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Making Science Lessons Engaging, More Popular, and Equitable Through Emotional Literacy

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Abstract

This article highlights the benefits of introducing aspects of emotional literacy into lessons. Data were collected from 165 Year 7 pupils in two schools over 1 year. Pupils benefit as they can enjoy science more, as well as learn to work together and support each other to learn. The research found that incorporating emotional literacy strategies into lessons on a regular basis increased pupils' interest in continuing with science as a subject, especially in the case of girls. The latter part of the article explains in detail the strategies that were used to develop pupils' emotional literacy and specifies how these can be utilised effectively so that interested teachers can replicate them.

Introduction

Science has an opportunity to capture interest, innovate thinking, and equip young people with the necessary skills to challenge aspects of the world around them. By creating opportunities for pupils to access a range of learning experiences, the personal development of the pupil can be supported and explored. The learning experience needs to be such that it considers not only the content of the science curriculum, but also how pupils develop skills necessary to communicate effectively in a technologically-advanced society.

Learning is a complex concept that incorporates many issues. For any pupil to achieve their true potential they must have some notion of the importance of education and its relevance to their own development. Both situational and social contexts have an important role in the acceptance of the individual as a successful learner. The experiences they bring to the learning environment are valuable routes by which to transmit pedagogy (Daniels, 1993). Contextualising the curriculum can be used to motivate pupils and encourage wider classroom debate surrounding current scientific issues. Hughes (2000) suggests that this approach to teaching science has unrealised potential and could challenge preconceptions of science as a male-dominated profession, thus making it accessible and relevant to a far wider range of pupils. This can be further supported by the work of Lave and Wenger (1990), whose analysis of the social nature of learning highlights the role of informal learning and its importance in the communication of knowledge. Significant value can therefore be placed on input from peers, family members, mentors, and teachers, all of whom play a part in learning. We can conclude that learning has social and cultural implications that are of great value to the pupil and enhance the learning experience.

Emotional Literacy

The phrases *emotional literacy* and *emotional intelligence* are often used interchangeably, although there are differences between them (Matthews, 2006). The term emotional literacy reflects the collaborative nature of the development of the emotions, as illustrated by the following definitions:

> The ability to understand ourselves and other people, and in particular to be aware of, understand, and use information about the emotional states of ourselves and others with competence. It includes the ability to understand, express and manage our own emotions,

> and respond to the emotions of others, in ways that are helpful to ourselves and others. (Weare, 2003, p. 2)

Similarly, the organisation Antidote (n.d.) defines emotional literacy as "the practice of interacting with others in ways that build understanding of our own and others' emotions, then using this understanding to inform our actions" (¶ 1).

These definitions are clearly social in nature, but they do not incorporate issues such as sexism and racism. Clearly, these would be a component of emotional literacy, as when people interact, aspects of their interactions have to do with gender, ethnic, and class differences which can be used as an excuse for discriminations. Taking into account these different aspects, we now extend the definition of emotional literacy to incorporate these issues. Hence, the definition of emotional literacy we will utilise is:

> Emotional literacy involves factors such as people understanding their own and others' emotional states; learning to manage their emotions and to empathise with others. It also includes the recognition that emotional literacy is both an individual development and a collective activity and is both about self-development and the building of community so that ones own sense of emotional well-being grows along with that of others, and not at their expense. Emotional literacy involves connections between people and working with their differences and similarities while being able to handle ambiguity and contradiction. It is a dynamic process through which the individual develops emotionally and involves culture and empowerment. For example, it includes understanding how the nature of social class, race, and gender (sexism and homophobia) impinge on peoples' emotional states to lead to an understanding of how society could change. Hence it incorporates an understanding of power exchanges between people and a challenging of power differentials. (Matthews, 2006, p. 178)

We can therefore understand that emotional literacy and equity are intertwined and should be considered mutually supportive of each other. We can now consider how it is possible to approach the development of pupils' emotional literacy in the classroom.

Why Might Developing Emotional Literacy Help Pupils Enjoy Science and Other Subjects More?

There are a variety of factors that affect pupil's enjoyment of lessons, such as being challenged in interesting ways and having the opportunity to be involved in practical group work (Osborne & Collins, 2000). One important factor is being actively involved in the lessons and being challenged and stimulated. Pupils like to be able to discuss their work, and to have a measure of control over what they are doing (Hodson, 1998; Osborne & Collins 2000). Vygotsky believed that social interactions were the basis of a type of development he referred to as "conscious awareness" (Daniels, 1993, p. 53). He described the importance of language as a tool for functioning socially and highlighted problem-solving as being key to learning. We believe the use of group work and active negotiation is essential in the development of these cognitive skills.

The significance of promoting a culture of achievement (Gerwirtz, 2001) in educational systems must not be undervalued, and the success of this vision is the responsibility of the teacher, the parents, and the learners themselves.

> Education is not a commodity, a collection of qualifications acquired as a means to a future end. It is an important end in itself, concerned first and foremost with the development of

> individual talents and capacities and with the fulfilment of personal goals in a complex and changing society. (Scottish Consultative Council for the Curriculum [SCCC], 1995, p. 3)

With a suitable classroom structure, we can help to develop a greater understanding and empathy between pupils with different life experiences (Duvall, 1994; Singh, 2001). The move to introduce a more relevant and contextual science curriculum can only improve motivation and allow students valuable insight into actual scientific practice.

This study reflects the importance of making informed decisions and judgements about the students that we teach. It is our responsibility as teachers to ensure that pupils are equipped to make personal choices on a rational basis throughout their adult life. In order to support and observe pupils in the development of their social and emotional skills, it was considered necessary to situate pupils within the context of normal teaching, and the reasons for this are as follows.

First, pupils spend most of their time being taught subjects. In secondary schools, academic subjects are taught separately. The framework to which subjects are taught is strong, making it difficult for pupils to transfer skills from one subject area to another. This is in marked contrast to primary schooling, where subjects are taught by 1 or 2 teachers. Second, the cognitive, social, and emotional are all intertwined. It is important that all teachers accept responsibility for developing pupils' emotional abilities and not separate it either as a subject in its own right or to be tackled exclusively in one area. With the present emphasis on academic development, a focus on how students develop both socially and emotionally within subject teaching becomes more vital. Finally, the last, but probably most important reason is that by engaging pupil's emotions, we can enhance their overall learning experience. This will help them to enjoy not just science but all their lessons, and develop skills for life-long learning.

Self-Theories, Esteem, and Development

One key element to developing emotional literacy is to see masculinity, femininity, and ability as fluid and influenced by the social situation. The research of Carol Dweck (2000) supports the view that pupils would benefit if a major part of their learning was socially orientated and ways of improving pupil's emotional literacy found and incorporated into teaching styles. Dweck explores the notion that children hold two theories. One is called the entity theory, in which factors are seen primarily as fixed traits that dwell within us and are unlikely to change. In contrast, other children see intelligence as something that is not fixed, but that can be cultivated and open to change. Dweck calls this the incremental theory. Incrementalists are, in comparison to entity theorists, more likely to believe that achievement is affected by social factors, work harder if they fail at a task, and have a self-image that is less affected by failure. They are less quick to stereotype and more likely to believe that people are open to change, and so reflect on a range of social experiences. Dweck also studied views on relationships. She found that people who tended to hold an entity theory tended to have a fixed, or destiny, view of relationships. On the other hand, those with an incremental view of relationships were more likely to believe that relationships were open to change; they made efforts to resolve conflicts, and so provided opportunities for growth. This was called the growth belief of relationships.

Dweck (2000) challenges us to think about our current classroom practice. For example, if teachers praise for attainment, the pupils accept this and rely on external motivation to bolster their self-esteem. Attainment praise reinforces the entity theory of learning. However, praise for effort and the way learning is being tackled results in pupils not seeing success and failure as fixed, but that they can learn through their own efforts, taking ownership of their achievements by

internalising the learning process and celebrating success. With this in mind, it becomes apparent that Dweck's research supports the idea that boys and girls will benefit greatly if educated in ways that enable them to learn. By recognising the role of peers in the internalisation of learning, we can promote pupil motivation and provide opportunity for skill development. Closer analysis of our teaching methods could enable all pupils in the classroom to develop social and emotional, as well as cognitive skills, that enable them to achieve in a variety of situations, thus increasing the quality of the learning experience and raising self-esteem.

Science and the Emotions

We would now like to reinforce why science naturally lends itself to promoting emotional literacy in the classroom environment. Contrary to popular opinion, science is inherently a social activity. Science incorporates imagination, creativity, and social and political values. It is therefore vital that our education system and curriculum reflects the needs of our society and provides opportunities to develop critical thinking skills and promotes positive working relationships. Hence, it is necessary to evaluate and revise our curriculum content and pedagogy to encourage social and emotional understanding.

So, in our opinion science lessons should cover three areas concurrently: 1. greater interest in, and understanding of, the nature of science, 2. developing positive methods of communication and interactions between young people to enhance well-being, as well as 3. maintaining academic success. A more detailed analysis is given in Matthews (2002, 2006).

It is therefore important that we find ways to help pupils develop their social and emotional skills, not just in science but within all subjects. Examples of what could be included within a social classroom, irrespective of subject, are:

> to learn to resolve conflict fairly; justify their personal opinions orally; contribute to group and exploratory class discussions; use their imagination to consider other people's views; to negotiate, decide and take part in school-based activities; and to reflect on the process of participating. (Department for Education and Employment [DfEE], 1999, p. 184)

Clearly, though, for pupils to progress emotionally they need to gain an understanding of each other and, in particular, to do so across gender and ethnic divides. Hence multiethnic co-educational schools, where the "other" is present to talk to, provide the greater opportunity to enhance social and emotional development. Dialogue and interactions are seen as central to helping pupils develop their sense of self and other.

It is possible to engage pupils with their emotions through the content of science lessons. For example, Alsop and Watts (2000) developed a section of work around radioactivity and its effects, uses, and dangers. They explicitly encouraged pupils to engage their opinions and emotions, arguing that:

> What we do not need is sanitised, antiseptic science but an appropriate balance of informed excitement and animated understanding. Our work continues to explore the relationship between cognition and emotion. (p. 138)

By engaging pupils' emotions to promote interest and learning, it is also possible to develop pupils' social skills within a formal educational setting. Indeed, devising ways of enabling pupils to handle their emotions ought to further their cognitive development. This point is worth reiterating. One way of engaging pupils' emotions is to get them to feel happy, sad, angry, or

concerned about aspects of science. Another is to engage their emotions about each other and science to improve their social and emotional skills in general and to explore how that affects their attitudes to science. The Improving Science and Emotional Development (ISED) project was set up to explore the possibility of doing this and to encourage pupils to be absorbed in science, rather than just observing it. The ISED project set out to test the hypothesis that pupils in co-educational schools could be helped to develop their communication, social, and emotional skills. Co-educational schools were selected because, for pupils to progress emotionally, they need to gain an understanding of each other and to do so across gender divides (Matthews, 2003a, 2006). Collaborative group work was chosen as a way of ensuring dialogue between pupils. Feedback mechanisms were introduced where pupils were observed and then discussed social aspects of their learning. The aim was to engage pupils in their emotions, rather than just telling pupils how they should change. Dialogue and the interactions were seen as central to helping pupils develop their sense of self and other.

Principles of the Research

We would argue that for pupils to develop emotionally, they need to have time to be involved in collaborative group work so that they are able to:

1. Communicate with each other in a safe environment.
2. Think and reflect on social processes and feelings.
3. Verbalise (through writing and talking) what the interactions meant to them.
4. Compare this with what other people thought had gone on (understand that there are different perceptions of the same discourse).
5. Discuss their perceptions so that they come to understand their own and each other's viewpoints; emotional, cognitive, and social.
6. Learn about and empathise with each other.
7. Learn science and become aware that it involves social interactions.

In order to encounter a wide range of social and emotional viewpoints, mixed-ability, multi-ethnic groups comprising both boys and girls are encouraged to work together.

Before explaining how the project can be done in the classroom, we will go over the main results of the research. It is not the purpose of this article to detail how the data were obtained and analysed, and interested readers can follow this up in other articles (Matthews, 2003a, 2004, 2005, 2006). In brief, pupils in experimental and control groups were given questionnaires at the beginning of the year before embarking on any classroom-based activities, and again at the end of the year so that any change in attitudes to science lessons and each other could be identified. The intervention, which will be described in detail later, involved boys and girls and, where possible, mixed-ethnic groups working together on a collaborative task. After working on a task, which was initially also observed by a peer, the pupils discussed how well they had worked together. About every 3 weeks during these lessons, pupils filled out proformas that asked them a variety of questions. These questions covered how well they thought they worked together, how much they learnt, and what they thought of their science lessons. The research and control classes were taught using the same schemes of work and so experienced very similar scientific content and practical work. The significant difference between the two groups was the research intervention of collaborative group work with feedback discussion on how well they worked together.

Results of the ISED Project

The results of the research indicated that experimental pupils enjoyed science lessons more and that their emotional literacy improved. In this article, we will focus on the pupils' attitudes to science.

There were three Year 7 (pupils aged 11-12 years, and in their first year of secondary school in the United Kingdom) experimental classes (82 pupils) and three classes that acted as a control group (83 pupils). All these pupils were asked about their attitudes to science and could select answers on a scale of 0 to 7. In the following tables, the results have been codified such that 7 represents the most positive response possible. The results are shown in Table 1.

Table 1
Pupils' Attitudes to Science

Question	When data collected		Change over the year
	Start of year	End of year	
Experimental students (n = 82)			
How happy are you when you see science on the timetable?	5.7[a]	6.1	0.4 * (boys 0.2, girls 0.6 *)
Are science lessons interesting or boring?	5.9	6.3	0.4 # (boys 0.1, girls 0.7 *)
Do you enjoy or hate science lessons?	6.2	6.8	0.6 * (boys 0.4 #, girls 0.9 *)
Control students (n = 83)			
How happy are you when you see science on the timetable?	5.9	5.4	-0.5 * (boys -0.6 *, girls -0.4 #)
Are science lessons interesting or boring?	6.3	5.8	-0.5 * (boys -0.6 *, girls -0.3)
Do you enjoy or hate science lessons?	6.2	6.0	-0.2 (boys -0.3, girls -0.2)

Matched t-test: * $p<0.05$, # $0.1>p>0.05$, other $p>0.1$.
[a]All scores are on a scale of 0-7, with 7 being the most positive.

The control group results reflect the generally recognised pattern that pupils' interest in school science decreases when they join secondary schools. The pupils who were doing the research group work with feedback showed a promising increase in their interest in science. It is also worthy of note that the girls' interest increased more than that of the boys.

The pupils were also asked, if they had an opportunity to drop science, how likely they would be to continue with it. The results are shown in Table 2. Although these results indicate that the pupils undergoing the research are more likely to continue with science, it is important to remember that the pupils were at an early stage in their secondary education and so it is not possible to say how they would have responded if they were at the end of their school career.

Table 2
Percentages of Pupils Indicating That, Given a Choice, They Would Likely Continue With Science

Population	Sex	
	Boys	Girls
Research	85	85
Control	71	76

Pupil feedback provided clear evidence that the changes in attitude were due to the group work and monitoring introduced as an integral part of the ISED project (Matthews, 2003a). Table 3 shows the results from questions given to pupils during lessons.

Table 3
Percentages of Students Responding to Questions on the Effects of Group Work and Monitoring

Question	Type of response		
	Negative	Neutral	Positive
Does group work affect how you feel about science?	18 (boys 13, girls 23)	14 (boys 5, girls 23)	68 (boys 82, girls 54)
Would doing regular group work make pupils more interested in science?	11	20	69 (boys 71, girls 67)
Is group work a good way to learn science?	0	11	89 (boys 89, girls 89)

The following quotes provide evidence about the connection between the group work and interest in science:

> “Because you can compare answers and if you are right it will make you feel good.” (Girl)
> “Because you can work with feelings.” (Boy)
> “Group work is good, because if you don’t understand the others will explain it and make it easier. Sometimes there are disagreements, but most of the time it is interesting.” (Girl)
> “It makes it more interesting because you are with your friends.” (Boy)
> “More interesting because you talk to other people.” (Boy).
> “It makes it easier because you get ideas from other people. There is more disagreements because we all got [sic] different ideas.” (Boy)
> “It is interesting, easier, and more social.” (Girl)

Of course, some pupils were less enthusiastic:

> “Depends on the group.” (Girl)
> “There are more arguments because of the [boys’] lack of work.” (Girl)
> “If I work by myself I get more time to think.” (Boy)

Overall, the indications were that the pupils not only enjoyed science lessons more, but also that they learnt to communicate more effectively and support each other in lessons. It is beyond the scope of this article to go into detail on this but interested readers can find details in other articles such as Morrison and Matthews (2006) and Matthews (2002, 2003a, 2003b, 2005).

Details of the Practice in the Classroom

We will now use a numbered sequence to outline procedures and teaching strategies teachers can use in implementing this practice in their classrooms.

1. O*rganising the groups*. There are two stages in the process of organising the groups. To begin, a student observer is used in each group so pupils have a critical eye to help them discuss what went on in the group. This means that, in the first instance, groups of 5 pupils are formed.

Observers are used only until the pupils are familiar with the procedures and the teacher feels confident that their interactions are being focused on. Thereafter, and where possible, the teacher organises the pupils so that there are 2 girls and 2 boys in each group (see sections 14 & 15 below for further information). This structure is used throughout the rest of the year.

2. *Developing emotional literacy*. The teacher explains that they are working in groups of boys and girls and the reasons for doing collaborative work. These reasons might include:

a) Learning, including developing:
   i) discussion techniques that enable you to learn more science.
   ii) talking and listening skills.
   iii) co-operative skills.
   iv) learning from each other.
   v) taking responsibility for our own learning, and so learn more of what we want to learn.

b) Improving relationships, including:
   i) communication skills.
   ii) being able to express how you feel.
   iii) getting on better with friends, parents, and others.
   iv) learning to understand another's point of view.
   v) promoting equal opportunities.

c) Developing ourselves, including learning:
   i) to sense and understand our emotions.
   ii) to effectively apply the power of our emotions to learning and relationships with others.
   iii) to empathise with others.
   iv) to make ourselves understood by others.

3. *Pupils establishing the importance of group work.* The pupils are then asked to work in groups to draw a poster of why they think it is important that they work together. They are asked to focus on working with others in science and how this impacts on their learning. The posters can be used as a basis for discussion and utilised to identify strengths that already feature in the pupils learning experiences. These strengths can then be built upon to create a sustainable strategy that the pupils themselves have helped to define. Establishing a classroom practice in this way encourages both the teacher and pupils to actively participate in the development of their communication skills.

This completes the preliminary orientation of the pupils to the nature of the collaborative work they are going to do. After this, and during normal science lessons, the pupils are told they will be completing a science task that requires discussion. Examples of such tasks include:

- The pupils had done some lessons on heat transfer. They were given a series of questions requiring short answers to fill in. They were only given one copy of the sheet so they had to agree on their answers.
- The pupils had done some lessons on forces. They had to write some questions for the rest of the class, and also have the answers available. The questions were passed to another group who had to jointly write down answers.
- A collaborative learning task, involving underlining some text in different colours, on how the heart worked.
- After a section on acid rain, the pupils had to prepare a poster giving their solutions to the problem of how to cut down acid rain.
- The pupils had to jointly decide how they were going to do a practical and fill in details on a sheet. Only one sheet was initially given to them. When the teacher had checked it, they were given more blanks so that everyone could have a copy.
- A practical, using circuits, was done with four pupils in a group.

Henderson and Wellington (1998) provide a good range of ideas for activities that could be adapted to generate discussion in lessons.

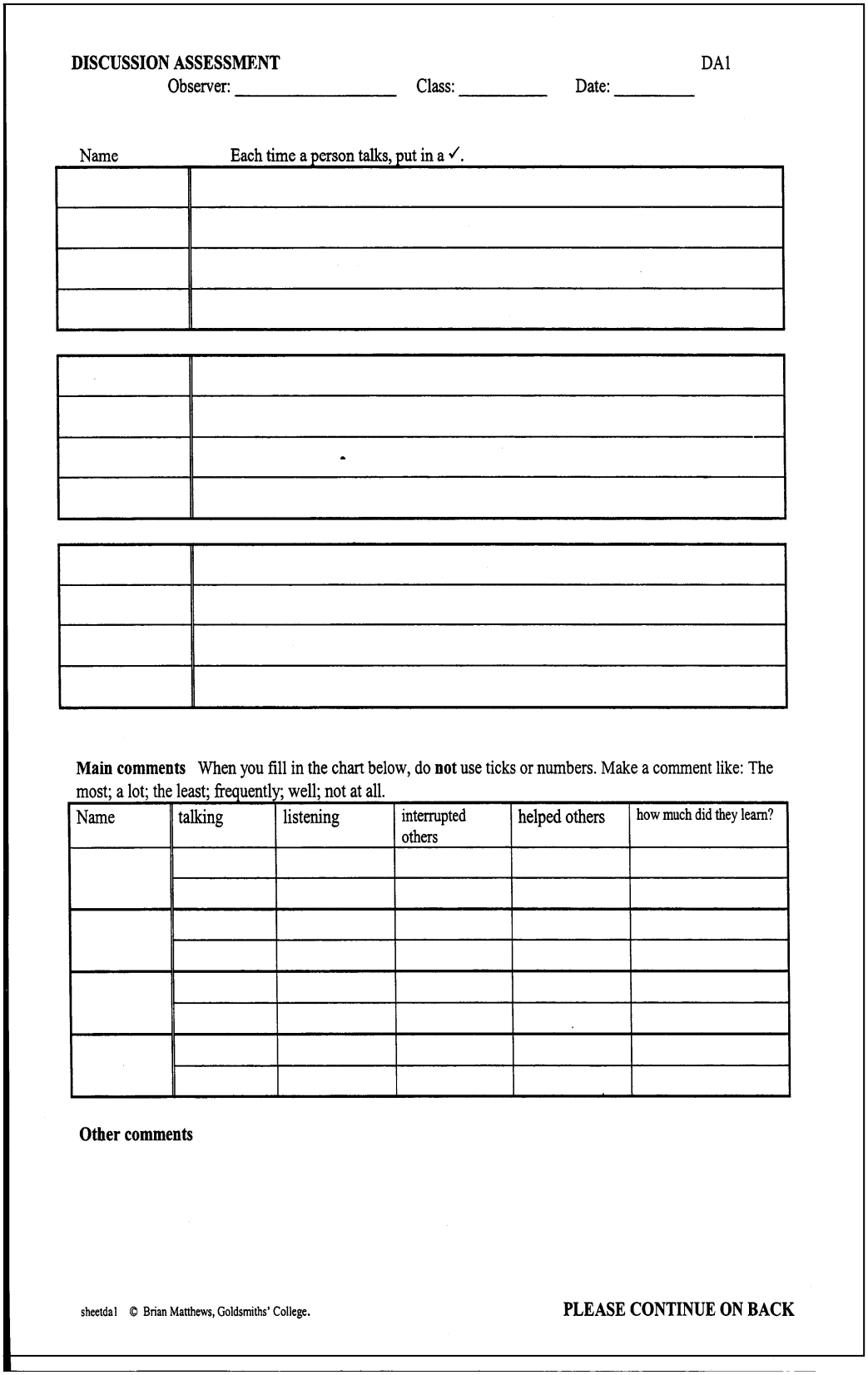
4. *Explaining the role of the observers*. The class is arranged into groups of 5. In each group, an observer is selected so that 2 boys and 2 girls remain. It is explained to the class that they will be observed as they work, and later be asked to discuss how well they learnt and worked together.

While the group of 2 boys and 2 girls are engaged in discussion, the observer is to fill in the top section of the Discussion Assessment Sheet shown in Figure 1. (The "DAI" in the top right-hand corner of this sheet is simply a document identification code.) The observer will record the names of the students in the group and fill in the chart using a tick when a pupil talks, an extended tick if they interrupt someone, and a vertical tail if interrupted while talking. Responses like "yes" or "uhm" are to be ignored. Any other comments about how well the group worked and got on together can be written in the Other Comments section at the bottom of the sheet, or on the back of the paper.

5. The Discussion Assessment Sheet is given to the observer and the teacher checks that they know how to fill it in. The pupils then engage in an appropriate science activity (see examples provided previously) from the science curriculum.

6. As the group works, the pupil-observer watches the 4 pupils and fills in the top section of the Discussion Assessment Sheet.

7. The teacher listens to the pupils and checks that the observers are filling in the sheets correctly. When most have completed the assigned task, the teacher asks the class to stop working on the activity.



DISCUSSION ASSESSMENT DA1

Observer: _____ Class: _____ Date: _____

Name	Each time a person talks, put in a ✓.

Main comments When you fill in the chart below, do **not** use ticks or numbers. Make a comment like: The most; a lot; the least; frequently; well; not at all.

Name	talking	listening	interrupted others	helped others	how much did they learn?

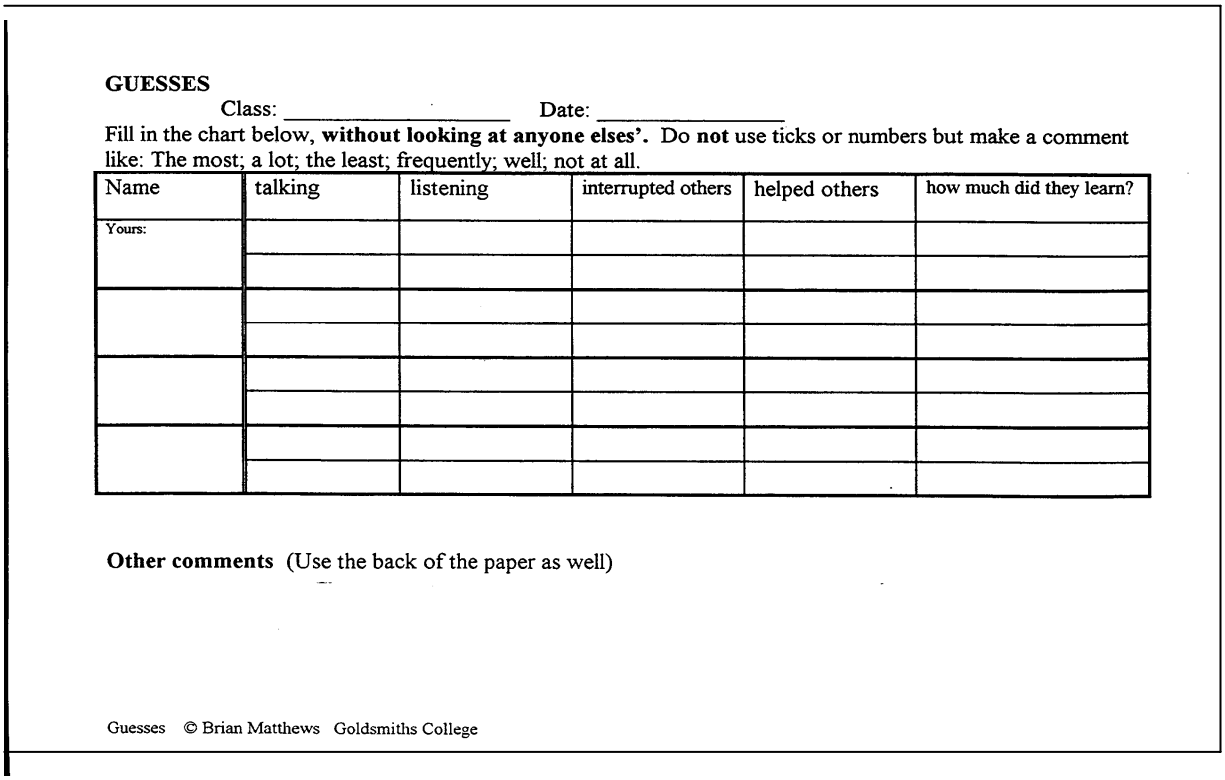
Other comments

sheetda1 © Brian Matthews, Goldsmiths' College.

PLEASE CONTINUE ON BACK

Figure 1. Discussion Assessment Sheet used by observers while pupils work.

8. The 4 members of each secondary group are then asked to complete the Guesses Sheet shown in Figure 2, where they estimate, without consulting anyone, how well they and the other 3 in the group had performed. The monitoring criteria are: (a) the amount of talking, (b) the extent of listening, (c) interrupting, (d) being supportive, and (e) how much they felt they had learnt. While this is being done, the observer completes the analogous Main Comments section on his or her Discussion Assessment Sheet and adds any additional relevant comments in the Other Comments section.



GUESSES

Class: _____ Date: _____

Fill in the chart below, **without looking at anyone elses'.** Do **not** use ticks or numbers but make a comment like: The most; a lot; the least; frequently; well; not at all.

Name	talking	listening	interrupted others	helped others	how much did they learn?
Yours:					

Other comments (Use the back of the paper as well)

Guesses © Brian Matthews Goldsmiths College

Figure 2. Guesses Sheet for pupils to estimate how much they contributed to discussions.

9. When all 5 pupils have finished, the observer collects all sheets.

10. The teacher then goes over, with the class, the principles that they should use while discussing how well they had got on (e.g., that they should be positive with each other).

11. The pupil-observer then discusses the results with the group in order to bring attention to the different ways the pupils had interpreted the talk, and to raise questions about the patterns of talk. In general, it is useful for the observer to get the members of the group to study their estimates and to see the extent to which they correlate with one another and with the estimates of the observer. All the sheets can be laid out by the observers, as necessary, so that everyone can see them. This process aims at making evident any gap between what each member of the group who talked thought had transpired and what the observer had found. The purpose here is simply to promote a discussion on how people feel about the social and emotional aspects of learning, and to have some evidence on which to base the debate.

12. The teacher should reinforce the desirability of pupils saying something good about each other (although this can prove much more difficult than it appears!).

13. The teacher then collects all sheets for possible review.

Teachers can use the Discussion Assessment and Guesses Sheets until the pupils are familiar with the orientation of this part of the curriculum. The sheets are commonly used for about 6 weeks, with the pupils doing such monitoring once about every 2 or 3 weeks. This is the first stage of monitoring pupils while they are engaged in learning in a social situation.

14. *Strategies without an observer*. Once the pupils are familiar with the procedures, and understand that social aspects of their learning are seen as important, the observer is removed so that all the pupils are engaged in learning. Where possible, pupils work in groups of 4; 2 boys and 2 girls. Where there are uneven numbers, single-sex groups are used to avoid a ratio of 3:1 by sex.

Initially, pupils can be quite resistant to working together, but as they become more involved and recognise the value of collaborative learning strategies that encourage positive communication, the orientation becomes embedded in classroom practice. At this point, the Discussion Assessment Sheet and Guesses Sheet are replaced by an Opinion Sheet, two examples of which are shown in Appendices A and B. (The numerals “6” and “11” in the top right-hand corner of these sheets, respectively, are simply document identification codes.)The form of the sheet used depends on which area of positive communication/emotional literacy the teacher would most like to focus on. An Opinion Sheet might be used in the classroom once about every 3 weeks.

15. Changing the groups regularly ensures that all pupils in the class get to know each other and experience working with different people.

Comments

The original concept saw pupils using Opinion Sheets as the basis for discussion about how well they got on and learnt. However, the pressure to cover the curriculum meant that the discussions required by the orientation could only be done occasionally. As it happened, this had a positive outcome. It emerged from interviews with the pupils that because the others in the group are unlikely to see and discuss their sheets, they felt they could be honest about what they wrote. Also, if they were unhappy, they would discuss how well the group got on outside the lessons and so were starting the process of taking responsibility for improving the social and emotional conditions of their learning.

These procedures are designed to legitimate pupil-pupil and pupil-teacher discussions around social and emotional issues, as well as cognitive ones. In essence, the teacher can aim to encourage pupils to develop a social coherence based on accepting each other and differences between individuals. They need to value each other for those differences. Teachers can be as flexible as they wish. The main use of the procedure is to legitimise the pupils talking and encourage them to talk to each other about how they feel.

The purpose of the sheets is to generate discussion and to provide for pupils seeing that other people may hold quite different views on the way a group has worked and got on. While one would like the completion of the Discussion Assessment Sheets to be accurate, it does not matter if this is not the case, as the principle is to provide a different viewpoint and promote discussion. Also, when the Guesses Sheet or an Opinion Sheet is used, it is clearly personal estimates that are being discussed.

Conclusion

This type of classroom practice is seen as only a start to legitimising some practices that incorporate essential elements of promoting emotional literacy in the classroom. It aims to encourage pupils to reflect on themselves as people and as learners. The results clearly indicate that introducing discussion strategies that focus on the relationships between pupils increases pupil enjoyment of science. This is likely to increase the numbers of pupils taking science. A key finding was that pupils help each other learn, and this is part of them being able to take more responsibility for their learning and to accept learning as a social activity. In Dweck's (2000) terminology, they may come to believe in the incremental model and so accept the importance of working hard for one's own understanding.

There is one other important outcome. As one of the teachers involved in the research reported:

> It got to that situation [in tutor-group meetings] where obviously, they had friends, their special friends, but as a group we could just talk openly about things because of doing all the group work and the questionnaires helped to really focus in on what they were doing and feeling. That gave them confidence within that group of knowing that nobody was going to be laughing at them or putting them down as is usually the case. They were very confident as a group; very. (Morrison & Matthews, 2006, p. 15)

The boys and girls learnt about each other and supported each other emotionally. This could provide the basis for a more genuine set of friendships, both sexual and non-sexual, which are key ingredients in addressing equity and social justice through developing emotional literacy (Matthews, 2006).

The foregoing provides sufficient justification for teachers to explore strategies to enhance the social and emotional communication skills of students during science lessons. We believe that teachers who explore these areas will find many benefits, including a positive impact on the learning climate in their classrooms.

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Appendix A

A Sample Opinion Sheet

Name:	Class:	Date: 6
Members of group:		

For each of Questions 1-4, write the names of the persons in order in the boxes.

1. Who do you think spoke:

The most?	next most?		the least?

2. Who do you think listened:

The most?	next most?		the least?

3. Who do you think suggested useful things to do:

The most?	next most?		the least?

4. Who do you think disrupted the group:

The least?	next least?		the most?

5. While I was working in my group, I felt . . . because . . .
6. Working in a group was useful because . . .
7. How does group work help you, or stop you, from learning?

Appendix B

A Second Sample Opinion Sheet

Name:	Class:	Date: 11

1. I found that working with the girl(s) in this group was . . .

   Next time we work in a group I would like her/them to . . .

2. I found that working with the boy(s) in his group was . . .

   Next time I would like him/them to . . .

3. Circle one (1) of the following statement to say how you prefer to work:

Only on my own	Mostly on my own	Sometimes on my own	Don't mind	Sometimes in a group	Mainly in a group	Always in a group

4. How important do you think it is to develop the social skills necessary to get on with others?

The advantages of developing social skills are . . .

5. The skills **I** need to develop to get on well with everyone in the group are . . .

6. I could get better at **my** skills by . . .

7. Order of speaking	8. Order of listening
Spoke the most	Listened the most
Spoke the least	Listened the least

9. With whom did you enjoy working? Write one or more names.

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