The Da Vinci project - Can we change pupils' perceptions of creativity in Science and Mathematics?

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Aims of the project

- To explore pupils' perceptions of creativity across the curriculum
- To show that being a 'scientist' and an 'artist' aren't mutually exclusive
- To measure the impact of the project on pupils' perceptions of creativity in Science and Mathematics

Dimensions of the study

Urmston Grammar School is a Trafford LEA 11-18 selective grammar school with 850 pupils, 63 teachers and 17 support staff. The project involved all Year 8 pupils for some of the activities and a group of 32 Year 8 pupils selected on the basis of their responses to the 'creativity questionnaire', for the extended project. The latter involved two parallel Year 8 groups. One group used observational drawing to make models to explore the science of movement. The other group produced an animation that reinforced scientific understanding of movement of food through the body. Nine teaching staff and three external partners were involved in the delivery. Activities were focused during 'National Science and Engineering Week' and 'Pi day'. Pupils were off timetable in order to take part in the activities. Two teachers led the project – one from Science (Riffat Wall), the other from Mathematics (Jane Tancred). They worked with three external partners – one a visual artist and two who were animators. Seven teaching staff from various curriculum areas and science technicians supported the project.

Summary of main findings

- Pupils' understanding of creativity broadened and deepened following participation in the project
- Pupils were more aware that all subjects, including Science and Mathematics, allowed them the scope to be creative
- Pupils worked as more independent learners
- Pupils were motivated by seeing staff working in a collaborative manner across the curriculum rather than within their distinct subject areas

Background and context

At Urmston Grammar School, many pupils had stereotypical views about creativity such as believing that the curriculum is divided into academic subjects and creative subjects. We developed this action research project to help to blur the divisions between the arts and sciences, so that pupils realised that these areas of study were not mutually exclusive. It was hoped that it would allow pupils to see that scientists, who develop the creative facets of their personality, were more 'rounded' individuals and as a result better scientists. We also felt that it would help artists who may see science as being difficult, clinical and remote, that it is accessible to all depending on the paths we take to develop our understanding.

The Da Vinci cross-curricular project was funded by CARA2 (Creativity Action Research Awards) which brings together classroom teachers and creative practitioners to explore the effect of creativity on pupil learning and motivation.

Teaching processes and strategies

Launching the project - this involved a number of key stages including:

- a 'Creativity Committee' was formed with interested colleagues from Science, Mathematics and Technology faculties
- all Year 8 pupils completed a creativity questionnaire which was developed by lead teachers to explore pupils understanding and experience of creativity and administered by form tutors. No reference was made about the 'Da Vinci project'

Analysis of the questionnaire allowed us to select our target group of 32 pupils. Pupils' understanding of creativity was the main criteria for selection. A quarter of the group had a very good understanding of creativity; a quarter of them had no understanding of creativity and half had some understanding. We selected pupils using gender as a criterion in order to ensure a balance within the group.

The project days:

- An assembly was presented to all Year 8 pupils about Leonardo Da Vinci and his work in the fields of art,

science, invention, engineering and architecture

- All Year 8 pupils were involved in a Mathematics workshop to explore the 'golden ratio', which has been used extensively in art and architecture for thousands of years, particularly by Leonardo Da Vinci

- All Year 8 pupils took part in a workshop to learn some animation skills

- The extended project began with a briefing to the whole group about the idea of working creatively. They were shown an example of a journal, produced by a member of staff, about Da Vinci and given some ideas about how and what they might record during the next three days. The pupils were then sent to work in their two groups

	Movement Group	Digestion Group
DAY 1	Close first hand observation of animal joints by dissection, observational drawing, note taking and photographs. Homework task: Pupils made paper automata of animals and people.	Pupils introduced to pixelation exercise and simplified flick book. Exploration of human digestive system. Observational drawings of a sheep's tongue, small intestine and stomach. Groups began to animate digestive process.
DAY 2	Working in teams, the main aim was the production of a working 3D model of a joint or muscle structure.	Figure drawing session of a clothed model - Work on animations and drawing animals' organs continued.
	Sharing work with the Movement group. Feedback from pupils about the creative processes they used.	
DAY 3	3D jionts and working automata completed.	Explored influence of Da Vinci on Disney drawings explored. Pupils completed research and presented their part of the digestive system.

The presentation

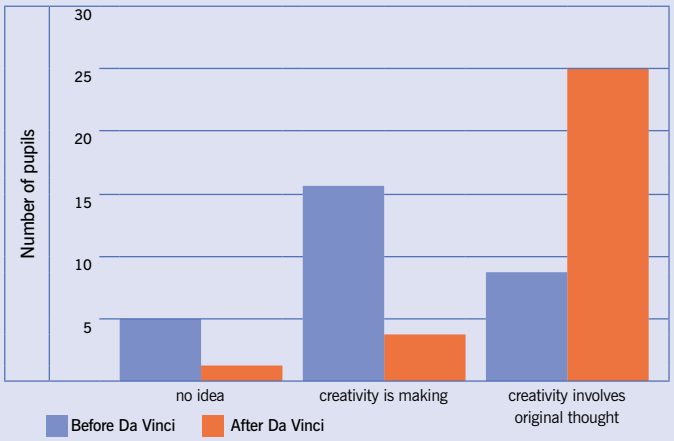
The project team formally invited the parents of all the pupil participants to an after-school presentation so that pupils were able to celebrate their achievements with family and friends.

Detailed findings

Pupils understanding of creativity - Graph 1

Before the project the majority of the selected pupils' equated creativity with making something. Our shared understanding of creativity involved individuals being imaginative, purposeful, directed at achieving an objective that was original and valuable. After the project pupils' understanding of creativity was much broader. Their responses to 'What is creativity?' also reflected a deeper understanding. Before the project one female pupil described her creative efforts like this: "…I was using plans and making something". After the project her response to the same question was "I was investigating and then using my findings to create something unique that had never been done before". A male pupil commented, after the project: "using my guitar to write original music and songs is what makes me creative" rather than just playing it.

Graph 1: **Understanding of creativity**



How pupils' views of specific aspects of creativity changed - Graphs 2 and 3

Pupils initially identified creative processes in obvious ways, such as drawing or playing a musical instrument, but after the project more pupils were aware that activities such as 'investigating' and 'looking for more than one solution' were also part of the creative process.

We felt that this shift in their understanding of creativity was crucial if we were to find that their perceptions of creativity in Science and Mathematics were to change. By recognising that these other processes were part of being creative the pupils were now open to interpreting creativity in a very different way. Pupils' perceptions of their own creativity changed. One pupil wrote "I think I will observe and investigate before starting big projects"; another had noted "I am thinking things through with a different point of view". A third pupil's comments showed that their awareness of the role of originality: "I think I've got more creative and it was good that I had different ideas than anyone else".

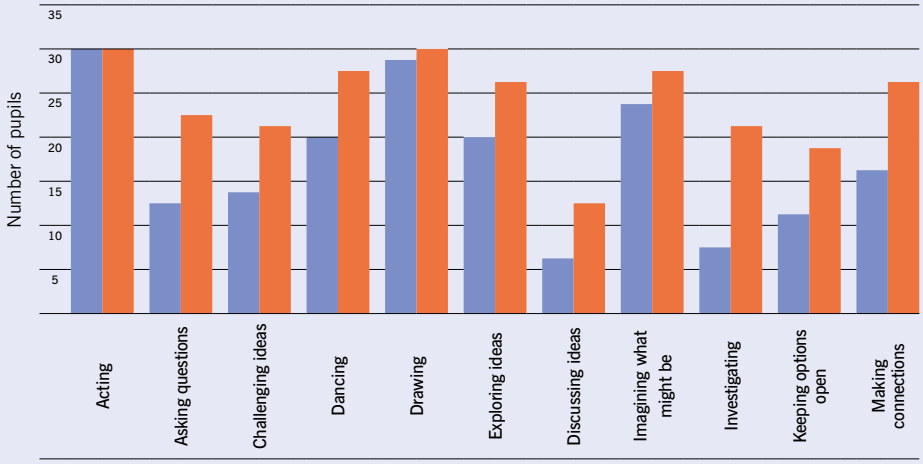
How did pupils' views about creative and non-creative subjects change? - Graph 4

Many pupils held stereotypical views that only certain subjects could be creative. The analysis suggested that pupils realised that all areas of the curriculum allowed them to be creative. The results for Geography were particularly significant and we looked for contributory factors for this increase, but could not identify any.

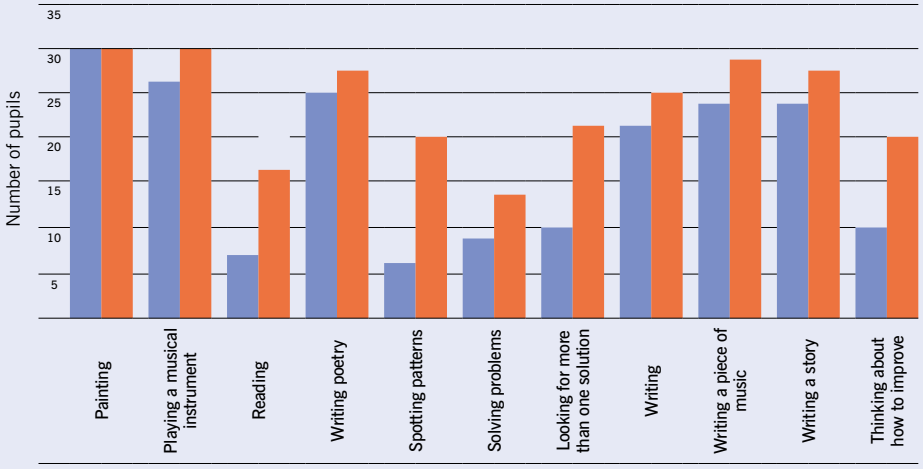
How did the pupils' approach to learning change?

Pupils' approach to learning changed as the project progressed. They became more creative and experimental. Pupils worked more independently and took charge of their own learning in the project.

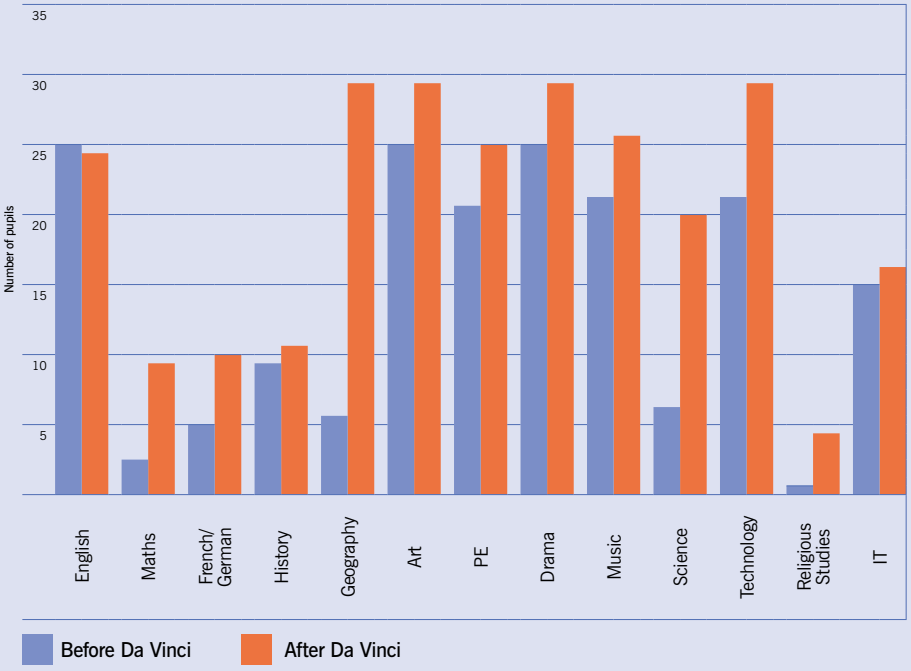
Graph 2: **Creativity is...**



Graph 3: **Creativity is...**



Graph 4: **Which subjects allow you to be creative?**



One external partner reflected that:

"The yp (young people) were able to do things for themselves and not be observers, direction was always at hand to support learning and looking … and ultimately the yp were in charge of their own learning only because they understood, and were encouraged to make decisions themselves". (Elaine Bennet, visual artist)

The lead teachers supported this view:

"When they encountered a problem, off they went to try and solve it. One group needed a tube to make a bone, so they decided that they would go and check with the site manager to find out if he had any pipes that they could use… They used the adults around them as a resource and sounding board, rather than someone who would supply the answers". (Riffat Wall, Science teacher)

"They realised the pixelation equipment was accessible and just what they could achieve. It was almost a 'eureka' moment, their confidence

and imagination took off… Once they knew they could carry on into the next lessons and they were not constrained by the traditional school periods, they soon became more willing to try things out, explore, experiment and were not afraid of not getting things right first time". (Jane Tancred, Mathematics teacher)

As the pupils' confidence developed the extent of co-operation and quality of discussion within the groups increased noticeably. They were also more inclined to plan out in rough, and were more adaptable. These were clear indicators that the pupils were working more creatively and showed a high level of engagement with and enthusiasm for the project.

Research methods

We collected data using a number of methods, including:

Qualitative processes	Quantitative processes
'Post-it' comments on 'Creative journey' wall	Questionnaires before the project - completed before pupils were aware of the activities
Pupil interviews	Questionnaires after the project
Comments after different activities	
Photographs	
Adult observations during sessions	

Conclusions

The evidence suggests to us that the Da Vinci project has had an impact on pupils' perceptions of creativity in Science and Mathematics. They also benefited from working collaboratively with other pupils. We have only measured the short-term effect on perceptions but it was encouraging to see the impact made in a relatively short time span. We feel the project offered staff opportunities for working collaboratively between faculties and gave them the confidence to feel that extended projects are possible within the academic curriculum of our school. We believe that thorough preparation and planning before and during the project contributed to its success. The school's commitment to the project meant that staff were released from teaching to attend planning meetings.

The outcomes of the project support our belief that schools should cater for the needs, interests and aptitudes of individual pupils. We have to shape teaching around the way different youngsters learn if we are to nurture the unique talents of each pupil. Schools have to be creative with their timetables and be prepared to take risks with the organisation of the school day and year if they are to allow opportunities for creativity to flourish.

Collaborative projects provide the perfect forum to promote creativity. By taking part in the Da Vinci project pupils have had the opportunity to work in a variety of ways, to develop some of the skills of learning independently in a less confined school day. They have learnt to appreciate that creativity has as much to do with the quality of thought taking place and the process or journey as with what is ultimately produced, a key aim of CARA2. The skills acquired should impact on day-to-day behaviour if they are revisited and reinforced, so that every pupil has the opportunity to become a lifelong learner.

Suggestions for further reading

National Curriculum in Action www.ncaction.org.uk/creativity/resources

Are we really serious about creativity? Pat Cochrane (Cape UK)

Making space for teaching creative science.
Tim Caulton (Cape UK)

DfES circular: Learning and teaching (March 2001)

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External partners:
Kath Shackleton and Zane Whittingham – Zoom animation
Elaine Bennet – Visual artist

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engaging teacher expertise