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Classroom research in religious education: The potential of grounded theory

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Grounded theory is one of the most common qualitative research strategies in social sciences. Currently, many applications of this theory are being developed for religious education. In the article it is argued that grounded theory deserves special attention for classroom research in religious education. For this reason, the basic features (fundamental openness and concurrence of data collection and analysis; constant comparison and asking analytical questions) as well as the coding strategies (open, axial, and selective) of grounded theory will be explained and concretised. An analysis of one example sequence demonstrates how grounded theory may be used to emphasise the communicative and substantive aspects (as well as the interaction between the two) of classroom interaction, therefore lending itself to data analysis. In this manner, grounded theory can also be used for an intensive analysis of a student's learning process, as the authors have done in one student profile analysis, as well as for a comparative analysis of teaching practice in an actual class or even a variety of classes.

Introduction

Educational research studies in the field of religious education repeatedly emphasise their exploratory nature (e.g. Knauth, Leutner-Ramme & Weiße 2000; Schreiner & Schweitzer 2014; Schweitzer et al. 1995; Schuster 1984). This is hardly surprising given the almost incalculable diversity of variables involved in actual classroom activity. The basic thesis of the present article is that, in view of such uncertain, still-nascent research conditions, grounded theory deserves special attention. On the one hand, this method was developed for the discovery of new theories and its ultimate strength may be observed in its highly creative-constructivist or exploratory-seeking character (cf. Glaser & Strauss 1967). On the other hand, as the term 'grounded' suggests, this method is 'object-oriented' or even 'object-based': Its theories are 'developed from the empirical data outward, and not derived deductively from a priori assumptions, thereby bridging the gulf that frequently separates abstract theories and empirical research' (Lamnek 1988:114f).

Reception of grounded theory in religious education

Grounded theory is one of the most common and 'thoroughly developed qualitative research strategies' (Leggewie 1996:vii; Strübing 2008; Wiedemann 1991:444). However, grounded theory has changed rather significantly since its development by Glaser and Strauss (1967; cf. Strauss & Corbin 1996:x; Strübing 2008). Moreover, its method steps are not to be understood as 'rigid' laws, but as 'rules of thumb' that can be varied depending on the object of study (Strauss 1987:7; Strauss & Corbin 1996:41).

As a result, it is unsurprising that the current reception of grounded theory in religious education – which probably dates back to Nipkow's analysis of the breaking points in teenagers' beliefs in God (1990) – has been by no means uniform. Two special features of the reception of grounded theory in religious education research should be mentioned briefly: Karl Ernst Nipkow applied grounded theory to an already extant and 'complete' body of texts, without expanding it with further textual inquiries. As a result, the methodological step of theoretical sampling was not employed.

Furthermore, the focus of this method's reception in religious education research in the 1990s lay primarily in the elaboration of categories and their dimensions and less so in the discovery of new object-related theories (Hilger 1998; Leyh 1994; Nipkow 1990; Rothgangel 1996; Rothgangel & Saup 2003:85–102). Nevertheless, Nipkow's handling of this method impressively illustrates how profitable a thorough elaboration of categories and dimensions can be. More recently, grounded theory has been increasingly used for the elaboration of object-related theories (e.g. Fuchs 2010; Hermisson 2016; Meyer 2012).

Basic features of grounded theory[1]

Fundamental openness and concurrence of data collection and analysis

The concurrence of data collection and analysis is a characteristic feature of grounded theory and is aptly described by Lamnek (1988) as follows:

> The research process begins with the collection of data; these are then encoded –Glaser and Strauss speak of the process of 'tacit' encoding; initial categories and their dimensions are formed and derived; these are immediately checked against the research field; concurrently, more data is collected, interpreted and utilized; categories are confirmed, rejected, modified or extended; at the same time, preliminary hypotheses are formed and checked; preliminary integration attempts are made in order to arrive at an overview of initial results; the earlier hypotheses, that frequently seemed disjointed at first, are soon integrated so as to form the basis for the emerging, central, analytical framework; this analytical framework is then gradually developed until it forms an object-oriented theory. (p. 118f.)

Through this, at first glance perhaps perplexing, description of grounded theory, it becomes clear that one should begin the data analysis with a fundamental openness. This applies regardless of any preconceptions and all theoretical background knowledge, which could influence theoretical sensitivity[2] and should thereby encourage the researcher to avoid a rigid, prefabricated 'drawer analysis'. Basically, the point is 'to maintain a balance between that which the researchers know and what may really be found in the data' (Strauss & Corbin 1996:30). Without delving into a discussion of whether grounded theory should be categorised as an inductive or abductive theory type, we could simply state that grounded theory should be understood as standing in contrast to 'theories of the logical-deductive type' (Lamnek 1988:114).

What significance does the concurrence of data collection and analysis as well as fundamental openness to the data holds for education research? The current reception of grounded theory in religious education shows that there is certainly no compelling need to collect further data after the initial collection and analysis. Here too, we can basically say that grounded theory is a flexible method that can and should be adjusted depending on the given subject matter and interest: 'Grounded theory offers a set of highly useful methods – in the form of essential guidelines and proposals for evaluation techniques – not rigid imperatives or cooking recipes' (Strauss & Corbin 1996:x).

Meanwhile, the fundamental openness to additional data collection is essential in the event that the first data collection and analysis do not yield a 'saturated' theory. Thus, for example, if an analysis of interviews raises new questions that may be answered through a video observation of the classroom, this new data collection may be performed and used to re-evaluate the data. In this manner, grounded theory's potential to religious education research becomes quite clear. Generally speaking, because of the complexity of the research field and its exploratory nature, the researcher cannot avoid gathering further data after an initial data collection and analysis, doing so until eventually a 'saturated theory' is obtained.

Constant comparison and asking analytical questions

The two general techniques that form the basis for the coding strategies used in grounded theory are constant comparison and asking questions (Strauss & Corbin 1996:44). In this sense, grounded theory may be described as an analytic method of constant comparison (Glaser & Strauss 1967:1 and *passim*), while more recent literature places a special emphasis on the posing of analytical research questions (Strauss & Corbin 1996:41). As a result of their importance, we will apply both techniques to the following sample exchange.

Sample exchange from the ninth grade in a secondary school.

Context: Following an introductory lesson and individual written work, the teacher invites the students to present their responses.

3. Teacher: Alright, I think you are all almost done. Let's go row by row: What does science tell us? What is the origin of the universe? [Student 19], could you go first please? What did you write for your response?
4. Student 19: The Big Bang.
5. Teacher: Okay. [Student 9]?
6. Student 9: I also have the Big Bang theory.
7. Teacher: Yes, [Student 5] …
8. Student 5: I also put down the Big Bang theory, and also that life developed on its own.
9. Teacher: Hmm, [Student 14], what do you have?
10. Student 14: [*Also the Big Bang theory*]
11. Teacher: Yes, [Student 1] …
12. Student 1: [*The Big Bang Theory*]
13. Teacher: Hmm, okay, did anyone write anything other than the Big Bang theory or the theory of evolution? [Student 15]?
14. Student 15: Yes well, I put those too, and then, hang on, [that life] emerged from unicellular organisms.
15. Teacher: Hmm, [Student 17]?
16. Student 17: Yes, I have the same thing – that plants and animals emerged from unicellular organisms.
17. Teacher: Okay, [Student 4]?
18. Student 4: The first living things [*appear*] several million years after the Big Bang.
19. Teacher: Yes, okay, do we have anything else? [*Writes on the board*] So then under scientific explanations we will put the Big Bang theory and the theory of evolution. [Student 13]?
20. Student 13: I put down emergence over billions of years.
21. Teacher: Okay. [*Writes on board*] I am going to group the responses that mention life's development from unicellular to multicellular organisms under evolution. What does the Bible tell us? [Student 23], could you start us off?

Comparing the first two students' responses – those of Student 19 and Student 9 – leads us to a twofold observation:

1. Strauss (1991:54–59) represents a good introductory text on grounded theory, recommended for teaching. For closer study, however, reading the basic sections of Strauss and Corbin (1996) proves unavoidable. Also Strübing (2008) has to be recommended for a deeper understanding of grounded theory.

2. 'Theoretical Sensitivity is the ability to detect what is important in the data and to give it meaning' (Strauss & Corbin 1996:30).

On the one hand, Student 9 specifies the Big Bang as a theory; on the other hand, Student 9 revises Student 19's laconic response ('the Big Bang') by reformulating it in a brief sentence ('I also have the Big Bang theory'). The similarity here is the reference to the Big Bang as well as the Big Bang theory, while the difference is Student 9's more specific and detailed reformulation of the preceding response. This comparison raises the following questions: Is the difference because of Student 9's greater verbal competence in comparison to Student 19? Or is the difference grounded in the specific communicative situation, in which the students express their responses in a row-by-row sequence? One motive could be that the previous student had already received a confirmation from the teacher for this answer ('Big Bang'). Do students typically adopt and develop content from a preceding response in conversational situations of this type?

The next comparison of Student 5's response seems to reinforce this question: Like the speakers preceding her, Student 5 also refers to the Big Bang theory; however, she expresses herself even more comprehensively and contributes the theory of evolution as an additional aspect ('I also put down the Big Bang theory and also that life developed on its own'). This statement can be viewed as a further indication that in the present communicative situation ('row-by-row questioning'), the students are impelled to ever widening expressions and that their verbal competence is not a crucial factor. At any rate, these are only preliminary hypotheses that are based on sparse data. If the inquiry of interest here lies in this 'communicative' direction and one wishes to investigate such conjectures further, one would have to gather further data in which, for instance, the statement sequence between Student 19, Student 9 and Student 5 would be altered, or their verbal competence investigated more closely. Another possibility is to analyse a larger number of different teaching transcripts on this topic, controlling for 'row-by-row questioning'. In essence, the constant comparison technique begins by comparing similar cases and gradually seeks to establish ever greater contrasts.

However, let us return to our comparative analysis of the given sample. Unlike the more detailed statements of Student 19, Student 9 and Student 5, the next two students (S 14 and S 1) follow their classmates with shorter, quieter statements that refer only to the Big Bang theory. Is this because of the fact that sequential questioning eventually leads the students to a unanimous position that then resolves in monotony? This would suggest that sequential questioning fosters an elliptical development to student statements: At first, the students strive to provide detail – only to become 'monosyllabic' after a certain limit is reached.

To be clear, we are dealing here only with tentative hypotheses – with a manner of sustained questioning that is based entirely on the data at hand while remaining principally open-ended. Moreover, we can pose questions about the teacher's role in this communicative situation: Does the brevity of Student 14's response stem from the teacher's prompt of 'What do you have?' which is more direct than the ones addressed to Student 9 and Student 5? (Cf. however, the teacher's initial question to Student 19) What role then is played by the teacher's feedback, which ranges from a simple 'Okay' and 'Yes' to the more direct prompt of 'What do you have?' Do such minimal differences play a role? To formulate this question more precisely: Do specific teaching situations allow us to determine the effects of such small differences? One is involuntarily confronted with the risk of over-interpreting here. Does this not require further sampling, done perhaps through a video recording, which could capture facial expressions and gestures for additional consideration? In grounded theory, this spontaneous question could be recorded in what is termed[3] a memo.[4]

A comparison between the teacher's next statement ('Hmm, okay, did anyone write anything other than the Big Bang theory or the theory of evolution?') and the student responses preceding it suggest that perhaps the teacher has noticed the monotony of the responses that began with Student 14 and Student 1 and now makes a direct intervention. Upon closer examination, however, it becomes also apparent that the teacher has introduced the term 'evolution' on his own, since the only allusion to this concept by Student 5 ('Life developed on its own') did not literally mention evolution.

At this point we can end our analysis of the sample exchange, since hopefully the importance of constant comparative analysis and analytical research questions has been sufficiently demonstrated.

Coding methods

Grounded theory distinguishes between three basic coding methods that are frequently merged in practice (Strauss & Corbin 1996:40): open coding, axial coding and selective or theoretical coding.[5] Wiedemann (1991) provides the following formulation to summarise the 'basic idea' of these three coding methods:

> Open coding relates to the formation of categories; here, the data are broken down into as many categories as possible. Axial coding aims to enrich and develop each category. Lastly, theoretical coding serves to integrate the different categories into a single model. (p. 443)

Because of their central importance, these coding methods will be set out in more detail below.

Open coding

On the basis of constant comparison and questioning, open coding begins with the formation of concepts in which concrete data are abstracted to a theoretical level. In our particular case, a teaching transcript is read thoroughly line by line, while ensuing concepts are noted in the margins.

3. About memos, see 'Open coding' section.

4. Marginal note: If we review our analysis of the sample exchange to this point, we notice that we began by comparing the responses of Student 19 through Student 5 – at which point our comparative analysis was extended to the more abstract relationship between teaching question/prompt and student response.

5. In earlier literature, this was referred to as 'theoretical' coding in the narrow sense.

Depending on the subject of interest, the concepts can refer to smaller or larger units of meaning within the data set (Strauss & Corbin 1996:53f.). The art of conceptualisation consists of remaining neither on a purely 'descriptive level' (Strauss 1991:59). nor relegating the textual content (the data) disproportionately to the background through the formation of concepts that are too abstract.

In the sample exchange above, we may observe the formation of concepts strongly focused on the content of the student responses and of concepts that pertain to the aforementioned communicative issues. The content-oriented concepts noted in the lesson transcript's margins are as follows: 'Big Bang (theory)' (S 19, S 9, S 5, S 14, S 1, S 4);[6] 'independent life formation' (S 5); 'unicellular organisms as the beginning of life' (S 15, S 17); 'Big Bang/Origin of life combination' (S 4); 'immense timespan of evolution' (S 4, S 13). The following 'communicative' concepts were noted: 'Teacher-Wh-questions about writing worksheet'; 'similar topic, from "monosyllabic" to sentence' (S 19 – S 9 – S 5); 'trailing off' (S 14, S 1) > 'teacher intervenes to change topic'; 'blackboard < student knowledge'.

Once the data have been assigned concepts in this manner, one can move on to the next step in which similar concepts are organised together. This grouping of concepts creates categories. One category is therefore a 'classification of concepts', itself a 'more abstract concept' (Strauss & Corbin 1996:43). Each category name should be chosen for clarity so as to 'quickly remember the concepts to which it refers. But it must also indicate a more abstract concept than the initial concepts' (Strauss & Corbin 1996:49). Thus, for example, the provisional category name for the above 'content' concepts is 'Student knowledge (verbally expressed) about scientific theories of universe and life formation'.

Open encoding enables not only the identification of categories but also of their properties and dimensions. 'Each category has several general properties and each of these properties varies over a dimensional continuum' (Strauss & Corbin 1996:51). Strauss and Corbin provide the category of 'Color' as an example: In this category, the general properties can be for instance 'shade,' 'intensity' and 'tint'; subsequently, one may assign each specific element of the 'Color' category its respective degree of 'shade' along a dimensional continuum (e.g. from 'very strong' to 'very weak').

In view of the above sample exchange, we may cite the following two properties for the category of 'Student knowledge (verbally expressed) about scientific theories of universe and life formation': 'Content-aspect variety of student response' and 'Eloquence'. To extend the example further, the dimensions of the 'Content-aspect variety of student response' property can also be designated: from no aspects at all to the Big Bang and evolution; (from a few to many) aspects of the Big Bang theory; (from a few to many) aspects of the theory of evolution; (from a few to many) aspects of the Big Bang and evolution. In this manner, one arrives at a helpful grid that graphs the content variety of student responses about the Big Bang and evolution.

Before discussing axial coding, we should briefly mention the importance of the so-called memos[7] that are also recorded during the conceptualisation stage. Without going into too much detail into the different types of memos, the general procedure for writing these memos has the analyst constantly record all his or her spontaneous associations, thoughts and ideas in separate memos during the coding stage. The ensuing memos can later serve as invaluable tools for developing the new theory.

Axial coding

It was precisely the differentiated description of axial coding in Strauss and Corbin (1996) and their productive application of it to teaching sequences that led us to give preference to this more recent version of grounded theory in the context of educational research. This coding strategy involves various methods 'which, by creating connections between categories, assemble the data derived from open coding in new ways' (Strauss & Corbin 1996:75). Basically, during axial coding, an existing category is further developed through its connection to the subcategories. This is done mainly through the application of the coding paradigm, which consists of 'causal conditions', 'context', 'intervening conditions', 'action and interaction strategies' and 'consequences'. The application of this coding paradigm allows the category to be specified beyond the properties and dimensions that were identified during open coding. Strictly speaking, the subcategories that are thus determined through the coding paradigm represent categories in their own right (and frequently have already been identified during categorisation); however, here they are reclassified as subcategories because of their (e.g. because of context or a causal condition) specific relationship to a larger category (Strauss & Corbin 1996:76).

Below, those factors of the coding paradigm that deserve further explanation shall be summarised with, where possible, individual references to the above sample exchange. With that said, the data of the sample exchange are too sparse to perform axial coding appropriately. A more detailed specification of axial coding can be found in the student profile analysis in the next section.

The concept of *causal conditions* refers to events 'that lead to the occurrence or the development of a phenomenon' (Strauss & Corbin 1996:79). An indication of causal conditions is often found in the data through the use of terms such as 'because', 'since', 'for', 'due to', and 'during' (Strauss & Corbin 1996:80). In the sample exchange above, a causal condition for the phenomenon 'Student knowledge (verbally expressed) about scientific theories of universe and life formation' would be the teacher's instruction to orally present the results of the individual written work (in row-by-row sequence).

6. To be clear, these parentheses contain references to the respective student responses.

7. An example instance is provided in 'Constant comparison and asking analytical questions' section.

Unfortunately, the responses above are too brief to allow us to follow up on further causal conditions which would emerge on their own from the reasoning of the pupils through the use of terms such as 'because' etc.

The *context* of a phenomenon is on the one hand the special dimensional expression of a category property, and on the other hand, the specific conditions, 'within which the action and interaction strategies take place' (Strauss & Corbin 1996:80). Thus, on the one hand, in the sample exchange, the respective dimensions of the category property 'content-aspect variety of student response' represent a context (i.e. that relatively few aspects of the Big Bang/evolution theories are mentioned in this conversation exchange). On the other hand, the written exercise as well as the 'row-by-row questioning' also serves as further contexts.

The *intervening conditions* refer to structural or 'broad and general conditions that influence action and interaction strategies. These conditions include: time, space, culture, socio-economic status, technological status, career, history and individual biography' (Strauss & Corbin 1996:82). Applied to the sample exchange, this would provide new aspects to elaborate, as is often the case when conducting a conditional analysis of lesson plans. These may be, for example, the following: the ninth grade in secondary school, the number of students, the socio-economic status of parents, awareness of the individual biographies of the students (e.g. S19, S9 and S5), their verbal proficiency and their psychological development.

The sample exchange does not allow us to derive subcategories concerning the *action and interaction strategies*; instead, we are left with only relevant assumptions that emerge from the constant comparison and questioning. An action strategy for pupils during 'the row-by-row questioning' could, as we said above, consist of the students referring thematically to the preceding statement and seeking ways to develop it. Of course, we cannot name any *consequences* of the actions and interactions in regard to the above example. However, this last aspect of the coding paradigm can be specified in the student profile analysis further below.

Selective coding

The final integration is a complex process. Strauss and Corbin (1996) write the following in this regard:

> After a period (probably months) of collecting and analyzing data, you are now faced with the task of integrating your categories into a grounded theory! [...] Integrating one's own material is a task that even experienced researchers can find difficult. (p. 94)

During selective coding, it may prove helpful to first make a 'descriptive narration or representation of the central phenomenon of the investigation' (Strauss & Corbin 1996:94) and to identify the 'central theme' of the narrative. This so-called 'central theme' refers to the core category: This could be one of the already identified and developed categories from the earlier stages of coding, and if this is not the case, then this central phenomenon must be given a name and developed through open and axial coding like any other category (Strauss & Corbin 1996:98).

Starting from this core category, links are sought and established to the other categories through the use of the coding paradigm (conditions, context, strategies and consequences). In combination with the memos, which the researcher now returns to, a theory is derived and then checked against the data in order to see whether it is 'grounded, or anchored in empiricism' (Lamnek 1988:112). In a way, this integration through selective coding is not very different 'from axial coding. It is simply performed on a higher, more abstract level of analysis' (Strauss & Corbin 1996:95).

It is not possible to illustrate selective coding on the basis of the sample exchange above, as too few data are available. Nevertheless, given the similarities between axial and selective coding, 'Integration of the results of axial coding' section in the student profile analysis should provide at least an idea of what selective coding entails.

Application to a student profile analysis

In this section, grounded theory is applied to a very specific aspect of educational research – to a close analysis of an individual student's learning process. To this end, a total of 4 h of teaching were held on the topic of science and religion at the ninth grade level of a secondary school. An initial survey was conducted beforehand, in order to assess the students' prior knowledge. Exit surveys were administered immediately after the lesson and 2 months later, in order to assess the sustainability of the students' learning process.[8] In the following student profile analysis, the emphasis is placed on a single lesson – the same one used for the sample exchange above.

To this end, the statements of the subject student are analysed in chronological order under the central question as formulated by the research group of the Comenius Institute Münster: 'Does it becomes clear that the student is activating and developing his/her prior knowledge?' The further interest lies in which factors determine the activation and development of the concepts in question. For the purposes of grounded theory, whether the student is activating and developing his prior knowledge becomes clear through the comparison of his statements at different times in the teaching unit, as well as in the responses he gives to the initial and exit surveys. The statements of classmates and the teacher will be used to explain conditional factors for such processes. For the given purpose, the version of grounded theory described by Strauss and Corbin is especially accurate because the coding paradigm that underlies axial coding enables a differentiated approach to the learning process.

8. For more detail, see Saup (2002). The educational background here is derived from certain procedures in the constructivist teaching-learning research, as they are used in particular in the teaching of natural sciences.

Data collection

As part of our project, we queried the subject student, Samuel 24, at different times orally and in writing for his views about the relationship between science and religion:

In the initial survey (T24a), he writes:

> 'The Biblical story of creation is not compatible with scientific theories of the origin of life and the universe because the 'faith-based' creation narrative is only believed and need not have really happened. For example, if you believe in something, that does not mean it will happen.'

During the lesson on the relationship between science and religion, Samuel 24 made five relevant statements:

Context: Discussion about the boundaries of science and religion: There is no evidence for or against the existence of God.

48. Samuel 24: But that is what faith is, that you cannot prove it.
49. Teacher: Uh-huh.
50. Samuel 24: Otherwise, you do not believe it, since it already is.

74. Samuel 24: Well, I wrote neither 'yes' nor 'no' here. […] I think you have to look at these things – that is, science and beliefs – as two things.
75. Teacher: Hmm, and this is why you think they're not compatible?
76. Samuel 24: I don't know that, it could also be otherwise.
77. Teacher: Can you share your reasoning?
78. Samuel 24: Well, if you view them as two things, then there could be a connection somehow …

114. Teacher: Okay, here, let's see a quick show of hands. Who believes that the natural sciences are correct? Let's put it that way. [*Students raise their hands*.] Mhm. Who believes that the Bible is correct? [*Students raise their hands*.]
115. Samuel 13: Only to a certain point.
116. Teacher: Uh-huh.
117. Samuel 24: If I can put it this way, if you are asking me about faith, then I would say the Bible; if you are asking me about knowledge, then I would say science.

Context: The teacher has presented and explained a presentation that argues for the reconciliation between science and faith. This is followed by a discussion of the argument.

134. Teacher: Yes. [Sm 24], you were also a bit unsure. What do you think about this then? Does this persuade you? Do you think that my argument could be correct?
135. Samuel 24: It could be.

142. Teacher: Hmm, yes, because it depends on how we read the Bible. Do we read the Bible so that we say that the Bible tells us the world was created in 6 or 7 days? Or do we read the Bible so that we say, this 6-day scheme is an expression of order, for the ordering principle of the universe, and the Bible is telling us that God is behind it all, behind the origin of the universe. Does that clarify things for you? Not entirely? That's the interesting question at this juncture. What is the message of the Bible? [Sm 24]

143. Samuel 24: Yes, I think, erm, that would be compatible. That would convince me a bit, since I actually had one more example: For example, if now I ask what [*God*] is, then I have to ask science. And when I ask why he's so, then I have to ask the faith. And therefore, to get both answers, I need both.

In the first exit survey (T24f), Samuel 24 believes science and faith to be compatible 'because they are two different things, but complement each other'; in the second exit survey (T24j) he reasons only 'because they are two different things.'

Open coding

When we code these statements, they produce, among others, the following concepts: the initial survey 'faith is unlike history'; the lesson 'faith is unlike proof' (statement 48), 'faith is unlike facts' (statement 50), 'duality' (statement 74), 'relation through separation' (statement 78) and 'faith/Bible – knowledge/science' (statement 117); finally, the first exit survey gives us 'duality > complementation'. When comparing these concepts, it becomes evident that they are remarkably focused on the aspect of a prevailing 'duality' between science and faith. Thus, in our open coding, we can establish a category called 'duality of science and faith'. The term 'duality' involves two semantically different aspects: firstly, the 'dualism' of the two components, secondly, their combination into a 'team' or a 'duet'.

We thereby assign a property to this category called 'compatibility', which may be gradated as 'incompatible' – 'rather incompatible' – 'unsure' – 'rather compatible' – 'compatible'.

Based on the particular dimension of the property, we can now, on the one hand, describe the student's thoughts at different points in time (the dimension of the property at that given time) that form the basis through which he explains his reasons. On the other hand, the changing dimensions allow us to comprehend his learning process by observing the evolution of the ideas he expressed initially.

If we locate Samuel 24's statements during the transcribed lesson on this scale, we can see that he activates and develops his prior knowledge. In which situation and under what conditions this take place will be determined through axial coding, the coding paradigm of which will be explained below, using the example of statements 74, 76 and 78.

Axial coding

As we already explained, the coding paradigm consists of five subcategories: 'context', 'causal conditions', 'intervening conditions', 'action and interaction strategies' and 'consequences'. Below, we will identify which aspects of the teaching session can be assigned to their respective subcategories by means of a concrete analysis of Samuel 24.

On the one hand, the *context* is formed through Samuel 24's specific student statements about 'compatibility' at their respective positions in the transcript, as well as the given dimension of that property ('incompatible', 'rather incompatible', 'uncertain', 'rather compatible' and 'compatible'); on the other hand, the context is formed through the teacher's prompts, the statements of other students as well the subject student himself. Statements 74, 76 and 78 express uncertainty regarding the question of compatibility ('neither yes nor no'), while in statements 48 and 50, Samuel 24 asserts the independence of faith from evidence.

The student's reasoning for or against compatibility can refer to *causal condition*s, as well as Samuel 24's idea that a possible compatibility of science and religion results from the fundamental separation of these two subjects.

By *intervening conditions* we understand the knowledge collected during our initial survey of the student – here, the judgement that science and religion are not compatible because of the fact that beliefs do not describe reality – as well as the student's biographical details: Samuel 24 is a 15-year-old, secondary school student; he showed himself to be very motivated and interested from the beginning of the lesson and is cognitively above average in comparison to his class.

The *action and interaction* subcategory describes the respective student and teacher-statements whose content was determined by the 'context' subcategory. At the point in question, it becomes noticeable that the teacher asks four follow-up questions and that Samuel 24 attempts an answer but remains uncertain.

Student responses to the first and second exit surveys are recorded in the *consequences* subcategory along with an assessment of learning outcomes (whether the activation or development of prior knowledge took place). In statements 74, 76 and 78, Samuel 24 activated his knowledge and developed it further: while in the initial survey, he argued for incompatibility, in these statements he expresses uncertainty. Later, in the first and second exit surveys he speaks for a compatibility, basing his reasoning in the 'duality' of science and faith ('because they are two different things') – furthermore, this argument is developed in the first exit survey through the two subjects' respective statements about one another ('but complement each other').

Figure 1 provides one example of how the results of axial coding can be recorded in a table during the research process.[9] The coding paradigm subcategories are listed on the left side of the diagram, while the first integration is represented on the right side.

9.For more about this, see Strauss and Corbin (1996:91f.).

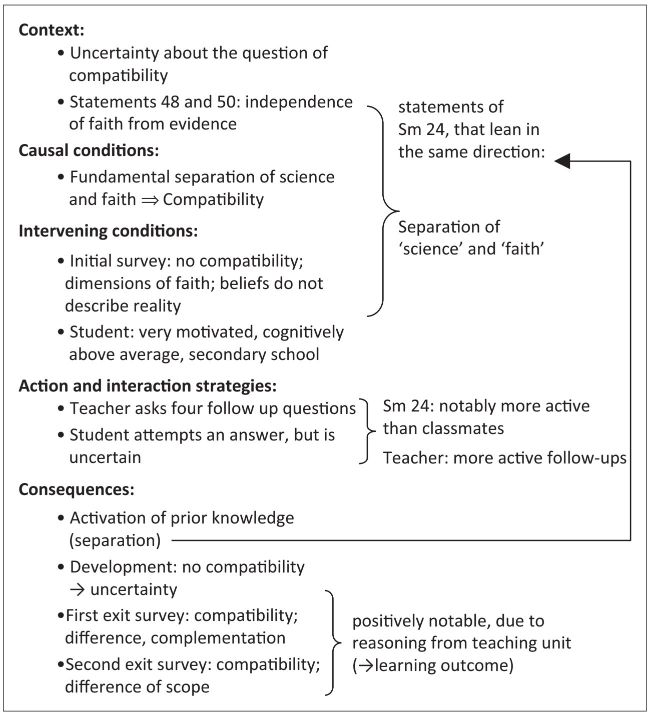

FIGURE 1: Axial coding.

Integration of the results of axial coding

From the diagram of the data in question (in this case, statements 74, 76 and 78), we will first attempt to establish connections between the individual subcategories (right side of the diagram) in order to detect initial connections between the individual elements.

Next, we will pose questions in order to differentiate the central research question ('Does it become evident that the student activated and developed his knowledge during this lesson?') from the background of collected data. The ensuing questions are closely related to the preceding analysis as well as the situation under analysis. They refer, on the one hand, to the relationships between the elements of the different subcategories and, on the other hand, to explanations for certain actions, strategies and practices that rose to the forefront of our research interest during the axial coding:

- What influence do the intervening conditions have on the phenomenon?
- Why does the activation and development of individual ideas take place?
- What does this lead back to?
- What other statements and/or media does Samuel 24 fall back on in this situation?
- What strategies does Samuel 24 employ? How do these differ from the strategies of the other students, and why?
- Which strategy does the teacher assign and why? How does Samuel 24 respond? How do his classmates respond? Why is there a difference?
- Can we identify a causal relationship between the teacher and student strategies?

When applied to statements 74, 76 and 78, these considerations lead to the following conclusions:

It is noteworthy that at this point in the argument Samuel 24 chooses an existing difference between science and faith as the starting point for his considerations. He activates the ideas he expressed in the initial survey and develops from 'incompatibility' to 'uncertainty' in regards to the possibility of compatibility between scientific world and life formation theories and the biblical creation stories.

If we inquire after the reasons for this process, we are unable to find any direct evidence suggesting a causal relationship in the foregoing exchanges of the teaching transcript.

With regard to the action and interaction models, we can note here the above-average activity of Samuel 24, who makes very detailed comments in comparison to his classmates and is willing to consider and attempts to find an answer to the teacher's questions. This too allows us to identify a change in the interaction strategy in the teacher's exchange with Samuel 24: When we compare the questions asked in the transcribed lesson, we see that the teacher is more active and intensive in her inquiries towards Samuel 24 than to most of his classmates. The reasons for this are obvious: The strategy of intensive follow-up questions is promising when applied to Samuel 24 because, on the one hand, he has the cognitive ability to understand the content of the lesson that swamps many other students in the class, and on the other hand, he is willing to participate actively in class discussions. This brings us to the conjecture that, here, the student and teacher strategies help determine each other.

As we move on to the next statement (117), we are faced with the practical research question of whether this statement can be viewed as standing on equal footing with statements 74, 76, 78 and 143 – since here, Samuel 24 is making no assertion about the compatibility of science and faith. There are two reasons for considering statement 117 in this analysis: Firstly, it is an important, substantive statement that gives us general insight into Samuel 24's views – he now sees the difference between science and faith as very significant – which secondly, is tied in with a very interesting interaction context: The teacher resorts to a new strategy here by asking the students to decide who is right, science or faith.

As part of the student profile analysis, the following questions arise: Why does the teacher switch to this strategy? What is her goal in doing so? To find an answer to these questions, the next step is to analyse the context. Looking over the preceding part of the transcript, we note that class discussion has stagnated at this point. It is unlikely that the students will make any further statements. So it seems likely that the teacher seizes on the new strategy spontaneously and without premeditation, seeking to provoke and enliven the stagnant learning interaction.

How does the class respond to this provocative question? Does Samuel 24's reaction differ from those of his fellow students? The majority of students make up their mind and vote by a show of hands; only two students, Samuel 13 and Samuel 24, voice raise objections; the teacher's strategy has had its desired effect on them. Samuel 13 begins by submitting a vague objection ('Only to a certain degree'); Samuel 24 clarifies his statement and his own previous statements (48, 50, 74, 76 and 78) by defining the reference frame of the two 'disciplines' ('if you are asking me about faith, then I would say the Bible; if you are asking me about knowledge, then I would say science').

What development can we observe in this situation with respect to our central research question of whether the ideas expressed in the initial survey were activated and developed? The student differentiates his argument of an existing duality between science and faith further and in so doing develops his prior knowledge as well. The interaction context is noteworthy here: Initially, Samuel 24 reacts to the teacher's strategy in the desired manner, developing his knowledge in respect to his own earlier statements and those of his classmate. The question of the causal factors for this development may therefore be answered by citing the various starting points: Samuel 24's statements, the utterance of a fellow student and the teacher's prompt.

The last statement of Samuel 24 (Statement 143) documents his learning outcome, which is reflected in the first and second exit surveys.

What conditions this learning outcome? Why does the student indicate a further development at this point? To answer these questions, Samuel 24's statement is compared with the preceding teacher and student statements under the following question: Are there substantive points of contact that suggest that Samuel 24 is referring back to a preceding statement?

Of central importance here are the statements of the teacher during the presentation (statement 130), in which she argued for a relationship between science and faith. The first part of the presentation reviewed the inquiry directions of science (the history and laws of life's development) and of Biblical faith (origin and meaning of life). The second part of the presentation articulated the respective boundaries of these two disciplines. After a summary of these issues, the teacher established that science and faith are not mutually exclusive when one accepts that they represent two different subjects with their own respective interests and with their own answers to different questions.

Another approach to determining the causal factors of the learning outcome is the teacher's input (statement 136), which – based on previous lessons – formulates the difference between the two disciplines through the different questions they ask (science: how? the Bible: why?). Finally, the learning process of Samuel 24 could also be caused by the immediate teacher statement (statement 142), which reiterates the Bible's intended message.

Why then can we observe a learning outcome in Samuel 24, following these remarks, while the majority of the class does not respond? Unlike many of his fellow students, he could grasp the teacher's statements and presentation through his cognitive abilities and motivation.

Summary

The results of axial coding make it clear that Samuel 24 managed to activate and develop his knowledge in this lesson. Considering his above-average learning outcome in comparison to his class, we must inquire about the reasons for the discrepancy between his learning performance and the lower learning outcomes of most of the class. An initial approach is the anthropogenic factors that allowed Samuel 24 to follow the lesson more substantively, while many of his classmates are overwhelmed. Analysis by means of grounded theory has shown that the above-average activity of Samuel 24 engenders specific teaching strategies, so that he receives more intense attention from the teacher, which in turn promotes his learning process. Finally, we should draw attention to the importance of the teacher's inputs, as well as the presentation media, the contents of which are reflected in the student's statements.

Perspectives

At an earlier stage of this education research project, we tested qualitative content analysis (Saup 2002) as an alternative to Grounded Theory. This method lends itself so well to curriculum analysis (Fiedler 1980; Rothgangel 1997:128ff. that – given its exploratory and flexible character – we deemed grounded theory promising for the complex, still nascent research into religious education.

It is not difficult to apply this method to the various aspects of classroom research. Even from the sketchy analysis of the example sequence above, we can clearly see how this type of analysis may be used to emphasise the communicative and substantive aspects (as well as the interaction between the two), therefore lending itself to data analysis. In this manner, grounded theory can be used for an intensive analysis of a student's learning process, as we have done in the above student profile analysis, as well as for a comparative analysis of teaching practice in an actual class or even a variety of classes.

A further advantage of this method is its multiple applications. It proves effective to an analysis of teenager's texts (Nipkow 1990); to students' perception training in conjunction with the 'documentary method of interpretation' (Hilger & Rothgangel 1997); and, as we have shown here to some extent, to religious education research as well.

One final point is worth noting: Grounded theory is a practical method. It has been developed from fieldwork. As applied to religious education research, using grounded theory to arrive at a practical theory would require constant reference to teaching practice as well as a constant 'shuttling' between data collection and data analysis. In so doing, this method could also offer the additional benefit of fostering a differentiated, professional perception of teaching practice in religious teachers. Perception training for the religiosity of students would in this manner develop further into perception training in religious education praxis in general.

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Authors' contributions

M.R. and J.S. equally contributed to the research and writing of this article.

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