skills which support such understanding.

The problem seems to be to arrive at the right combination of:

- generation of ideas and discussion
- the presence of a supportive adult
- the sharing of concrete experience
- the right language to develop understanding and evaluation.

Groups have to be carefully chosen to ensure that effective interaction takes place. Galton et al (1980) expressed a concern that children working in groups might be simply working individually, and thus not developing group working skills. It is not always possible to put children in groups and expect them to co-operate. Noreen Webb (1987) suggests that children should be trained in group work skills. Her study has demonstrated the effectiveness of having a classroom where helping skills are valued. Children interact well together when they are shown how best to accomplish this. The task set is also very important and should demand that everyone join in if the group is to be successful. However, it may be that contributing to the success of a group task will limit the value of the task for one (or more) group member, particularly if the group works to previously identified strengths of the individuals within it.

The problem of grouping children in design and technology had interested us before. An incident at the start of a design and technology course directed further attention to this question.

"On the first day of the design and technology course I was feeling rather apprehensive about the activities I would be involved in. The first thing we were asked to do was to get into groups of three and I found myself with one woman who had a technology degree and another who was responsible for all the technology in a large school. We talked and planned our task together but when it came to the actual practical part they had far superior ideas and skills and this resulted in me doing all the basic cutting

Sylvia Burgess

*Primary School
teacher, Dorset*

*Edited by Bridget A.
Egan, Course Leader
for Primary Design
and Technology, and
Professional Studies
Course Manager at
King Alfred's College
of Higher Education,
Winchester*

and colouring while they did the actual designing and making.

This started me thinking about what actually happens in the classroom when we group the children for practical activities. Do the less able children get enough chances to try out their own ideas, or are they overshadowed by the children with superior skills? I learnt new ideas by watching the others in my group but did not have the confidence to try them out. At the time I believe I would have learnt a lot more by actually doing these things myself on my own design, whilst working alongside others that I could watch and copy new skills from." (SB, coursework study 1996)

The resource book *Design and Technology in Process* (Author unknown, published by Heinemann) emphasises the importance of whole group efforts but also suggests pupils work individually, although ideas are discussed in groups.

"The advantage of this approach is that students benefit from peer group discussion of ideas, while each member of the group experiences an individual challenge of turning ideas into reality."

However, a group working to a common goal will probably apportion tasks in a way designed to achieve success, rather than in ways that will ensure new learning for individuals.

Teachers have mainly adopted the practice of sitting children in groups so that valuable discussion can take place. This small group is acknowledged as a useful teaching strategy. Bennett and Dunne (1992) write,

"Learning is optimised in the settings where social interaction, particularly between a learner and more knowledgeable other, is encouraged, and, where co-operatively achieved success [is] its major aim. The medium of this success is talk."

Although working in a group gives children the chance to share ideas, test them, encourage, criticise and share skills, knowledge and particular expertise, one might question whether this benefits all pupils when it comes to the practical work. Grouping in most schools is very random and can be based on comparable, mixed ability or friendship groups. It is accepted in most schools that children will work in groups for technology lessons. The question is whether this is always to the advantage of all the children. Alexander (1984) writes:

"Grouping ... emerges as an organisational device rather than a means of promoting more effective learning, or perhaps exists for no reason other than fashion and ideology dictate it."

Slavin (1987), on the other hand, says:

"Research has established that under certain circumstances, the use of co-operative learning methods increases student achievement more than traditional instructional practices."

Our starting point, therefore, is the belief that grouping can help children to learn. The problem is to find how best to group children in technology classes to ensure the most effective learning of new skills.

In order to discover what might be the most favourable circumstances for a child learning in a group working situation, the effects of different groupings were observed, with specific consideration given to the performance of a particular child.

Methodology

A case study approach was adopted. The advantage of such an approach is that it allows detailed and careful observations of a range of phenomena (in this case, responses by the individual children) in different circumstances, without placing too heavy an emphasis on expected outcomes. The results and analysis of such observation, however, while they may offer indicators for future consideration, cannot be generalised. The complex nature of human

learning and social development will make the experience different for different individuals. The main aim of using this approach for this study is to discover whether changes in grouping affect the performance of the individual, and it should be possible to observe this.

Initially, two children were chosen as the 'target' children, and each was placed in a variety of group situations for design and technology. Their responses were carefully observed. The criteria for choosing the two children in question were that they were seen as being of average general ability. Both, however, lack a degree of confidence, have little prior experience in design and technology, and were seen as in need of skills development. It was also important to select children who would cope with being put into several different groups, sometimes with children from other classes, and also with being taken out of normal lessons if the timing of the research did not coincide with existing technology lessons.

Each child was observed working in several different groups. Different tasks were offered, as it was important that the 'target' child should not become over-familiar with the task.

Emma

Emma is 6 years old and of average intelligence and capabilities. Emma is quiet and slightly unsure of herself. Although she has good ideas she usually needs encouragement to see them through. She is very adaptable and easy going. She already has basic skills in design and technology including the ability to investigate, disassemble and evaluate materials.

Initially Emma was observed in several different groups. The size of group was also considered important. The argument for groups of four is very strong since such groups are said to enable the best interaction and communication between pupils. Kagan as cited in Bennett and Dunne (1992 p. 114) says:

"Teams of four are ideal. A team of three is often a dyad and an outsider, in a team of three there are three possible

lines of communication, in a team of four there are six. Doubling the line of communication increases learning potential. Teams of five often leave an odd man out and leave less time for individual participation."

Groups of four children were therefore used throughout this study.

The choice of task and the type of co-operation required were also very important. Bennett and Dunne (1992) suggest three possibilities:

1. children work individually on identical tasks for individual projects, but are asked to talk to each other about their work, to help each other, thereby establishing co-operative endeavour
2. children work individually on 'jig-saw' elements of a task, so that a certain amount of co-operation is built into the task, especially in terms of planning and organisation
3. children work jointly on one task for a joint outcome so that co-operation is of paramount importance.

The third of these options was chosen, although it was expected that the groups would probably naturally revert to the second, as the children apportioned tasks among themselves. When observing the child working individually the first strategy would be used, to allow the child to make something on her own but still have every chance available of learning new skills. Choosing the children with which she would work was more difficult, but in each case the choice was based on ability and level of skills learnt.

Group 1

The first group was one in which Emma would be with more able children, to see if her reaction was similar to SB's in a similar situation. The other children in the group were:

Owain A very bright, capable child. He is full of ideas and has very good background knowledge and skills. He likes to work on his own.

Dean A careful, neat worker of average ability. Good basic skills.

Lucy A confident, organised child with good basic skills.

The group was set the task of making a vehicle from 'junk' material. It had to have wheels. Each child was allowed to make her/his own model.

Observations

Owain and Dean were immediately full of ideas and Lucy asked a lot of questions about practical aspects of the task. At this point Emma remained quiet and only offered ideas if directly questioned. Owain, Dean and Lucy began drawing a design straight away whilst Emma watched them and said she wanted time to think before she started. Emma finally started and they all got on with the task well. All the children asked for a lot of help but also helped each other with holding, sticking etc. They worked well as a group sharing resources but tended to work as individuals and did not pass on knowledge of skills to each other. Emma did not really learn anything new in this lesson from working with the others as she turned to the observer for any help or reassurance. She produced a basic cardboard box car with four wheels. So far she had only worked with familiar materials and used techniques she was sure she could manage.

Group 2

This group consisted of Emma, two girls of average ability and one less able girl.

Claire A year one child. Very chatty and willing to co-operate but not many ideas or skills.

Natasha A year two child with interesting ideas and good basic skills but rather a loner, preferring to work on her own.

Becky A withdrawn, quiet child with few ideas and poor skills.

The task was to make a face using a paper plate and a variety of materials for decoration.

Observations

Emma worked well. She had a lot of ideas and drew a good design on paper first. She then made the face, using a good selection of materials. She used colour well and was pleased with the result. As Becky needed help from the observer with every stage, the others worked mainly on their own. The difference in Emma's behaviour was very noticeable. She was very confident and used a wide variety of materials. She voiced and developed her own ideas and tried out different ways of cutting out the eyes.

In both these groups the children were working as individuals and there was less interaction between the children than had been anticipated. Emma had shown far more confidence when working with less able children but was not actually learning many new skills. She was being very helpful and co-operative so the next step was to try her with three of her own class-mates to see how she worked on a joint project. The purpose here was to see if she followed their lead and did tasks for them or whether she actually used new skills and applied them.

Group 3

This group consisted of one able child, two children of average ability and Emma.

Jenny Very capable, intelligent child with good skills.

Alex A 'born leader', very confident with lots of ideas and good skills.

Frances A quiet, less confident girl but with good ideas and skills.

Their task was to make a model between them of a fire engine. This task related closely to previous class work and they had several toys and pictures to help them. They

could use a variety of junk materials and the model had to have moving parts. The observer decided to offer as little help as possible and to observe the relationship between the children.

Observations

Jenny had plenty of ideas but found it hard to get the others' approval and tended to ignore them and work on her own a lot. Alex and Frances worked well together. Both were very enthusiastic with lots of ideas. Emma was eager to help and do things right. She proved to be a very good helper and usually ended up holding things for other people, cutting out shapes they asked for etc. Emma and Frances both tended to look to Alex for guidance and approval. This might be because he was the only boy in the group or because he tends to be a leader anyway.

When the other three argued or swapped ideas, Emma tried to keep the peace. She did a lot of standing and watching. If she had good ideas, she tended to tell them to Frances, who is her friend, and get her to tell the others. When there was a long discussion about how to get the ladder to go up and down, Emma listened but did not take part. She was very organised and would say things like, "We need windows on the side. I'll make them", but she did not offer to do anything mechanical and only used existing skills. She was perfectly happy, but was not confident enough to tackle any of the bigger jobs and showed no inclination to attempt them. She actually had some very good ideas but was not confident enough to put her thoughts forward. Alex quickly realised she was happy to do the boring jobs so he gave them all to her. If Emma was working on something and Alex needed help, she immediately stopped what she was doing to help him. The other two saw it as her 'job'. During the whole task she had not tried out any new techniques or really learnt any skills. She had watched the others a lot and might have seen things she could try in the future but had not gained any practical experience.

From the above observations, it was evident that Emma would tend to work only in her areas of confidence, whichever group she was placed in. When working with more

able children, however, she lacked the confidence to put forward her ideas, and readily took on the less challenging tasks that others did not want, or the role of helper to another child.

The next phase of the study was to observe Emma tackling similar tasks, requiring the same sorts of skills, in different groups. To stop her getting bored the tasks had to be fairly simple but challenging enough for her to use and apply concepts learnt, if possible.

Group 4

This group consisted of two year 1 (slightly younger) children, one child of average ability, and Emma.

Charlotte Average ability and skills.

Claire Year 1 child of average ability.

Becky Year 1 child of average ability.

Their task was to build the tallest tower possible with wooden bricks. The activity started with a discussion, considering the bricks available, and the need for a strong base. It was suggested that they use bigger bricks at the bottom.

Observations

Claire and Becky started to sort the bricks into shape and size. Emma and Charlotte began building. Emma got quite agitated because Charlotte was using the smaller bricks first and she knew this was wrong. She told the observer, who did not intervene, so she went back and tried to take over. She had never done this before with the more assertive children. Charlotte insisted on carrying on for a while but Emma gradually persuaded her to do it her way by showing her it would work. They eventually built a tower but Charlotte took over again and the whole project became hers. Emma said "I know what to do but every time I put something on, Charlotte takes it off again."

Emma became very frustrated having to work with the others as she knew what to do but was not assertive enough to get them to do it her way. She actually had the best

approach but did not get the chance to try it out and prove it to herself.

Group 5

The same group of children as in the previous observation was asked to work on a related task.

The task this time was to build a tall tower, working independently.

Observations

Becky and Claire built small towers near each other and then combined them and played with it. They completely forgot about trying for height. Charlotte and Emma moved away from each other and Emma immediately made a wide base. She had obviously remembered the lesson the previous week and she carefully measured the bricks against each other and built a strong structure. She was very pleased with the result and it seemed that she had really learnt something about structures.

Group 6

This group consisted of the following, plus Emma:

Alex	From group 3.
Sophie	A confident Year 2 child with good skills.
Cheryl	A Year 1 child with poor concentration.

The task was to make a simple puppet using card and split pins. The group knew about using split pins but had not actually used them to make a puppet before. Observations of previous groupings seemed to indicate that Emma worked better independently, so this was permitted, but they were near enough to help each other if they wanted to.

Observations

Emma worked quietly and well, only occasionally glancing at the others. She selected her own materials and made good use of them. She tried out different ways of making holes and after a couple of mistakes

learnt to adjust the hole-punch to get the hole in the right place. She was completely 'on task' and did far more on her own than she had ever done in a group. If she did have a problem she would ask for advice. She made a successful puppet, learnt to use the single hole punch and was very pleased with the result.

Later in the term, after a visit to see Pinocchio at the theatre, Emma made a very good puppet with moving parts using the skills she had learnt on the previous occasion. She worked on her own but offered advice to others on her table and told them when they were doing things wrong.

Conclusions

Emma works well in a group because she is polite, generous and amiable, but these characteristics hold her back with more dominant children, who take advantage of her. With someone like Charlotte (Group 4) who she knew really well, she became more assertive, but still gave in to keep the peace. She worked better with less able children, offering help and advice, but was not learning new skills herself. She seems to work best on her own with an example to follow and an adult on hand to ask for help when needed. Most of the things she does well she says she has learnt from her mother at home. She is not afraid to try out new skills as long as she is working on her own. Jarvis (1993), drawing on research by Bennett and Cass, suggests that the presence of high achievers in mixed ability groups "are able to support the less able children with inputs of knowledge as well as with suggestions and explanations." In the above observations, we see Emma acting in this way with children less able or less confident than herself, although other group members were not always receptive to her help. There is little evidence, however that she derived real learning benefit from working with those children who were higher achievers. Jarvis goes on to point out, however, that:

"...the proportion of high attainers in the group is likely to be significant. It was found [by Bennett and Cass] that when two high attainers were grouped with one low attainer the latter tended to be

ignored or opted out. When the proportions were reversed all the children performed well."

It seems clear that Emma learnt most through mediated learning with the greater participation of the adult observer, in a group which did not challenge her confidence (i.e. of children at a similar level of attainment or of slightly lower attainment than herself) seemed to facilitate the most new learning.

The next phase was to extend the study, observing older children. They would already have acquired more basic skills and it might be easier to assess what new skills they were learning.

The target child in the next two groups is Georgina, a very quiet and shy child who offers few ideas, and has a poor level of skill.

Group 7

This group consisted of children in Year 4. The group conforms to the pattern said to offer the most opportunities for the less able child in learning from others (see Jarvis, 1993, op. cit.), in that only one child of higher attainment is present. All four are seen as fairly easy going so it was expected that they should help each other and share knowledge.

Georgina

Wendy Average ability, amiable.

Tanya Average ability, amiable.

Samantha Good ideas and skills.

The task set was to use rolls of newspaper, sellotape and string to make a house that one of the group could get in and out of.

Observations

All the children started making rolls and tried different ways and thicknesses. There was good discussion and all four were very active. Samantha and Wendy quickly discussed and decided how to make the

square base. Georgina was happy just to make rolls and continued to do so while the other three discussed how to construct the house. She tried to help at one point but said she did not know what she was doing and would go back and roll up newspaper again. She would come over and hold things when asked but did not contribute to the actual building process. She was quite willing to follow instructions all the time. The others used her as their labourer and she actually said at one point "I'm the holder aren't I today." They completed the task but Georgina did not appear to have learnt much from the experience and she did not have a sense of achievement when it was finished.

Group 8

Later in the week Georgina was placed in a different group to see if she would behave differently.

This group consisted of Georgina, with Alice, Sam, and Katie, all less able but easy going children.

The task was to work together to make a vehicle out of junk.

Observations

Georgina was very confident and immediately came forward with complicated ideas. She volunteered to draw the plan and thought carefully about what they would need. They drew a good plan and made a careful list of materials. Georgina was very good at explaining her ideas to the others and she spent over 20 minutes planning. She then went on to organise the jobs each of them should do and then watched carefully what the others were doing to make sure they were keeping to the plan. She helped others when things went wrong and 'taught' them a better way. The others actually checked with her that things were right at each stage and obviously looked on her as leader. She tried out new ideas and asked for advice. She discovered she could curl silver paper with a pencil to make smoke and was extremely pleased with the result. When the group discovered coleslaw pots were not satisfactory as wheels she decided on card wheels, cut them out and connected them. She showed an obvious skill for thinking ahead and seeing possible

outcomes. When the model was completed she was able to discuss how it could have been made differently to improve it.

Summary

Georgina acted totally differently in the second group. She became a confident leader, tried out new ideas and helped the other children. She had learnt new skills and applied old ones well. She had shown an ability to plan, assemble, and evaluate – all skills prescribed by the National Curriculum under designing and making skills and knowledge and understanding. The difference in her behaviour was quite startling.

Conclusions and implications for design and technology teaching

Observations of Emma and Georgina in different groupings reinforce the findings of others that group composition has a significant effect on individual performance. The evidence of these observations, however, suggests that children who lack either confidence or skills in design and technology will not necessarily develop them if grouped with more able children. In both cases, the less confident child was placed in the position of being used by the more able or confident children as 'helper' or 'holder'. They may have learned from watching the approach of the other children, but it's difficult to assess how much or what was learnt in this way. In terms of kinaesthetic learning through handling and manipulating materials, the placing with more able or confident peers can be seen to restrict their development. In these circumstances both confined themselves to using previously learned skills and techniques, and were reluctant to experiment. Placed with children of lesser ability or confidence than themselves, both were able to offer help and advice, and to experiment with techniques they had not previously tried.

Design and technology may be a special case in terms of group composition, relying as it does on the first-hand experience of materials to build both knowledge and manipulative skills. While it is difficult to generalise from a small number of case studies, it is clear that group composition and group working need further research and more specific consideration in this subject area than they have previously been given.

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