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INTEREST DENSITY
A CONCEPT FOR AN INTERACTIONIST VIEW OF INTEREST IN MATHS CLASSES

Abstract:

Research has shown that interest is an important factor in learning. However interest has not yet become a relevant issue in maths education research. This paper presents the theoretical and the methodological framework of an empirical study about situational interest in maths classes relating to social interactions. The aim of the study is to build up a theory which is able to describe, and probably prescribe, the emergence, the increase and the decrease of situational interest in maths classes. For that, two concepts are established; the concept of *interest-change-phenomenon* serves as a filter for relevant data and the concept of *interest density of a situation* serves as a basic concept for building up the theory.

Introduction

Interest is an important factor which supports learning, individual development and achievement (RENNINGER 1992, BAUER 1988, KRAPP 1996, DICI 1992, 1998). My investigations on students with interest in maths have shown that the students who join a maths working group, despite a low level of interest in maths, used to come to the meetings for a long time because they realised the teacher's behaviour was a supportive one (BIKNER-AHSBAHS 1999). Researchers agree that interest is an outcome of social processes (RENNINGER 2000, DECI 1998, KRAPP 1996) but there is a lack of research which focuses on this (DICI 1992, KRAPP 1996, WILD/KRAPP 1996), especially on interaction processes in maths classes. Therefore I planned a study[1] to investigate social processes which foster or hinder the development of situational interest within maths classes, in order to develop a theory which is able to describe, and probably prescribe, the emergence, the increase and decrease of interest in mathematical classes. The basic concept of the theory is the concept of interest density describing the situational quality of interest in maths classes. [2]

First I am going to give a brief summary of the theoretical framework which exists so far (for a more detailed description see BIKNER-AHSBAHS 2001). I will then explain the methodological approach and the methodology which refers to the presented data and finally I will present some data gathered from a transcript of a maths competition during a lesson. This leads to the concept of interest density of a situation. Since I have not yet completed my analyses I will present some further research questions at the end.

[1] This study is supported by the Müller-Reitz-Stiftung.

[2] I have brought the content of my research report from 2000 into line with the current results of my investigations (BIKNER-AHSBAHS 2000, 2001).

1 Theoretical Framework

1.1 The concept of interest which exists so far

Educational psychologists have developed a theory of interest concerning individuals (KRAPP 1992). Following that theory, interest is regarded as a construct which describes a relation between a person and a topic area. This relationship can be observed by the activities an interested person carries out. An interest-based activity shows three remarkable aspects:

1. It is linked to expansion of knowledge (cognitive aspect);
2. It is associated with predominantly positive feelings (emotional aspect);
3. It links advanced value to the interest matter (value aspect).

Research focuses on two different kinds of interest - individual interest and situational interest (HIDI/ ANDERSEN 1992).

1.2 Two kinds of interest

Individual interest is situated closer to the intrinsic side of motivation while situational interest is located more on the extrinsic but self-determined side of motivation (DECI 1992, 1998). Individual interest develops slowly but in a relatively stable way. It is independent from situational circumstances to a large extent whereas situational interest is influenced by the environment and therefore fluctuates (HIDI/ANDERSEN 1992, HIDI/BERNDORF 1998). In maths classes situational interest is more important than individual interest because the environment and the social interactions can more easily influence it. Moreover the number of situationally interested students should be bigger than the number of individually interested students. Situational interest can more clearly be observed than individual interest because of its short-term development.

However, little is known about how situational interest emerges and how it might lead to individual interest (HIDI/BERNDORF 1998). Undoubtedly, situational interest is a phenomenon of social processes but this has not yet been investigated in maths classes.

1.3 The concept of situational interest

Mitchell's research (MITCHELL 1993) indicates that situational interest consists of five subfacets. First of all, situational interest in maths classes can be caught by group work, computer usage and puzzles, which means that situational interest can be caught by social or cognitive stimulation. However environments which stimulate interest need not necessarily hold situational interest. Situational interest can be held if students perceive a topic area as meaningful (meaningfulness) and if they get involved in the topic activities (involvement).

2 Methodological framework

I have investigated the interaction processes in maths classes by means of an interaction analysis of transcripts from specific episodes. The focus is situational interest and the aim is to

- identify conditions which might foster or hinder situational interest, and
- develop a theoretical approach which describes and probably explains the phenomena.

The following concept serves as a filter for relevant episodes extracted from videotaped lessons.

2.1 The concept of interest-change-phenomenon

In everyday lessons a common goal links the teacher and the students: namely studying maths, hence students are usually willing to get involved. A critical question is how to identify interest-based actions. For that, 70 children aged between 11 and 13 were asked how they know when their friends are interested in a topic area during a maths lesson. 25 students answered that there was no interest and therefore, could not answer the question. The others mentioned the following indicators for interest-based actions: engagement and involvement in the activities, increased attention and concentration, behaviour which focuses on understanding and wanting to know more (cognitive aspect) and which is linked to positive emotions (emotional aspect). The value aspect could be seen implicitly, as interested students seemed to avoid distraction from their engagement.

However it can occur that engagement in an interest-based activity changes. The activity can

a) change to a lower activity when the attention focuses on something else

b) cease

c) become more intensive

d) remain intensive despite disturbance.

In all cases we have observed an interest-change-phenomenon, which is reconstructed in the study.

2.2 Research design

In my research I combine a social, an individual and a subject-related perspective. I have observed a class at 6th grade level and written records from each lesson with the exception of those lessons which were involved with taking tests. To take sequentiality into account I observed only one class for a period of six months.

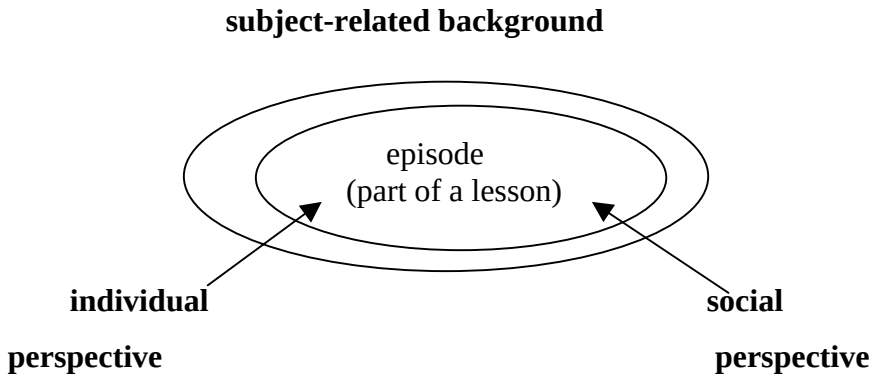

Figure 1: Three different kinds of data

Three different kinds of data are used to reconstruct interest-change-phenomena; subject related data, social data and individual data (figure 1).

Subject-related data: Using the results of interest research (BIKNER-AHSBAHS 1999) interventions were planned and implemented to increase the chance of observing interest-based activities.

Social data: A cameraman videotaped the interactions in the class with two cameras.

Individual data: Through a one-to-one-correspondence between university students and the students of the class the pupils wrote letters about their experiences during the maths lessons and at the end I arranged individual interviews to get more information. Moreover the students had to order their subjects three times according to their preferences: at the beginning, three months later and at the end of the data collection.

Now I will explain the method of analysing the data.

2.3 Analysis of the data

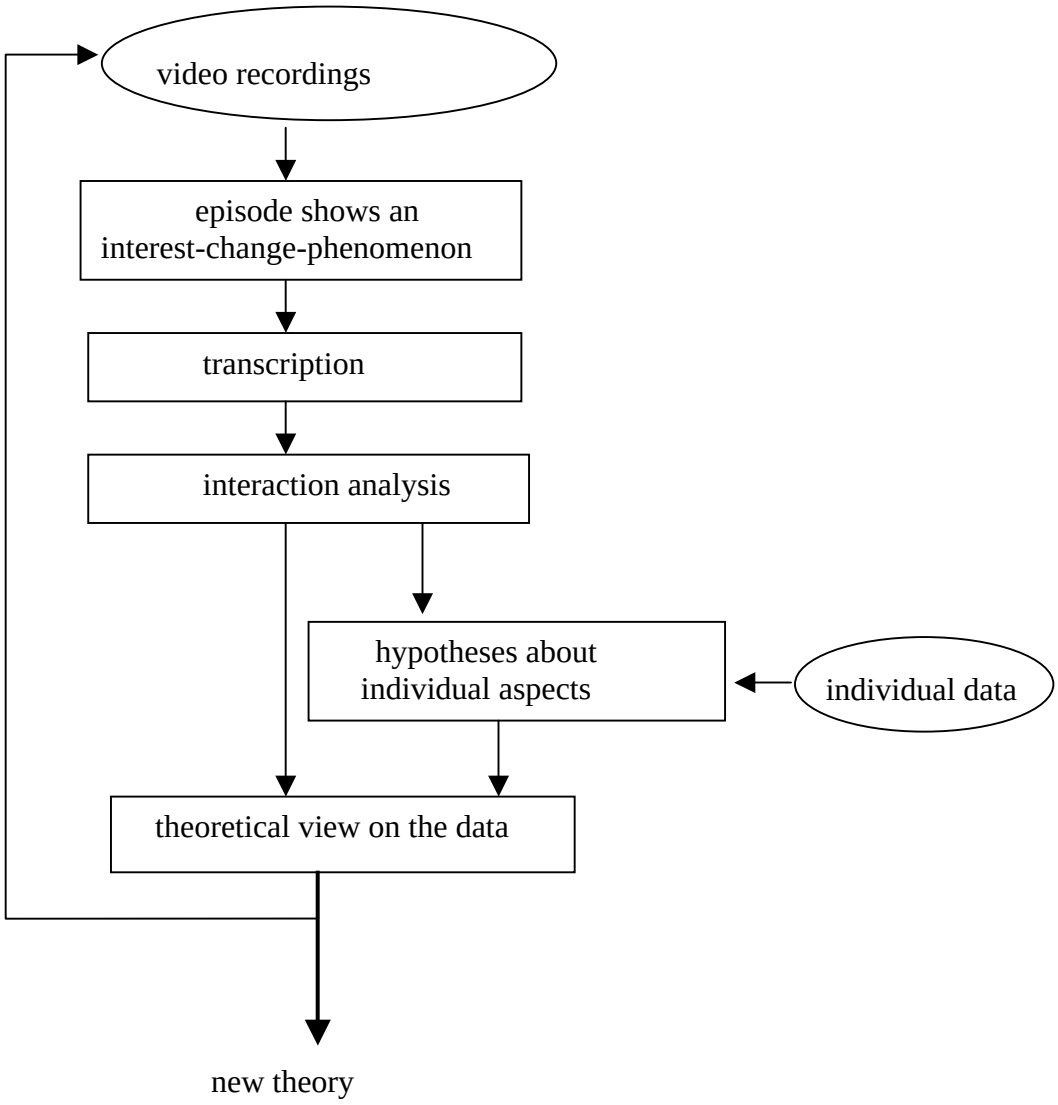

Figure 2: Analysis of the data

Interest-change-phenomena cannot be planned. Nevertheless I chose and prepared the video data in a methodologically controlled way. Using the concept of theoretical sampling that

refers to the grounded theory (STRAUSS 1994), the method of analysis and building up an appropriate theory follows a recursive sequence of five steps (figure 2):

- First of all an episode from the video, which shows an interest-change-phenomenon, is identified.
- A transcription of the whole episode is then made.
- Thirdly the interest-change-phenomenon is reconstructed by means of an interaction analysis of the episode to find out the interest matter, and the conditions, which lead to the change of interest in the maths topic area.
- If the reconstruction shows indicators which suggest hypotheses concerning individual aspects, then the individual data are taken into account.
- Fifthly the analysis should lead to a theoretical view on the data. Keeping this theoretical view in mind the next episode that shows an interest-change-phenomenon is identified and is replicated throughout the following steps. If the theoretical view is new I refocus on the applicable episodes, if not I continue to build up the theory beginning with the next analysis cycle.

The analysis ends when I am not able to extract any new aspects.

Interest cannot be observed directly, rather it is inferred from indicators. That means that the results come out through interpretation and the method of the analysis follows the concept of interaction analyses (for the theoretical background of interaction analyses see BECK/MAIER 1994, KRUMMHEUER/NAUJOK 1999, KRUMMHEUER/VOIGT 1991, VOIGT 1995, KRUMMHEUER 1995).

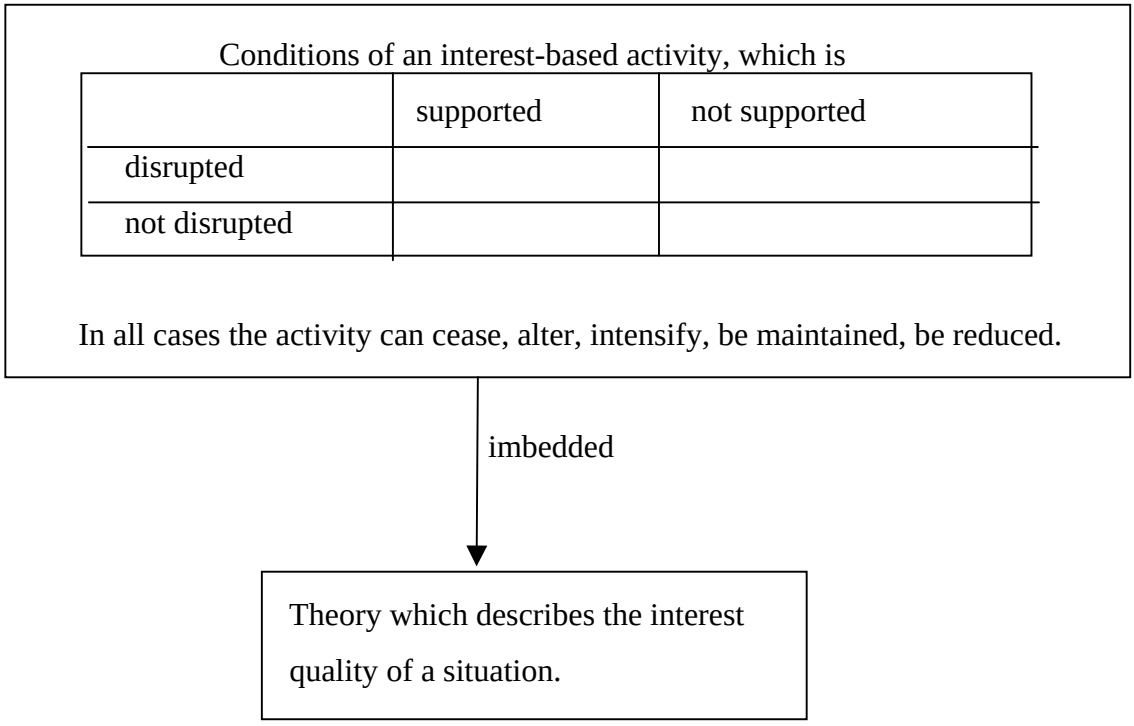

Figure 3: Expected results

An interest-based activity can either be supported or not and equally, be disrupted or not. In either case the activity can cease, modify, intensify, be maintained or reduced (figure 3). The

reconstructions of the interest-change-phenomena will lead to an empirical theory about the change of interest in maths. This theory will then be embedded in a wider theory describing the interest quality of a situation in maths classes.

3 Some data: A competitive situation with short question-answer-routines

I have investigated four competition situations with short question-answer-routines so far. The following transcript consists of a scene that is part of one of them. The results refer to all four episodes.

All these competitive situations show interest-change-phenomena. The situational interest seemed to be caught by the competition but it did not last.

The students of the class are divided into two teams standing on either side of the teacher's desk. The teacher sets the task, which the first two candidates of the teams must solve. The one who solves it first may sit down; the other one has to join the queue again. Tobi and Anti are the next candidates.

Transcription key

S(s), T	student(s), teacher
<u>exact</u>	emphasized
EXACT	with a loud voice
e x a c t	prolonged
exact.	dropping the voice
exact´	raising the voice
,exact	with a new onset
(.),(..)...	1, 2 ... sec pause
(....)	more than 3 sec pause
(*gets up*)	non-verbal activity
/S	interrupts the previous speaker

1	T	(*rubs his hands*) the ggT (*German term for largest common denominator*) (.) the ggT of 19 and 41 (...) (*looks at Anti, looks up, puts the forefinger to his mouth*) a quieter
2	Tobi	one
3	T	(*looks at Tobi*) right why is it one´ Tobi.
4	Anti	oha (*turns round and goes out of the line*)
5	Tobi	um because 19 is only divisible by itself and one
6	T	exactly and 41 too. (*Tobi goes out of the line.*) what ,what do we <u>C A L L</u> these numbers 19 and 41´ (*bends down to the left as if he wants to pick up something, comes up again and points at the candidates Kia and Eric with both forefingers at the same time*.)
7		(*Kia, at the left of the T, and some students from the other team are raising their hands, Kia and Eric are the candidates, Lea and Ina are standing behind Eric. Kia raises her hand but Eric does not. The T looks at Kia first, then at Eric and then at Kia again.*)
8	Kia	prime numbers
9	T	right (*does a circling movement with his right hand above Kia´s head and looks at her, but Kia does not leave the line.*)

10 Kia (*doubtfully*) oh should I sit down´
11 T yeah that was it.
12 /Eric sch (*turns*)
13 Lea oh well oh well he didn't know that
14 /Ss he didn't know that
15 /Eric I didn't know that
16 Lea he didn't know that
17 T (...) that was a question (..)scht
18 (*Eric turns round and goes to the end of the line.*)
19 /Ss that's mean
20 /Lea that's mean Mr K
21 (*The protest of the pupils gets louder.*)
22 T no, a question (....)
(*The pupils all shout out at once.*)

"The teacher defines the situation as a learning situation using the opportunity to repeat the knowledge about prime numbers (3-6). Tobi is the first to give the right answer, so the next question for him cannot simply be another competition task (3-5). From the view of the students, too, the learning process is defining the situation (3-6). As usual in the contest, the teacher looks at the next candidates alternately and points at them, but by raising their hands the students do not regard the next question as a competitive one (6; 7). There are three reasons for that; the task still belongs to the previous learning context, the teacher's movement (6) gives the task a casual status and the question does not ask for a number as it usually does in this competition, but for a term.

As Kia is allowed to sit down, the students of the other team probably feel at a disadvantage (13-22) and protest vehemently. Obviously the pupils are more concerned with winning the contest than with learning. The teacher however seems to know about the problem with the situation (17, 22), but he gets the upper hand." (for a more detailed interpretation look at BIKNER-AHSBAHS 2001).

4 Results concerning the presented data: Construction of a basic concept

4.1 Situational interest and competition

From the students' viewpoint, learning and competitive situations do not go together. Changing the definition of the situation must be clearly pointed out to avoid confusion. From the teacher's viewpoint competition is just used as motivation; the whole situation is regarded as a learning situation in which the teacher is usually allowed to change rules. However, changing the rules during the game causes the impression of a lack of fairness. The students are captured by the competition and therefore demand sticking to the rules.

But what about the situational interest during the competition?

During the contest there is no opportunity for individual activities or the development of individual ideas. Therefore students cannot get involved with the task and they do not have any chance to construct further ongoing meanings about mathematical aspects. The motivation is

directed towards winning and not toward the topics. Thus situational interest cannot be held and hence if there had been situational interest the matter of interest would not be maths. The value status is tied up with winning the contest.

Deci and colleagues discovered and confirmed that competitive situations undermine the development of individual interest (DECI 1992).

Competition situations with short question-answer-routines do not foster any development of interest (individual perspective).

This result evolved from an interest theory with an individual perspective through a subsuming inference (KELLE 1997). However what about the social perspective concerning the situation? A theory which describes the interest quality of a situation in maths classes does not yet exist but the investigated competitive situation with short question-answer-routines seems to be a prototype of situations without any quality of interest in maths. The problem now is, what to extract to construct a concept of interest quality in a given situation. The construction of such a concept has to follow an abductive inference (KELLE 1997, Beck/Jungwirth 2000). To be consistent with the individual theory of interest I require that interest quality or *interest density* (as I am going to say) of a situation is a concept, which describes a relation between the social situation concerning the interactions and a maths topic area (social perspective). Since the results show that a competitive situation with short question-answer-routines has no quality of interest in maths I inverted the important aspects to gain the desired concept.

4.2 A concept of interest density in maths classes

To assign *interest* quality or *density* to a situation in maths classes this situation has to comply with three conditions.

The definition of the concept need not include all the children in the class but only the participants (see KRUMMHEUER/BRANDT 2000)[3] for it is only the participants who shape the situation into one with interest density. Therefore a situation in a maths class is one of interest density if firstly

- there are students (at least one) who indicate interest-based actions (wanting to report about a project they did, asking questions about maths, telling far-reaching ideas, showing eagerness for knowledge, ...).

Secondly a common topic area is needed to build up a relationship between the group of participants and the maths content. That means that

- there has to be a common mathematical topic area
  - in which the participants become involved and
  - in which the participants are developing further ongoing meaning.

The participants themselves need not necessarily be interested in the topic area. However, together, they all construct further ongoing meanings turn by turn and hence one after the other is getting involved in the activity.

[3] I use the term participant to mean active participant. The non-active participants in a class are recipients (compare Krummheuer/Brandt 2000).

Thirdly, we have seen that the value status of a situation can be tied up with a non-maths aspect. However, in an situation of interest density in a maths class

- the value status of the situation is assigned by the subject of maths in an implicit or explicit way.

If there is only one participant (and the teacher of course) a situation of interest density is a situation in which a student shows situational interest although he/she need not be aware of his/her interest. Only if the student consciously experiences involvement and meaningfulness concerning the topic area would we say that the student is situationally interested. Therefore the concept of interest density describes situations in maths classes from which situational interest of an individual might follow.

4.3 Questions for my further research

Since I have extracted the concept of interest density from situations without any quality of interest it was necessary to find a situation of interest density in the data. However, the current analysis shows that such situations are rare, occurring only about once a week. Most of these situations refer to one student (and the teacher of course) and only in a few of these situations a group of participants (and the teacher) are involved in generating interest density. How can this phenomenon be explained?

The goal of the study is to build up a descriptive theory about interest situations in maths classes. This requires asking for the special patterns which situations of interest density follow in conjunction with the role the teacher plays.

To translate interest development in maths classes into actions it is necessary to know under what conditions interest density emerges and under what conditions it ceases.

5 Conclusions

The concept of interest density is only a relevant basic concept for a theory about interest change in maths classes if it leads to a theory which is able to describe and probably explain or prescribe the emergence of interest and the increase and decrease of interest - especially situational interest, even if students are not aware of their interest. The current analysis refers to two processes within a lesson, which cannot be separated: learning maths and gaining, holding, deepening or losing situational interest in maths. Moreover both processes have to be seen as social and individual processes in parallel. For that, on the one hand, a theory about interest change in maths classes has to be connected to the individual theory of interest and, on the other hand, it has to be tied up with a theory about social and individual learning processes in maths classes and the roles the teacher and the students play. In addition, the continuing focus on the current study raises the following question; are frequent experiences of interest density in maths classes likely to increase individual interest or situational interest in maths?

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