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Between absolute truth and multiperspectivity: New students' orientations towards science, with a focus on students of educational sciences

Abstract

The university environment contains both explicit (i.e. standards and rules) and implicit (i.e. cultural spheres) features. In addition, and with regard to these features, university settings possess a distinct potential for socialisation. However, the successful socialisation of new students cannot be assumed. This article suggests that new students' implicit images of how science is usually put into practice are crucial for explicit scientific learning and processes of socialisation. Based on qualitative empirical findings, an exemplary typology of two ideal types of new students' implicit images of science ('essentialist-answering' and 'questioning') is illustrated here, and the implications for academic teaching are discussed.

Keywords

Higher education, orientation towards science, new students, socialisation, documentary method, qualitative research

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Zwischen endgültiger Wahrheit und Multiperspektivität: Wissenschaftsorientierungen von Studienanfängerinnen und -anfängern der Bildungswissenschaft

Zusammenfassung

Der Bildungsraum Hochschule beinhaltet explizite (wie bspw. Bewertungsmaßstäbe und Regularien) und implizite Aspekte (wie bspw. in kultureller Hinsicht spezifisch gefärbte Räume), die zusammengenommen sozialisatorisches Potential besitzen. Es kann allerdings nicht davon ausgegangen werden, dass die Sozialisation Studierender generell gelingt. Der Beitrag setzt sich mit der Frage auseinander, inwieweit habituelle Wissenschaftsorientierungen von Studienanfängerinnen und Studienanfängern für Lern- und insbesondere Sozialisationsprozesse von Relevanz sind. Anhand qualitativ-emirischer Daten wird eine exemplarische Typologie von Wissenschaftsorientierungen von Studienanfängerinnen und Studienanfängern der Bildungswissenschaft skizziert und im Hinblick auf Konsequenzen für die Lehre diskutiert.

Schlüsselwörter

Hochschulbildung, Wissenschaftsorientierung, Studienanfänger, Hochschulsozialisation, dokumentarische Methode, qualitativ-empirisch

1 Introduction

Universities represent an environment with a distinct potential for socialisation (HUBER, 2002). Especially when beginning their studies, students are confronted with regulations and requirements that are usually verbalised *explicitly*. Additionally, in research and academia they face a variety of *implicit* codes of conduct and practice. In this context, successful socialisation cannot be assumed, particularly given earlier findings that indicate that capacity for socialisation in universities plays less of a role than students' social backgrounds (BURKART, 1986, as cited in HUBER, 2002, p. 429).

Moreover, a student's habitus, which is the result of family and school socialisation, can differ in its ability to adapt to different social environments. As a result, the specific relation between the habitus acquired in the subject's social background and the habitus that is favourable in the respective educational environment impacts educational careers (BOURDIEU & PASSERON, 1971). As studies have shown, a person's habitus generally plays an important role in educational socialisation (e.g. HERZBERG, 2004) and academic achievement (e.g. GADDIS, 2013). In this context, the present paper suggests that one important yet undiscussed part of a new student's habitus involves the student's implicit and habitual orientations towards science and scientific work.

The present paper describes an exemplary typology of new students' orientations towards science and discusses the implications for academic learning and teaching. In the next chapter (2), orientations towards science are distinguished from related concepts and highlighted as a relevant component that is worth examining. In Chapter 3, the key findings of relevant studies are outlined. Based on a qualitative empirical method (Chapter 4), the paper then outlines an exemplary typology of new students' orientations towards science (Chapter 5). In Chapter 6, the results are discussed with regard to academic learning and teaching.

2 Theoretical background

2.1 Orientations towards science as relevant dispositions of new students

The importance of new students' orientations towards science can be explained by the role generally played by orientations in socialisation processes. According to Karl Mannheim's sociology of knowledge, the social world, and thus the university environment, can be described as a „double structure of everyday interaction and

communication“² (BOHNSACK, 2006, p. 42). On the one hand, this means that expressions, designations and documents can be understood in a literal sense (BOHNSACK, 2006, p. 42). On the other hand, tacit rules, relevancies and *modi operandi* which apply to certain social spheres of experience can or cannot be understood implicitly, depending on one’s habitual knowledge. This knowledge about *how to talk or do things normally* is acquired by being part of a certain sphere, such as a scholarly sphere, and by ‘naturally’ participating in its typical practices. Following the concept of orientation patterns, a theoretical core element of the documentary method, this knowledge can be labelled an *orientation towards* a specific area of experience and practice (BOHNSACK, 2006b, pp. 132-133). A specific orientation, developed through socialisation processes, is a factor that in turn implicitly guides the subject’s actions (BOHNSACK, 2006, p. 43). As a result, orientations are highly relevant to a subject’s potential behaviour (e.g. in a student researcher position).

Consequently, a student’s implicit orientation towards science is relevant for achieving success within the cultural spheres of the university in general, as well as particular fields of study. Each field of study utilises a specific language and a shared *Weltanschauung* (HUBER, 2002, pp. 436-441), which presumably include implicit features. This is particularly relevant in research-oriented teaching and learning settings because they require students to incorporate these tacit structures and codes in order to use them successfully in a way that corresponds with the “epistemic habitus” (ALBERT & PARADIS, 2014, p. 362) typical for the respective field of study. Additionally, it is widely accepted that personal knowledge and assumptions about science and scientific methods – whether explicit or implicit – have a considerable impact on processes of cognitive scientific thinking (BARCHFELD, 2008, pp. 105-108).

² All direct citations were translated by the author of this article.

2.2 Orientations towards science and epistemic beliefs

Having characterised the concept of orientations towards science and its importance for scientific thinking and learning, as well as for socialisation processes in higher education, I will now move on to contrast it with the construct of one's epistemic belief, which deals with one's personal conception of knowledge and knowing using a developmental approach (SEPPÄLÄ, 2013, p. 23). Depending on the specific inventory, each developmental stage corresponds to a more or less mature stage of epistemic thinking, such as absolutism (knowledge is right or wrong) or relativism (knowledge is context-dependant) (SCHOMMER-AIKINS, 2004). In addition, most inventories also contain beliefs about learning (e.g. about its speed or a person's ability to learn), since research has demonstrated that epistemic beliefs and beliefs about learning interact (SCHOMMER-AIKINS, 2004). Epistemic belief inventories are usually non-domain-specific (DEBACKER et al., 2008, p. 289).

In conclusion, both the concept of orientations towards science and the construct of epistemic beliefs represent the subject's image of science. However, their varying methodologies lead to different limitations. Beliefs are usually surveyed explicitly via questionnaires and with the help of theoretical preconceptions of their nature. Thus, large samples can easily be surveyed under standardised conditions. In contrast, the examination of orientations, which is strongly action-oriented and therefore context-oriented, is achieved through observations of practice. With regard to new students' scientific work, the advantage here is a detailed, first-hand reflection of their actual practice, which in any case represents one essential didactic demand in teaching. In this context, non-standardised observations, which are not limited by prior operational definitions, are crucial. Due to this circumstance, only small samples can be investigated. To sum up, the construct of epistemic beliefs can be used to examine *explicit and mainly general* images of science, while the concept of orientations towards science allows for a contextualised examination of *implicit and habitual* images of science and the related practice.

3 Empirical evidence

The following chapter gives a brief outline of the limited empirical evidence that exists concerning the investigation of student orientations towards science. Furthermore, it briefly describes relevant concepts that address the problem of heterogeneous habitual dispositions of students in education.

Apart from a study by FRANK (1990), orientations towards science have not yet been included in current empirical research on student habitus. Frank examined six new students' "images of science" (1990, p. 91) as part of their general academic habitus. She found that the students' images of science appeared to be extremely individual and dependent on each person's biographical background. For example, they exhibited strong trust in whatever can be achieved through science and science as a means of deepening self-knowledge, and even elaborated positivist positions. The main weaknesses are the study's small sample and its scattered results, which do not allow for condensed typification.

As far as the problem of heterogeneous habitual dispositions in the classroom is concerned, there is still a lack of sufficient concepts that address it didactically (LUEG, 2011). With regard to the transformation of habitual orientations in general, the theoretical yet empirically substantiated approach of transformative *Bildung* has to be mentioned. In this approach, processes of *Bildung* are defined as transformations of orientations that are essential to a person's self-image and worldview. Marotzki (1990), for instance, argued that such transformations can be initiated by critical biographical experiences, which render a person's former orientations useless when faced with substantially new demands in their life. As a consequence of the study's biographical perspective, the results are difficult to apply in specific educational contexts.

By contrast, PREECE (2009) refers directly to educational settings. Investigating the language and identity of first-year undergraduate black and ethnic minority students, she found that the students persistently characterised the academic community as 'the other', indicating the perceived differences between the students' own habitus and the habitus that supposedly matches the demands of the academic

community. As an approach towards inclusion, Preece proposes more interaction in the classroom, as well as offering personal and peer mentoring. Addressing the same problem of heterogeneous habitual dispositions in the classroom, LUEG (2011) favours a different approach. In response to the issue of the various habitus groups of sociology students, she proposes establishing different pathways within the curriculum.

With specific regard to student orientations towards science, the findings of WALKER & MOLNAR (2013) are also worth considering. When evaluating high school students' participation in an educational project in which they assumed the role of the researcher themselves, the authors found that 'authentic' scientific practice might lead to a change in the students' perceptions of scientists and themselves as capable of scientific investigation.

4 Methods

4.1 Sample

The data were gathered during an academic course at one of the universities of the German Federal Armed Forces. They consist of 33 texts written by first-semester educational sciences students who participated in an introductory class on scientific work and writing (four lessons in total) held by the department of further education. The courses offered are progressively research-oriented. The main aspect discussed by the students in their texts was 'What is an adult?', a question that was answered with the help of a number of texts provided by the lecturer.³ The students' texts (about 6000 words each) were written within ten weeks of enrolment.

All of the students in the sample were military personnel in the German Armed Forces, whose careers as officers involved obtaining a university degree (in various

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fields of study). As a consequence, the sample's sex ratio of 22 % female and 78 % male authors differs distinctly from the more balanced sex ratio at civilian universities.⁴ Due to the author's role as supervisor to the students, no further data on their social backgrounds were systematically collected. As studies show, though, students of the universities of the German Armed Forces are generally more likely to have a less educated social background⁵ than students of civilian universities. In addition, in the author's experience the majority of the participants in the relevant seminar group had no professional experience prior to their studies, apart from an obligatory 15-month officer training. However, even this training does not usually involve scientific work as it is typically required in academia. Hence, the students' orientations can be described as a result of school, family and military socialisation.

4.2 Methods

The students' texts were analysed using the documentary method, allowing a reconstruction⁶ of habitual and incorporated knowledge which orients practices implicitly (BOHNSACK, 2006a, p. 40). In the process of interpretation, *formulating* (step one) and *reflective interpretations* (step two) were made for each of the 33 texts. In particular, the students' texts were initially rephrased to reconstruct *what* had been said in a literal sense. The reflective interpreting process then worked out *how* 'science' was put into practice (rather than just explaining *what* the authors believed to be true about science). Generally, the reflective interpretations were carried out as comparisons (within each case as well as amongst the cases), in order

⁴ In 2012 approx. 50/50 (MIDDENDORFF et al., 2013, p. 68).

⁵ Parents with university degree 38 % (military) to 51 % (civilian) (BULMAHN et al., 2010, p. 30).

⁶ Due to the nature of orientations and practices as a social construct, their examination is termed re-construction (BOHNSACK, 2007).

to condense cases into types and remove them from the interpreter's personal point of view.

In this process, the interpretation followed Schütze's concept of text type analysis, which sees narrations and descriptions as representations of implicit knowledge, while valuations and argumentations highlight explicit knowledge (NOHL, 2008). The students' texts were not biographical interviews or group discussions, but rather essays with a certain amount of theoretical underpinning, so valuations and argumentations were interpreted differently. As NOHL (2008) suggests, in this case, valuations and argumentations can be used to reconstruct the implicit logic within the construction and justification of an argument. For example, the students' varying ways of arguing and contextualising their ways of examining the questions dealt with in the context of their personal lives, societal problems or educational research can be seen as representations of their implicit knowledge of the structure, topics and purposes of science and research. Consequently, the analysis was solely concentrated on the introductory parts of the texts, in which, unlike the main parts, the students' integrated the topic(s) dealt with into a specific discourse that seemed meaningful and relevant to them.

5 Empirical findings: Between questioning and essentialist-answering orientations

The examination resulted in two ideal types (following Max Weber's typology concept) of orientations towards science, representing rather extreme ends of a continuum of orientations. Due to the subject-specific background of the texts, the reconstructed orientations towards science must be seen as accordingly contextualised. They will here be termed 'essentialist-answering' (4.1) and 'questioning' orientations towards science (4.2). In section 4.3, similarities between the orientations will be discussed.

5.1 The essentialist-answering type of orientation towards science

One essential feature of this orientation is its focus on applicability. Thus, for this orientation, science represents a method that aims to find answers and solutions to specific problems of practice, which are mostly specified as commonsense or everyday life problems. They are personally relevant to the authors, such as the assessment of an encountered person as adult or non-adult and the desire to adjust one's behaviour towards that person accordingly, "*which raises the question of objective decision criteria which illustrate in an unambiguous way if a person can be described as an 'adult'*" (Dorothee). Less often, supra-individual purposes are mentioned, for example when the question "*to what extent it would help the society to draw a universal, unambiguous borderline between these two life stages*" (Frank) is raised. These two examples, which are typical of several other similar texts, are also remarkable in their expressed desire for unambiguous scientific solutions. In some of the other students' texts, the claim for clarity appeared, occasionally dampened or even paradoxical, as the challenge of determining "*an unambiguous theory or definition*" (Hasan), the "*vagueness of a definite date*" (Tabea), an "*explicit definition*" (Ahmed), a "*universally valid definition*" (Sven) or a "*final and satisfactory answer*" (Bruno).

The students' demand for unambiguous scientific solutions leads to the interpretation that scientific practice, in the students' implicit orientation, enables essentialist insights. Additionally, solutions found can either be clearly true and adequate or clearly false and inadequate. Furthermore, generally accepted solutions, as demanded by the students, would have to be truly universal, which means that they would have to be valid in any situation and context. In contrast, polysemous and contextual scientific knowledge would require interpretation according to respective contexts and would thus not be ready-to-use. Hence, science's direct applicability and thus its very right to exist are lost according to this type of orientation towards science. Corresponding to formal logic's utilisation of the term 'definition', this can be interpreted as an implicit understanding of science that permanently attaches paired combinations of terms and meanings (METSCHL, 1996, pp.

90-91). In this context, the essentialist-answering type of orientation refers to science as a stable supplier of absolute and applicable truths and, consequently, as capable of ultimate reasoning.

The respective orientation is characterised by tautologous, circular and paradoxical reasoning. This can be seen as an implicit reflection of the students' disorientation when faced with the impossibility of determining absolute truths. Another crucial characteristic of texts with an essentialist-answering orientation is the students' framing of the topic discussed as an everyday life problem and therefore as a problem that they have experienced in various ways. Accordingly, such framing refers to an implicit image of science that clearly focuses on 'solution-oriented' applied research. Hereby, self-references in reasoning can be seen as a solution-oriented approach towards the orientation's inconsistencies, resulting in the opposed ideals of universally valid scientific truth on the one hand and applicable science (which cannot avoid the contextualisation of its insights) on the other.

5.2 The questioning type of orientation towards science

In contrast to the orientation described above, the questioning orientation towards science includes an implicit or partially explicit assumption of multiperspectivity in the processes of scientific knowing. This is indicated by the absence of demands for clarity that would be typical of essentialist-answering orientations. Moreover, it is indicated by the framing of the students' texts as a discussion of "*views*" (Georg), "*approaches and perspectives*" (Christian and Fred) or "*definitions and perceptions*" (Karl). Accordingly, and in contrast to students with an essentialist-answering orientation, the students here tend to ask questions that are not necessarily structured in a dichotomous way, for example: "*Could a 22-year-old person be described as adult? From a juridical point of view, probably yes, but what about a societal point of view? And particularly, if he is not an adult, what is he then? Still adolescent? How would he define himself?*" (Martin).

In connection to the assumption of multiperspectivity in processes of scientific knowing, the students prefer to discuss the adequacy of a definition and its poten-

tial for scientific research, rather than the definition's truthfulness. For example, Georg asks: "*Which kinds of challenges with regard to research become visible when adulthood is looked at from different perspectives?*" This questioning orientation towards science allows for follow-up questions about the scope and connectivity of insights gained.

However, how respective topics are framed in the students' writings differs only slightly from the framing of students with an essentialist-answering orientation. For example, some students with a questioning orientation connect the given topic to problems that are actually discussed in the studied subject. Nikolas, for example, underlines the necessity of first clarifying "*basic terms and concepts in order to enable scientific work and research at all*". However, this kind of approach is the exception. The majority of the examined texts refer to everyday life problems when framing the topic addressed. Nevertheless, with regard to argumentation structures, this kind of framing is used here to stress the analogy between the plurality of subjective opinions and scientific perspectives in general, rather than to underline the importance of examining the respective topic.

5.3 Common grounds: Science as 'the other' in need of traceability and definitions

Many cases of both types are similar in the ways in which they quote the literature. The students do not necessarily cite correctly, but they do mention the author, year and title of the cited source explicitly. This can tentatively be interpreted as a common perspective, according to which scientific practices of knowledge acquisition must be replicable and comprehensible.

On the whole, it seems that most students are challenged by framing the topics discussed within the subject studied, as would be expected of new students. In short, both of the orientations refer very little to the subject's specifics (yet). Hybrid cases, in particular, are remarkable for their way of framing the topic discussed as relevant due to the debates of scientific actors named as "*researchers*" (Susann) or "*theorists*" (Bruno). Hence, science is still done by 'others'. Even in

texts with an underlying questioning orientation, the students asked “*However, which other perspectives exist, especially scientific ones?*” (Georg; emphasis by FK), after previously having described more familiar perspectives on the topic (for example, the connection of adulthood to the chronological age of a person). Thereby, it seems interesting that, while differentiating between familiar and unfamiliar, students apply constructs (such as maturity) and numbers (such as 18 as the legal age or 21 as the age of capacity in a juridical sense) as opposites, whereas constructs belong to the ‘unfamiliar’ and numbers to the ‘familiar’. This can be interpreted as evidence of the students’ general unfamiliarity with the abstract terminology of the subject studied.

Furthermore, terms like ‘definition’, ‘to define’ or ‘definitive’ occur frequently throughout all the texts (27 occurrences in the 33 texts). Consequently, and according to almost all the students’ understandings of science, scientific practice requires the “determination or fixation of the meaning of a linguistic expression” (METSCHL, 1996, p. 90) in order to establish a shared understanding of terminology. Then again, the students’ orientations differ in the implicit assumption as to whether definitions have to be established prior to the scientific work or are an integral part of the work itself.

6 Discussion

The types of orientations towards science derived resemble the core ideas of absolutism (essentialist-answering orientation) and relativism (questioning orientation) as specific beliefs in epistemic belief models. Consequently, they can be seen as a selective validation of epistemic belief models containing at least one of these positions, such as the path-breaking model of PERRY (1970). This clearly shows that the interaction between habitual knowledge about science and epistemic beliefs needs further theoretical, methodological and empirical investigation, particularly when considering that both forms of knowledge interact with the way that subjects position themselves in terms of learning. With regard to the biographically contextualised results of FRANK (1990), the question arises of the way in which the con-

sideration of individual biographical experiences in the investigation of images of science could, on the one hand, reasonably deepen the understanding or, on the other, hinder the didactic utilisation of results due to a lack of necessary abstraction.

With regard to habitus, the results indicate that new students' initial habitual knowledge about science and scientific practice is highly diversified. It does indeed favourably or unfavourably 'fit' into the actual academic setting, even though all the students still seem to be unfamiliar with their subject of study. For example, the implicit assumption found in questioning orientations that there is a need to contextualise scientific questions and solutions is reminiscent of the hermeneutic circle, a principle which is common for current scientific practices in the arts and humanities. According to KOLLER (2006, pp. 83-85), this principle defines scientific recognition as procedural through multilevel interpretations of the acquired knowledge and, as a result, as infinite. Students who exhibit a questioning orientation towards science right from the start might profit from it in their academic work, especially in research-oriented settings. In contrast, the ideal type of an essentialist-answering orientation towards science has a teleological focus on truth and absoluteness that has little in common with scientific proceedings as currently applied. Students who exhibit this orientation might find academic and especially research-oriented learning, as well as dialectic arguments, difficult or, in the worst case, pointless, since they will not lead to any kind of 'real truth'.

This raises the question of how to address the problem of heterogeneous orientations towards science in terms of academic teaching and socialisation. In this context, the qualitative results allow for contextualised suggestions. At the same time, this advantage is also the study's most serious disadvantage. The underlying methodology and the study's small and specific sample (i.e. only military students) cannot provide sufficient data to generalise the results. Another weak point may be the collection of data through student essays, which may only partially represent the students' implicit images of science. Therefore, the following suggestions should be seen as sample ideas that are open to further investigation and elaboration.

As described in chapter three, the students in PREECE's study (2009) persistently experienced the academic community as 'the other', which is similar to most students in the present study with regard to their characterisation of science. Concerning the present context, in which almost all students experience otherness, inclusive methods, as suggested by PREECE, might generally help the students by fostering their process of inhabiting an academic identity within the academic community of practice. Specifically, taking part in peer mentoring provided by more advanced and settled students might help to alleviate feelings of otherness. Furthermore, the students should be constantly involved in 'authentic' activities of scientific work and research. As WALKER & MOLNAR (2013) suggested, these activities can contribute to transformative learning concerning the students' perceptions of scientists and themselves as capable of scientific investigation.

In addition, implicit assumptions common to most of the students should be addressed in an explicit way during the teaching process. Concerning the present sample, the students' assumptions about the necessity of scientific traceability or their unfamiliarity with an understanding of 'meaning' that is typical of the arts and humanities (and, in particular, of the educational sciences as the subject studied) should be discussed in the classroom. Following MAROTZKI (1990), this discussion could take place in a way that challenges the students' current orientations.

Following LUEG (2011), separate first-year courses on scientific work and writing for groups with various orientations towards science could be another supportive measure. Thus, course content could be tailored with regard to the participants' actual dispositions. For example, since the results indicate that the perceived purpose(s) of scientific research are essential for all students' implicit images of science, all of these courses should deal with this topic. With particular regard to students with an essentialist-answering orientation, the topics of how to generate scientific *questions* and how to approach knowing and knowledge non-dualistically should be addressed.

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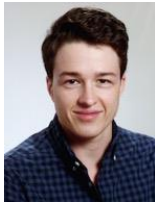
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