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PGCE Secondary in Science

2nd Assignment

Developmental School Experience



Developing Investigation Skills

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2006-2007



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Introduction

This assignment linked to my developmental school experience at my placement in St. Mary's College in Crosby, it is centred on an investigation work planning by me as a trainee teacher, for pupils to develop their ability of being a science investigator.

As a good way to start I would like to make a short introduction around all the contents of what have been developed.

During my developmental placement I tried to developed different assessment criteria's by making an investigation activity in science. Beside the presence of all the learning styles, it is important for pupils to learn and be able to work as autonomous students to solve problems, as well to put hands on practical procedures integrated into the tasks.



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The form group where I developed the investigation work was Year 7 (pupils with 11-12years old). This particular form presents good chemistry knowledge but still need some improvement when working as science investigators to develop more independence as autonomous students.

Seymour Papert one of the MIT workers introduced the concept ` **hard and fun** ´ to explain that pupils can have difficult tasks to achieve, but the teacher have the responsibility to plan those tasks on a ` funny ´ way allowing pupils to find the task challenging.

It is really motivator to teach this group, because they are always enthusiastic with most of the science topics, and they are normally ready to have a new and challenge science task.

St. Mary's College it's a private school that doesn't follow all the contents of the NC. I went to study some of the main ideas of the National strategy, framework to teach science in year 7, as well studied the purposes of the NC, Sc3 for unit about changing materials. I thought it would be reasonable and important for pupils with a young age to develop more ability to do an investigation work in science as well to develop new skills and tools (like being independent workers and having the ability to find out the answer to a question, making some scientific research to making observations, explaining results and also suggesting aspects for improvement etc.) that they might use during their daily life.

The reality is that each project or investigation work is unique, but the fundamental principal is that students are the main project actors.

(` project teaching is not about "teaching" knowledge to a more or less passive class but about putting groups of students in active situations where they "learn" knowledge & skills´ - **TEACHER-SCIENTIST PARTNERSHIP GUIDE - 2005-2006**).



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The investigation work follows the scheme of work (appendix 1) defined and adapted by myself having in consideration pupils' background and feedback since I started to teach them.

The unit that I've taught was about Changing Materials (KS3, Unit F (Simple Chemical Reactions), sub unit F4 (Fire Fighting) of the catalyst text book) that includes five sub units:

1. Changing Materials
2. Acids and Metals
3. Acids and Carbonates
4. **Fire fighting**
5. Burning Changes

The sub unit underlined reflects the topic where pupils carried it out an investigation work.

Fire fighting is a topic that involves main ideas that normally pupils feel interested about it, because of a fire fighter job. In a sequence of lessons that I've spoke with pupils about chemical and physical reactions, fire fighting appears as a topic to make pupils understand and describe the process of simple combustion as well to name the 'reactants' and 'products' of a burning reaction to expand knowledge about it by achieving different skills. This was one of the main key purposes of the investigation work.

As learning outcomes pupils will be able to identify combustion as a chemical change, to identify the fuel, oxygen and energy needed to start a burning reaction, as well be able to carry it out an investigation work about a candle in a jar as a way to develop more knowledge about the topic and establish a relationship about what they already know from the unit.



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I split this investigation work in three important parts. 1st of all, I tried to introduce the topic by setting an individual worksheet to answer after pupils make some research about it (actually two worksheets, because I used a differentiation strategy), and write everything that they already know and might find or not about the fire fighting unit ideas.

The 2nd part and after pupils learnt the main concepts, they carried it out the experiment. Before the experiment I lost some time explaining all the method, making a demonstration of the specific experiment (reference to health and safety issues) explaining the objectives and the assessment criteria's for them to know previously what they need to be aware to make a good investigation work.

After pupils learnt all the key purposes that I said above, they put hands on the experiment as well answering some of the questions around the practical.

At the end a discussion has been taking place to make pupils understand all the contents achieving the main purposes as well the learning outcomes of the investigation work.

It is important to say that I've used some ICT resources (see appendix) during this investigation work with pupils, as a way to support the practical investigation helping pupils to experience the entire experiment process as holistic and cyclical (*Independence does not mean pupils working alone* (Jonathon OSBORNE, KING'S COLLEGE LONDON & Sara HENNESSY, University of Cambridge)).

In collaboration with my Curriculum Mentor, and the chemistry lab technician all the conditions were provided for pupils to find a motivator and safety environment to carry it out the investigation.



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The following report will explain in more detail the summary I have given in my introduction.

Introduction references

- *‘Independence does not mean pupils working alone’ (Jonathon OSBORNE, KING’S COLLEGE LONDON & Sara HENNESSY, University of Cambridge).*
- **TEACHER-SCIENTIST PARTNERSHIP GUIDE - 2005-2006.**
- GALLAGHER James, **Teaching Science for Understanding: A Practical Guide for Middle and High School Teachers**
- DEPARTMENT FOR EDUCATION AND SKILLS, **KS3 National Strategy** 05/02
- PAPERT Seymour, **The Connected Family** 1996.

Discussion

This discussion will give details about my investigation planning, as well about how I initiated this investigation to pupils carried it out. In addition to all this details I provided a detailed evaluation of the investigation work that I’ve used with my year seven form as well a page explaining my mark scheme.

- **Planning**

I started planning this task for pupils with a short assessment by checking all the misconceptions those pupils might have about fire fighting, as well which important concepts pupils were aware of it, and if they can improve their answers making some scientific research at home and in school. This was a task that supported me planning the rest of the investigation work.

I didn’t want pupils carried it out an experiment without having any idea about their topic knowledge, and also without developing a skill that allows



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them autonomously to go find the answer for a question. A variety of activities were made during the introduction of the unit as you can see on my lesson resources as well on my scheme of work(see appendix) .

- **Carrying it out...**

After pupils understood and learnt the simple word equation for combustion, as well identified some of the major problems of fire fighting related to burning reaction, pupils carried it out the investigation practical experiment to see how different sized jars affect how long it takes for a candle to go out and write up the experiment as follows (see copy of the investigation worksheet in an appendix):

- 1 – Title
- 2 – Aim
- 3 – Method
- 4 – Diagram
- 5 – Table of Results
- 6 – Graph
- 7 – Conclusion
- 8 – Was it a fair test?
- 9 - How can I improve the experiment?

It is important to say that I've lost some time before pupils put hands on the practical, explaining all the bullet points and checking if pupils could understand all the concepts and the questions. Some health and safety considerations were including to pupils be aware of practical risk assessment (see lesson risk assessment).

One of the most considerations that I've share with pupils was a brief discussion about the investigation work assessment. Children had the



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opportunity to see an evaluation investigation sheet with all the criteria of assessment. They had some doubts about it, so I tried to explain all the contents of the assessment, for pupils give their best to carry it out the rest of the investigation work. The Learning objectives and outcomes were shared on the first lesson, and pupils already knew that one of the assessment criteria's was the scientific research that they made to answer the initial worksheet (see appendix) that I handed in.

This practical and answering the questions of the investigation worksheet, allowed pupils to understand the combustion reaction process, and was helpful to pupils established a connection with other subject links like maths (making a table and a line graph), citizenship (health and safety and how can we protect us when a combustion is taken place) etc.

After this, pupils had a time to discuss about their own conclusions, as well sharing with the teacher and rest of class, all the doubts they had after they have done the investigation experiment.

Note:

You can find at the end of this report as appendix all the resource materials (scheme of work, sequence of lesson plans linked to fire fighting unit as well a copy of the investigation worksheet developed) that I've used during the investigation work lessons.

- **Investigation work Discussion**

Before I show the mark scheme and the investigation evaluation sheet of the work developed by pupils, it's relevant to speak about the role of teaching in the development of key skills.

Science is an integral part of modern culture. It stretches the imagination and creativity of young people. Its challenges are quite enormous



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(Professor Malcolm Longair, Institute of physics Fellow in Public Understanding of Physics, Head of Cavendish Laboratory, University of Cambridge).

In this case an investigation challenge work for this specific form have happened, so the teacher have the responsibility to include in all her or his planning the key purposes of the activity as well provide a detailed assessment criteria for pupils know in which areas are they being evaluated and why that investigation work? This is a path to follow as a future teacher when to work it in skills development for pupils stretch their science creativity and ability.

‘The development of faculty and competency in key skills, such as direct observation and feedback, the modelling of problems solving, management practices, and self directed learning should become the norm.’ **(Residents teaching skills (1996) – Janine EDWARDS, Joan FRIEDLAND and Robert BING-YOU)**. I totally agree with this statement on a way that allows me to think in developing more strategies as a future teacher to improve my lessons, when I want to make pupils to develop new skills, by connecting different areas of the knowledge, having in consideration always their ability to the topic.

On this first investigation work I’ve learnt that all the contents of the experiment need to be established, and pupils need to be aware of it, because doing this I’m still making them developing new skills (like self management to solve problems).

Basically and depending of the curriculum and school flexibility I’ve learnt also that an investigation work should include some main key purposes



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(e.g. Discovering and better understanding of scientific research, its methods and its results, applying this knowledge to the problem of the topic, improving skills to deal with complexity, increasing the awareness of local implications like: how do you, your family, your school and your town contribute to the problem and to solutions? etc. Acting in society, sharing the results of the work with a public and as well having in consideration assessment criteria to be shared with students) to be successful.

After this short reflection, below, I present my group investigation work mark scheme and evaluation sheet. I would like to say that was quite difficult for me to think about assessment criteria, because at the end this practical included so many aspects that I took in consideration, and I wanted to establish a connection between all of it, without knowing how to do it. So, I tried to think in some aspects that pupils could improve but at the same time struggle with some of them, making me being aware of that and being useful for setting one more of my targets to work it out with this particular form group.

- **Investigation work Mark scheme**

The table below shows all the criteria's that I've considered for the investigation activity. The following description describes which main keys I used to evaluate pupils investigation work for each criteria.



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1. Independent students

- Pupils need to carry it out the experiment by showing that, they can develop skills on an autonomous work environment, like making some scientific research inside and out of the lesson.

2. Presentation

- After Pupils finish the investigation worksheet by answering all the questions, they need to hand in a clear presentation worksheet to be marked.

3. Health and Safety

- Pupils need to show that they are aware of practical risk assessment by answering some Q+A before practical, and also show comfortable with that purpose during the experiment.

4. Conclusion

- The conclusion needs to be clear and approach all the investigation purposes. Pupils need to include aspects to improve the experiment, and also their personal view about it, as well demonstrate that they can use correct scientific words and symbols when writing about the experiment, crossing link with other subjects.

Marks:



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1 – Excellent 2 – Very Good 3 – Good 4 – Satisfactory 5 –Satisfactory but needs improvement 6 -Poor

The marks system that I've used was basic, but I think it was because I tried to make an assessment moderated by me, and all my observation of pupils' tasks, during the development of the investigation work.

I think the assessment was one of the points where I failed. If it was today the investigation work, I would probably use a much more detailed assessment aspects, where I can include pupils in different levels having a better idea of their progress and main difficulties.

Form 7G Investigation Work Evaluation

Names	Independent students	Presentation	Health and safety	Conclusion	Total	Comments & Targets for improvement
Jadene Allan	2	1	2	2	7	Develop more independent work.
Katherine A.	2	2	2	3	9	Improve writing by copying more notes.
Alex B.	3	2	2	2	9	Set worksheets to develop more autonomy.
Ben B.	3	3	2	3	11	Set some ICT work to develop creativity. Careful with writing
Charles Bond	2	2	2	2	8	More Q+A
Ruth Cawdron	1	1	1	2	5	Set more challenge worksheets
Andreas C.	3	3	3	4	13	Improve conclusion and set more worksheets about the topic.
Stephen C.	2	3	3	2	10	Good improvement



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						but need to be careful with health and safety.
Ryan Hodge	2	2	2	1	7	Set more challenge worksheets.
Danielle H.	2	3	3	3	11	More Q+A and support worksheets.
Robert Howat	2	3	2	2	9	Careful with worksheet presentation.
Ben Jones	3	3	4	4	14	Improve conclusion and set an experiment worksheet review
Patrick M.	2	2	2	3	9	Careful with writing.
Shona M.	2	2	2	2	8	More challenge worksheets.
Holly Milne	2	2	2	2	8	More challenge worksheets.
Mathew M.	-	-	-	-	-	-----
Patrick N.	2	3	3	3	11	Worksheet to review experiment and unit main concepts.
David Noble	2	2	2	1	7	Set more challenge worksheets.
Alex Poole	2	2	2	4	10	Improve conclusion.
Grace R.	3	3	2	3	11	Set more writing work to practice.
Philip Robinson	1	1	1	1	4	More Challenge worksheets
Louisa Warnkel	1	1	1	2	5	More Challenge worksheets

As you can see above, I wrote some comments as targets for pupils to improve and for me as a teacher to follow their progress for the next lesson contents. After I shared some of the assessment notes with pupils, I think I failed on an important assessment aspect. I should had another table just for myself, and write some targets that I could make to improve not just the mistakes of my lesson, but to set some important tasks for me also, to improve areas where I felt uncomfortable to expand.



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Teaching science in secondary school is about teacher assessment also and not just pupils. So, I think that a good way to start my synoptic placement is to develop a class and personal individual assessment.

I can say that this investigation work during my developmental placement was generally positive when I think in class management, variety of resources and pace.

This new skill that I've started developing made me understand and learnt my priority as a teacher. I need always to consider and evaluate the effectiveness of the teaching and learning strategies, by focus on an investigation experimental learning and teaching activities, helping children developing skills and be engaged with those skills, that they might use out of school.

References

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APPENDIX



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LESSON RESOURCES



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