

Databases and Database Design

1 Research Question

Can student design and use of databases enrich and enhance their research process and support higher order thinking skills?

2 Abstract (for web)

The use of databases has given students a real insight into the many facets of research. Their ownership of the design of the database played an important part in their desire to discover information. Students showed perseverance in finding information about their topic and also realised the need to be specific about their findings. Students showed enthusiasm in entering data as it was a collegiate activity and the classes responded well to that. It had cache as a learning tool.

All questions were discussed and some excellent thinking went on through the discussions because they were thinking about the implications of the data found, not only by them but by the others in the class. In some instances eg the Gold project, the students became more sympathetic about the people involved and that led them to talk about the way indigenous people were treated during the gold rush. When the data was sorted, it was obvious that gold discovery made an enormous difference for the lives of indigenous peoples and students were able to see that at a glance. Some students were visualising themselves in these circumstances and that generated different perspectives for them.

It has empowered many of the children to continue their research because it has fired their imagination. Most students were able to answer questions posed in the planning document (see Appendix)

3 Main Report Findings

I worked with three classes, two 6/7 classes and a 4/5 class at Dernancourt Primary school on a variety of research topics. With each group, the students were involved in learning about databases through demonstration and explicit teaching and then the design and planning of a database relevant to their topic. The database they designed was then used to input their research findings. Once all the data was entered they were able to have input into what data they wanted sorted and why.

What was the research?

Databases are well suited to support student learning and develop higher levels of thinking. I investigated whether students who are involved in the design of databases for their research will be able to question and display skills using Bloom's hierarchy of higher order thinking skills. Bloom's higher order thinking skills of Analysis, Synthesis and Evaluation are perfectly suited to the in depth activities students can engage with

databases and database design. When students are empowered to have input into the design of their research and the data that is collected, their ability to reach deeper understandings of areas of learning are enhanced.

Why is the research educationally significant?

My premise is, that databases are an excellent vehicle for students to engage in higher order thinking as they facilitate the following criteria

Students Who Are Higher-Order Thinkers:

- Identify the essential elements in a problem as well as the interaction between those elements; use electronic tools to facilitate analysis.
- Assign relative values to essential elements of a problem and use those values to rank elements in meaningful ways; assess similarities and differences in problems and their elements.
- Construct relationships between the essential elements of a problem that provide insight into it; extract implications and conclusions from facts, premises, or data.
- Create and apply criteria to gauge the strengths, limitations, and value of information, data, and solutions in productive ways.
- Build new solutions through novel combinations of existing information.

Anderson, L. M. (1999). *Rethinking Bloom's taxonomy: Implications for testing and assessment*. (ERIC Document Reproduction Service No. ED435630)

Students access databases all the time. They are passive recipients of what the programmer has decided the output to be. Many research projects require the reporting of other people's collected data. They often use this data without question. Showing students that data can be used in many ways, opens up their questioning and analysis of data. Designing their own database requires the student to think ahead as to what output will be required. This encourages thinking of a high order and enables creative hypothesizing as to what the data might suggest. Sampling and bias can all be discussed as students recognise the database as a tool for discovering more about their learning.

Examples of the data/evidence

See databases on CD

How the data/evidence was interpreted

Data was gathered by observation, the types of questions posed by the students and the data gathered and inputted and the student's ability to question. The data was gathered as students discussed what they needed to include in the database, what they would need to find out about the topic and this generated much discussion and debate. Once decisions were made about the defining of the topic and research parameters, students then went about finding the answers to their posed questions. They entered their information into the relevant fields in the database. These individual entries were then able to be viewed as a whole when the class looked at the entire set of data available to them. They were able to compare, list and sort all the collated data to make meaning of a bigger picture than just their individual contribution.

Collecting the data/evidence?

The research was interpreted by the process of defining the research questions with students, the way the students went about gathering the data and what learning they achieved by their success or lack of success in finding the information. Further their ability to extrapolate information from the collated data.

Research findings

Students started with enthusiasm to the topic and the process eg the idea of learning about the database because it was new - the concept of using a common recording tool was an appealing notion to students. It generated discussions about data eg .What's the point of obtaining data and why are we entering it?

Many of the younger students (Years 4/5students) despite determining their own questions were initially writing down information on anything about the topic and when they came to entering the data they didn't have the correct information. Even with constant reminders they still collected unnecessary data until they had to enter the data into the database. Some couldn't find data about some aspects. In creating the databases and entering the data, the following was noted by the staff involved and the students.

- Different approach to entering the data – cut down on presentation time allowed for other activities because of this that involved better use of student learning time.
- Students enjoyed the presentation of their data
- Easy to enter the data and was not long winded so it was perceived as being easy
- Information found was relevant to the question and if they couldn't find it they asked for help
- Focuses the students very closely on what information is being collected
- Students have recognised difference between what is required and what is not
- Some questions were difficult to find information about
- More specific with their internet search and being discriminating with the sites they visited
- More focused on finding specific information
- Students are looking at the questions and where we go to from there
- Breaks the information into parts so that they can explore the relationship between the parts
- Comparing the information so we can go onto analysis
- Creates discussion about what happens now and what is the action from that
- Shown an understanding of the information collected to enter the data appropriately
- They have combined knowledge from previous situations to select the data which is suitable for entry into the database
- Has made children organise their thoughts and summarise their notes to enter the database
- Improved searching skills such as internet surfing because they are phrasing their questions more succinctly to the search and therefore finding the information in a shorter time.
- Using all the skills of RBL such as key wording, note taking etc
- Students are thinking more
- Generated lots of discussion about everyday and present day
- More family interaction
- Some students are questioning data in other areas

- Focused their attention onto other databases and they are more aware of how they are made up

Conclusions

The research was extremely worthwhile as it gave students a completely different approach to their research. It empowered them as they realised they were controlling their research. It also led to some frustration as they realised they couldn't add just any information regardless of how interesting. They were able however to see that it was important to have the correct information otherwise they couldn't make comparisons and sort data later.

How has this research changed your theory and practice?

The research has given me an absolute belief that explicit teaching of thinking skills makes an enormous difference to the way students approach an area of learning. It scaffolds them and enables them to make learning exciting and relevant. Design and use of databases is one way of enhancing these critical thinking skills. However if students haven't been exposed to any previous explicit teaching about thinking they are disadvantaged in their ability to formulate generalised questions. For this reason the staff involved in the project made a decision to teach a series of thinking skill strategies in each of the classes and then review the student's ability to sort generalised data after these skills had been taught.

What new questions emerged for you as a result of this research?

If students were given more opportunity to control their research and understand the implications of what data is gathered and why, they were scaffolded with thinking skill strategies, would they then be able to formulate or hypothesize about other areas of learning. Would they be able to question data from different sources and apply the same high level of thinking skills as to the areas they have researched? From their individual research they were asked to look at the collated data and pose questions about what could be gleaned from the gathered information. Most students could analyse, synthesize and evaluate the data they collected. Only a few groups however could use these same skills to analyse the whole database and pose questions that would lead them to a greater understanding of the topic.

4 Resources

Powerpoint presentations (See CD and Appendix)

1 Introduction to staff

2 The databases and how information was used

5 References

Author	Title	Web Address
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Watson, J	Computing	N/A

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6 Personal reflection

Student's enthusiasm to entering the data exceeded my expectations. The unexpected spin offs such as teachers saying that the databases saved important learning time (because presentation and the entering of data became one task) as well as being a learning instrument. It allowed more class time for talking, discussion and importantly the thinking that went along with that. The students perceived the learning as fun and different. Next year I will use student's own data rather than data they have researched as I think this also would be a very powerful way of examining issues and areas of concern to them personally.

It was very rewarding having the time to work with three very dedicated teachers at Dernancourt Primary School. I would like to thank John Western, Gay McKenzie and Yvonne Pascoe for their insights and their great contribution to the success of this research.

Appendix

The following is a checklist of questions and skills that enable students to demonstrate higher order thinking using Bloom's Taxonomy. These questions and skills will be used as the checklist to assess if the students' use of databases is promoting higher order thinking skills.

Checklist of skills and questions

Analysis

Questions

- What are the parts or features of _____?
- Classify _____ according to _____.
- Outline/diagram/web _____.
- How does _____ compare/contrast with _____?
- What evidence can you list for _____?

Skills

Analyse	Separate
Order	Explain
Connect	Classify
Arrange	Divide
Compare	Select
Explain	Infer

Synthesis:

Questions

- What would you predict/infer from _____?
- What ideas can you add to _____?
- How would you create/design a new _____?
- What might happen if you combine _____ with _____?
- What solutions would you suggest for _____?

Skills

Combine	Integrate
Modify	Rearrange
Substitute	Plan
Create	Design
Invent	What if?
Compose	Formulate
Prepare	Generalise
Rewrite	

Evaluation

Questions

- Do you agree with _____?
- What do you think about _____?
- What is the most important _____?
- Prioritize _____.
- How would you decide about _____?
- What criteria would you use to assess _____?

Skills

Assess	Decide
Rank	Grade
Test	Measure
Recommend	Convince
Select	Judge
Explain	Discriminate
Support	Conclude
Compare	Summarize

Research Studies

The following is a brief description of each of the class's resource topics and data the students have collected. The students in each class contributed to the questions they wanted to find out about the topic, and therefore what data would be collected.

Gold Discovery Room 2

Students were put into groups of three or four to work on the following areas of gold discovery

- Ancient times
- Middle ages
- Australian gold rush
- Californian gold rush
- Alaskan Gold Rush
- Canadian Gold Rush
- Spanish Gold Rush
- African Gold Rush
- South American Gold Rush

They researched the following in relation to their main topic

- Time of discovery
- Where the gold was first discovered
- Person who discovered the gold
- Effect on way of life
- Effect on indigenous populations
- Uses gold put to
- What immigration occurred
- Effect on populations

From this information the class teacher and I devised a set of questions that would test the student's understanding of the information gathered.

Evaluation questions

Analysis

What are the features of gold that have drawn people over the years?
Classify gold according to its mineral value.
Outline on a map of the world where gold discoveries have been made
How does gold compare with other precious metals?
What evidence can you list for the effect of gold discoveries on indigenous people?

Synthesis

What would you predict would happen if there was a gold rush in Adelaide?
What ideas can you add to how gold can be used to unify nations?
How would you create or design a new piece of gold jewellery
What might happen if you combine gold with another element?
What solutions would you suggest for rehabilitating the environment after a gold rush?

Evaluation

Do you agree with the way indigenous people were treated when gold was discovered?
What do you think about the way people judged gold?
What is the most important gold mining discovery and why is it so?
How would you decide about opening a mine in Kakadu National Park?
What criteria would you use to assess if it was causing environmental damage?

Rice Room 17

Students worked in pairs on a country to investigate information about culture and rice production. Information researched included the following:

- Name of country
- Rice yield
- Population
- Traditions involving rice
- Diet
- Growing rice
- Export and import of rice
- Type of rice grown
- Who grows the rice
- Production capacity
- Subsistence versus large farming
- %of farms growing rice
- irrigation of rice crops/ rainfall versus irrigation

The information researched was entered into a database and children entered the data found on their country. The data was used to answer questions about their research as a whole.

Evaluation Questions

Analysis

What are the features of rice productions in your country?

- Biodiversity
- Terrain
- Methods of irrigation
- Large scale
- Small scale/large scale
- Labour intensive

Classify production according to

- yield/hectare
- total crop grown
- total export
- total imports

How do European countries compare/contrast with Asian countries in their production and usage of rice?

What evidence can you list for the importance of rice in the culture you have researched?

Synthesis

What would you predict to be the method of rice cultivation in the country you are researching? Is there a gender bias?

What ideas can you add to increase Australia's production of rice?

How would you create /design a new product to encourage people to eat more rice?

What solutions would you offer to increase rice yield?

Evaluation

Do you agree with Australia growing its own rice? What do you think about rice as a main food source?

Prioritize countries in order of the importance of rice in their culture. What criteria would you use to assess this?

How would you decide about where to purchase your rice and why?

Natural Disasters -Room 9

Students were divided into groups of three or four to investigate Natural Disasters

- Floods
- Famine
- Cyclones
- Volcanic Eruptions
- Tidal Waves
- Drought
- Earthquakes

- Avalanches
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The following areas were researched by the students and the data put into the database.

- Type of natural disaster
- Location of Natural Disaster
- Year happened
- Number of people killed
- Cost to the community
- Length of time
- Warning signs
- Effect on the environment
- What emergency services were involved
- Benefits of disaster
- Future actions
- Effects on population

Evaluation Questions

Analysis

What are the features of a natural disaster?

Classify natural disasters according to their severity.

Diagram the sequence of events in your natural disaster.

How does one natural disaster compare with another?

What evidence can you list for Australia to be a safe or unsafe place to live in.

Synthesis

What would you predict would be the most likely country to have a natural disaster?

What ideas can you add to an emergency action plan?

How would you design a new machine to measure to give prior warning of a natural disaster?

What solutions would you suggest for making houses less likely to be damaged in a fire?

Evaluation

- Do you agree with cities being built on an obvious fault line?
- What do you think about Japan's National Disaster Day?
- What could be included in a National Disaster Day that teaches people about bushfire safety?
- Choose a natural disaster. What is the most important thing about surviving this natural disaster and prioritise what would be required in that circumstance.
- What criteria would you use to assess the severity of a Natural Disaster?