



GIS as an artefact in geography education: Some future challenges

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Outline of today

- Artefacts
- Creating an instrument:
theory of instrumental genesis
- Research project:
Creating an instrument
Implications for teaching
- Future challenges



Artefacts

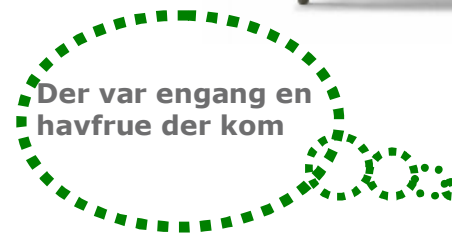
What is an artefact?

What are the artefacts within this room?



Chair

Projector



Language

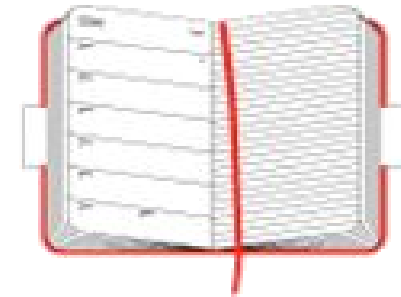


→ artefacts have meaning for how we behave and interact in this physical and intellectual setting



Artefacts

How an artefact creates meaning - pocket diary

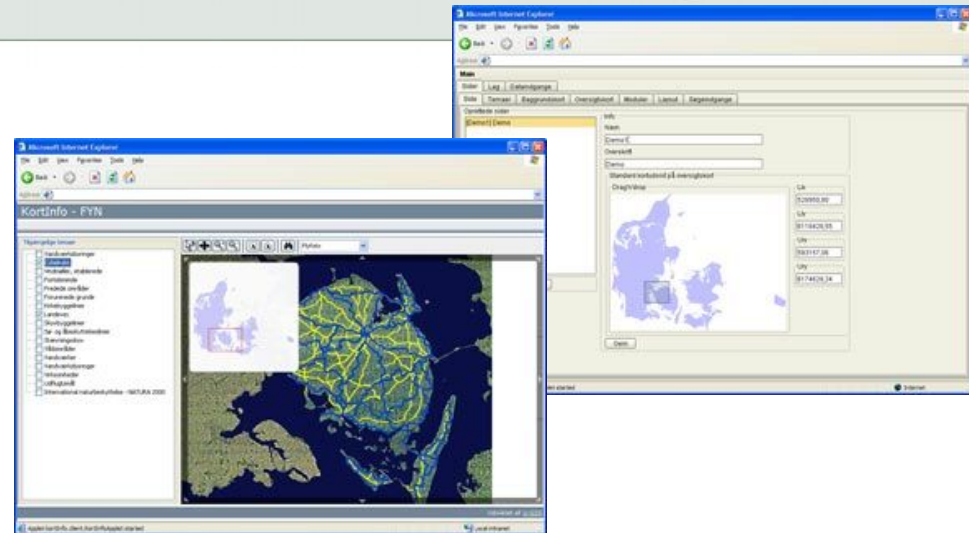


'We think in symbiosis with the pocket diary. We exchange meaning, content and sense between the user and the artefact in relation to reading and writing. We can metaphorically speaking park meaningful statements like information in that type of artefacts and call them to life again, when we need them' (Säljö 2003:80).



Artefacts

GIS as an artefact

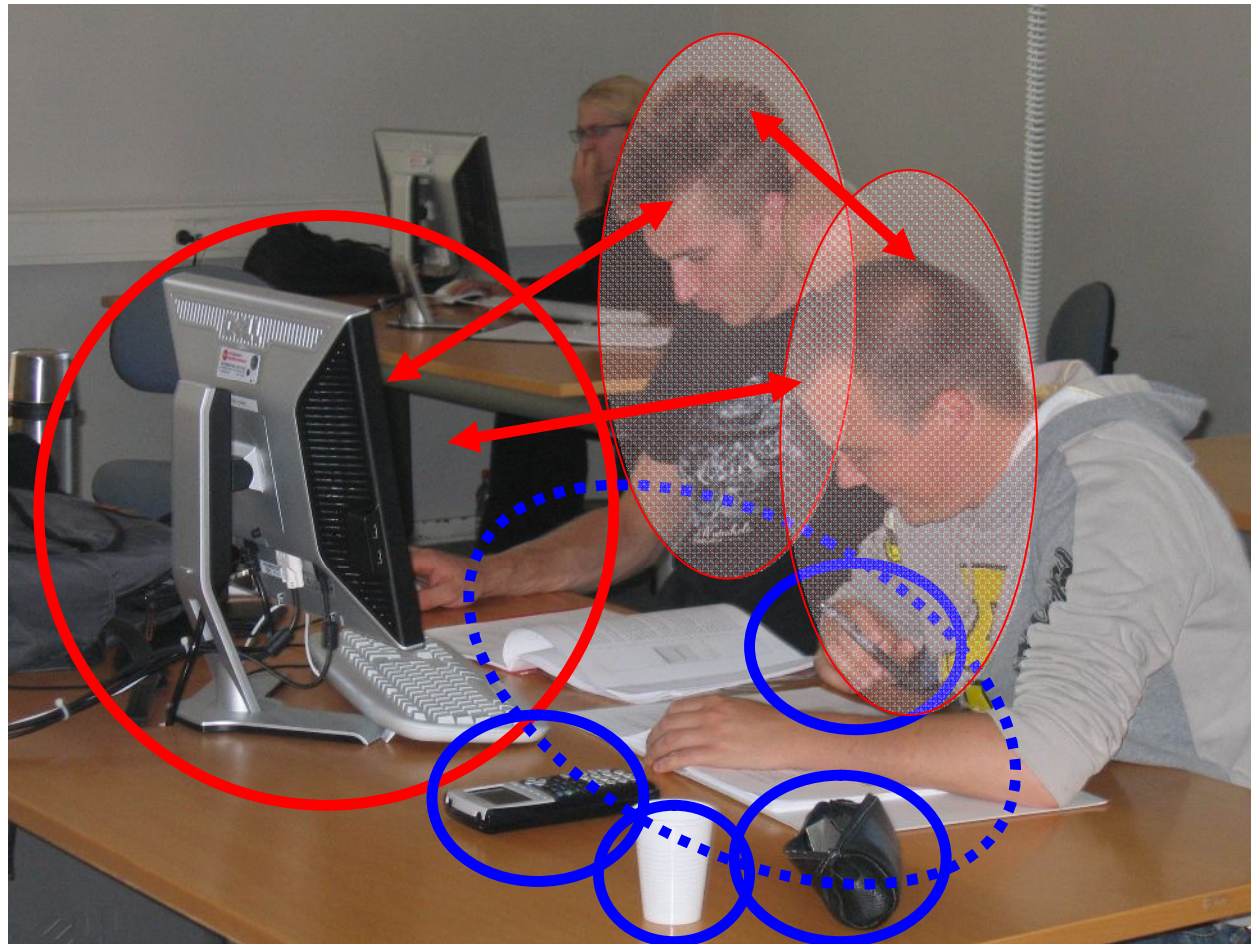


- *A physical artefact: needs skills to operate*
- *An intellectual artefact: needs training in how to think about geographical issues*

Often interwoven both for the student and the teacher



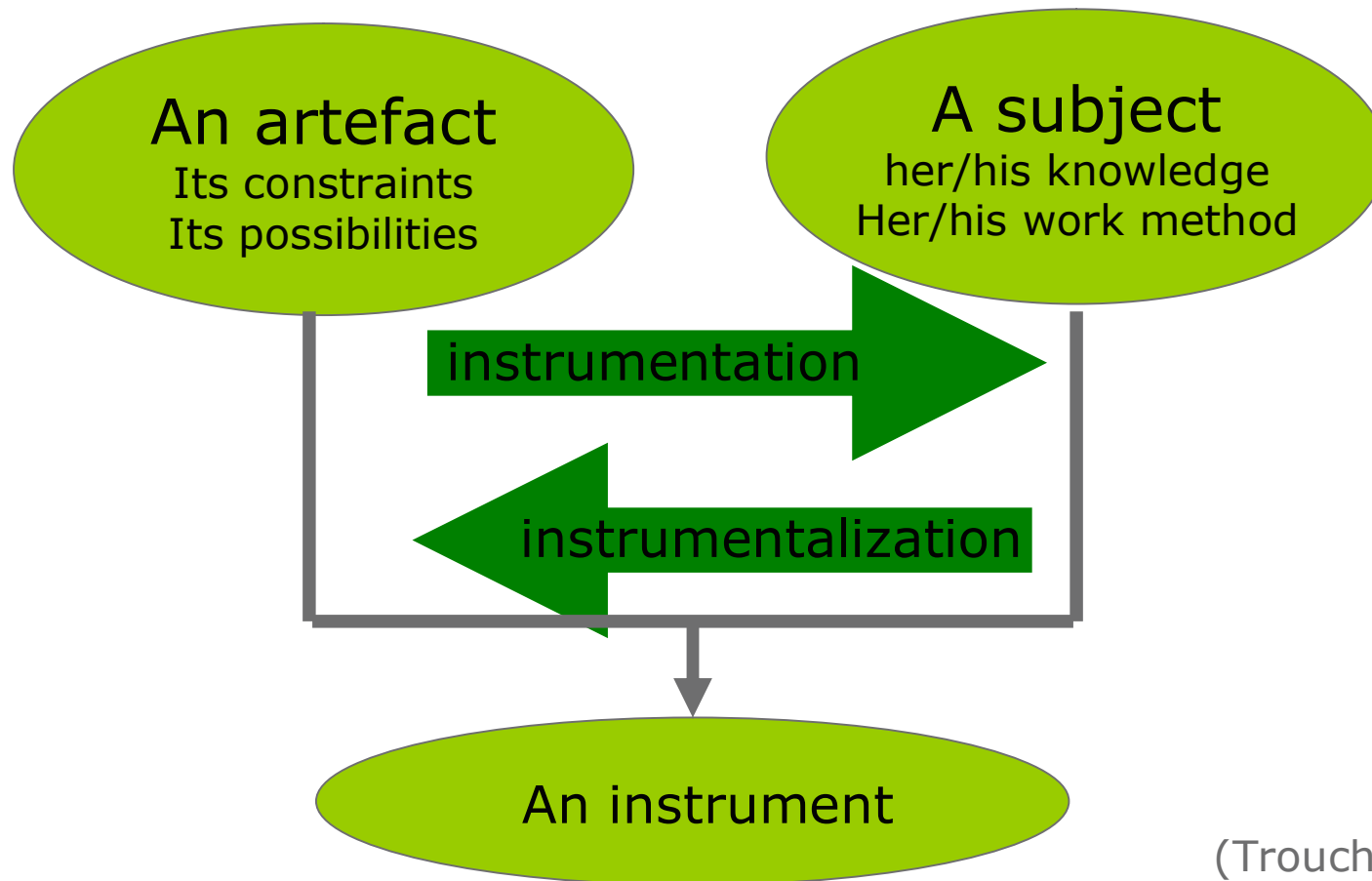
Creating an instrument





Creating an instrument

- From artefact to instrument



(Trouche 2005)



Creating an instrument

Theory of instrumental genesis

- Introduction of Computer Algebra Systems (CAS) in mathematic education
- Shows that CAS in mathematics teaching not only changes the way students learn but also what they learn.



$$f(x) = x \sin x$$

- Teaching and teaching material can – to some extent – support students' development of instruments.



Research project: Creating an instrument

The course "introduction to GIS"

7 week course:

- 2 weekly lectures
- 2 weekly laboratory classes (in total 6 hours)
- Work 2 persons with one computer
- textbook manual
- Evaluation is a written exam





Research project: Creating an instrument

Example from the textbook manual

Choose **Spatial Analyst** → **Reclassify**, put Input-raster = *dist_water*, press **Classify**, press the Method-arrow and choose **Equal Interval**, press the Classes-arrow and enter **8** and press **OK**. Press the first **New Values record** in the Reclassify-window and replace the value 1 with 8, the value 2 with 7 and so on. Let the field with **No Data** be untouched. Press **OK** and see the result which is placed in a new grid file with the name *Reclass of dist_water*.



Research project: Creating an instrument

Methodology

- Students' written descriptions of their learning process
- Interviews with students
- Observations of the laboratory classes

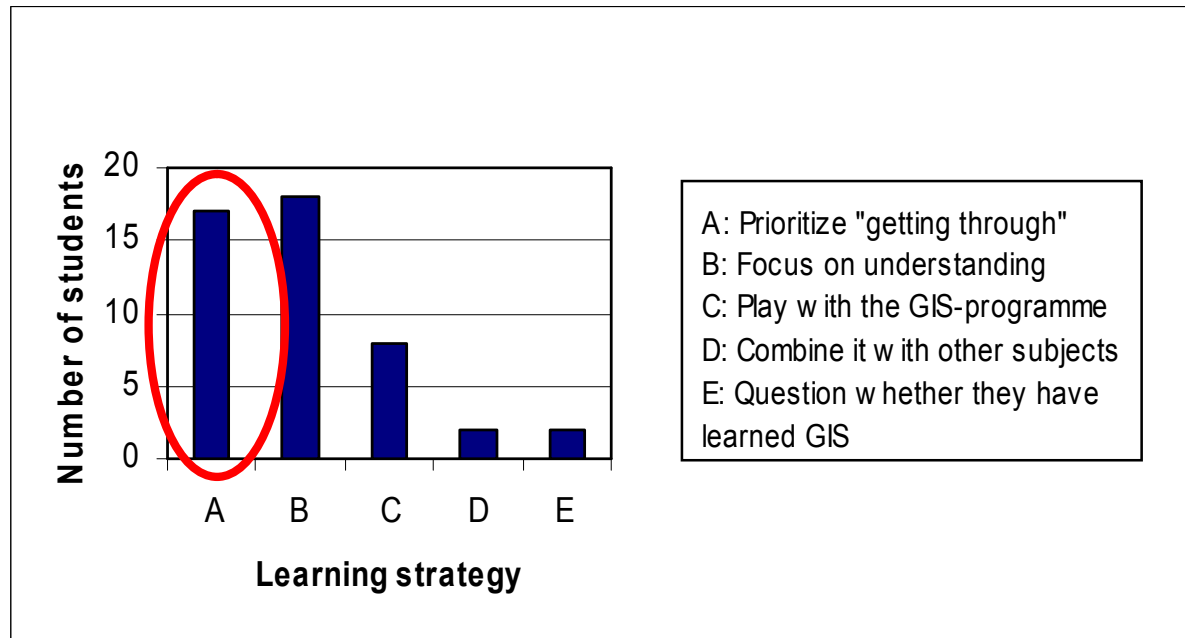
with 49 first year geography students, University of Copenhagen



Research project: Creating an instrument

Learning strategies

- We found 5 different learning strategies among the students





Research project: Creating an instrument

Learning strategies

- Example of type A: Prioritize "getting through"

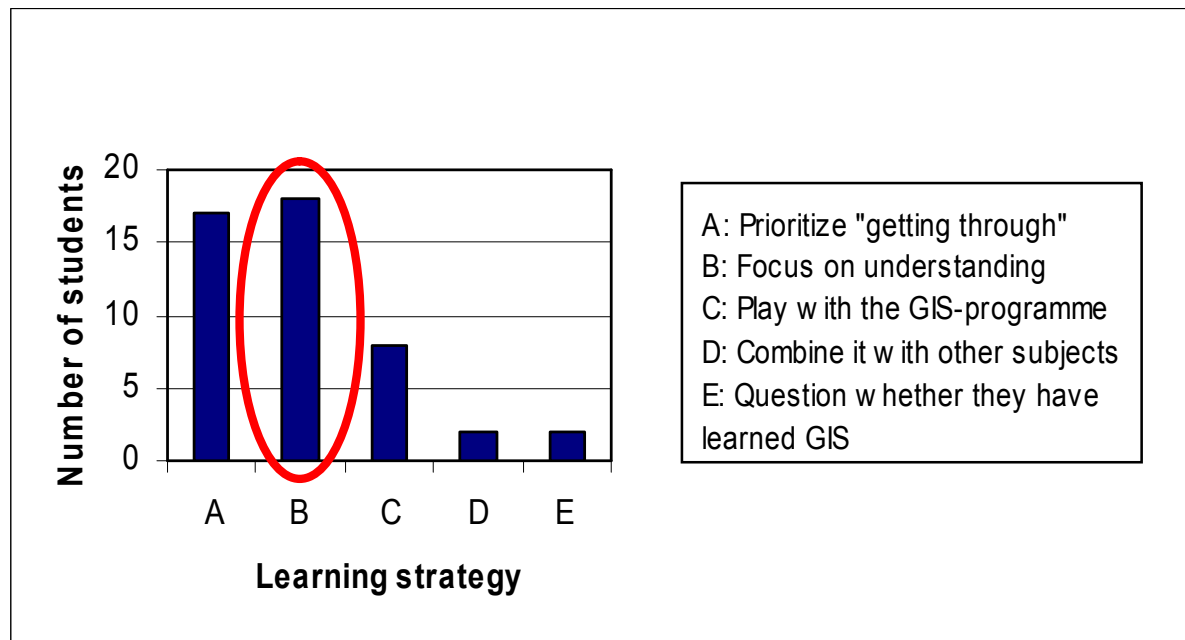
'I attended the lectures, wrote notes and printed the hand-outs out. Before exam I read all the assignments including the hand-outs. I made notes so I had an overview of the different concepts and expressions. I wrote down where in the assignments the different concepts were defined. I did markings in the texts and made tables of contents to the texts that we did not receive tables of contents for. I put the texts and notes in a briefcase organized in accordance with the lectures. I attended all the classroom exercises and the ones that we didn't finish we made sure we finished at another time in the week' (student interview).



Research project: Creating an instrument

Learning strategies

- We found 5 different learning strategies among the students





Research project: Creating an instrument

Learning strategies

- Example of type B: Focus on understanding

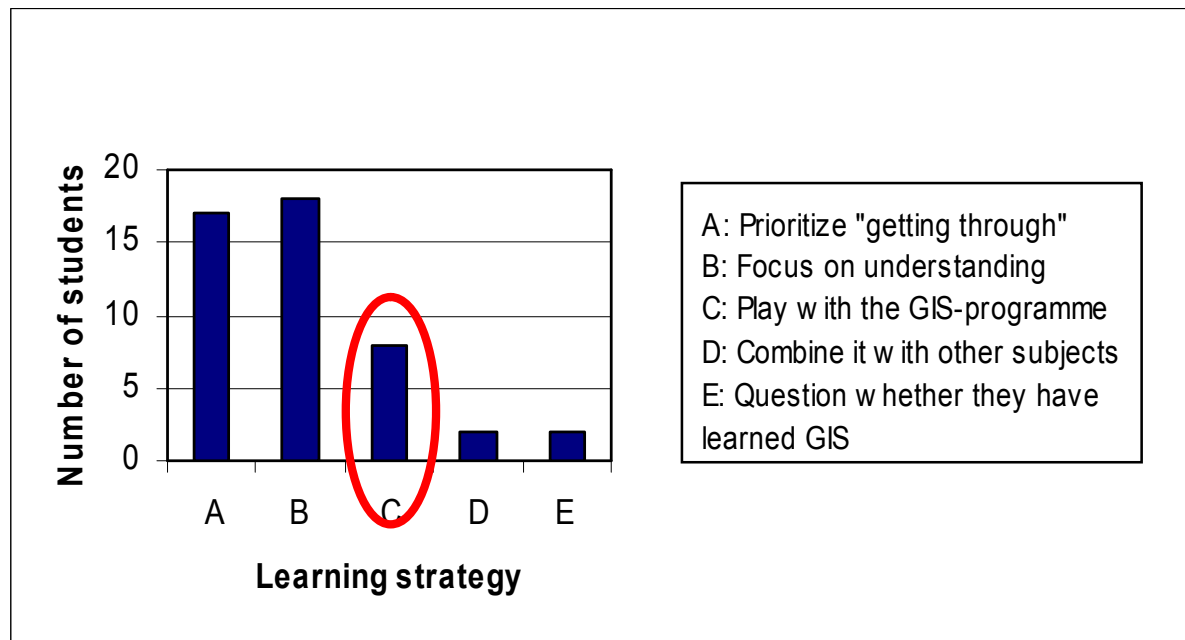
'I went to both the lectures and the labs. In the labs I focused on understanding what we were doing and not just go along [and finish the exercise]. I read all the course assignments, however only once.... I sat down in the exam preparation period and discussed different topics with the other students' (student interview).



Research project: Creating an instrument

Learning strategies

- We found 5 different learning strategies among the students





Research project: Creating an instrument

Learning strategies

- Example of type C: Play with the GIS-programme

'I sat many hours with ArcMap/ArcCatalog [the computer programme ArcGIS] both at home and in the labs. That's given me a pretty good overview to understand what the lectures were about' (student interview).



Implications for teaching

Orchestration with textbook manual

Different responses:

'It is just so schematically and pedagogically put together that you are able to put yourself on autopilot – that's at least how we have experienced it – and we sit and are almost – not falling asleep, but you get very tired in your head because – and now it is very harshly said – but you just put yourself on autopilot and just do [press with the fingers in the table] what is said in the papers [exercise manual].'

'I often stop during the GIS-exercise and think through what I just did on the computer screen'



Implications for teaching



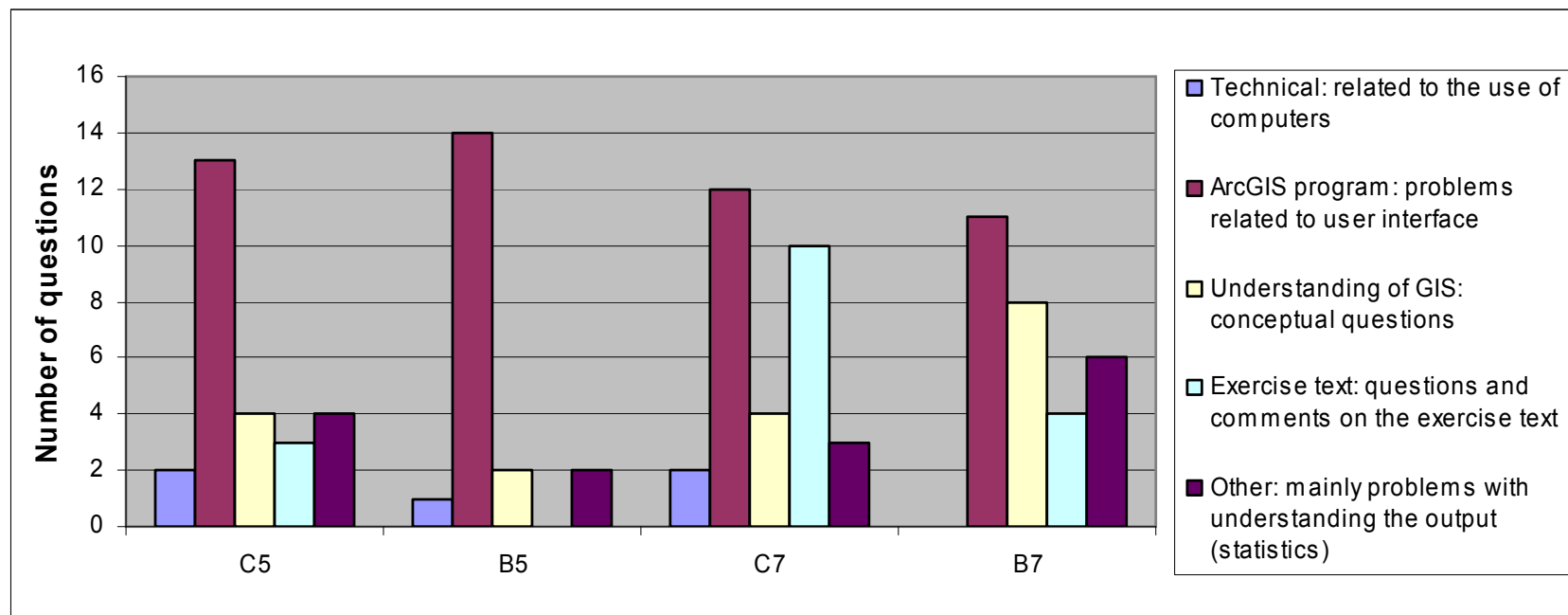
Relations between different learning strategies and responses to the orchestration

- *Students that focus on understanding: oppose the textbook manual*
- *Students that focus on playing element: do not at first oppose the manual but defines the learning process outside it*



Implications for teaching

- *Questions during a laboratory class*





Implications for teaching

- *Student thinking geography through the GIS:*

'You have a road and must calculate the area that will be affected by noise in a zone 200 meter from the road. Then I think in concrete GIS: select residence and ... then these words and that way to do it, and the structure you have trained through the laboratory classes The way you have learned to think is that you choose some things and then they must be selected, overlaid or ... make buffers. Buffer gives sense because...if you just think buffer is the straight distance from a point, then it gives no meaning ...you see that picture of a circle around a point for instance and then it gives meaning to a start and then you can use the theory to explain why it looks like it does'. First year student 2006



Future challenges

We need to:

- *Recognise GIS as an artefact interwoven in the professional development of becoming a geographer*
 - *Research the challenges it presents to educate students*
- and inspiration can be found in the theory of instrumental genesis*