What is implied? Exclusion of STEM students by the curriculum

Introduction

Research has increasingly emphasised identity as a pivotal component in understanding students choosing a bachelor programme within science, technology, engineering, or mathematics (STEM) or not (Bøe, Henriksen, Lyons, & Schreiner, 2011) and whether they complete the programme (Ulriksen, Madsen, & Holmegaard, 2010). As pointed out by Shanahan (2009), also the social structure plays an important role in both the formation of identity and in the opportunities students have for adjusting and acting their identities.

Educational exclusion is related to the social background of the students (Archer et al., 2012; Bourdieu, 1984), but also to the educational setting the students are entering. Bernstein (2000) provides a framework for analysing how the educational setting contributes to the inclusion and exclusion of participants. Following Bernstein, a curriculum is constructed according to a pedagogical discourse that regulates both the content and the pedagogical form of the programme. Ulriksen (2009) suggests that a curriculum holds an implied student. This is a set of attitudes, practices, interests, and prior knowledge and experiences that are presupposed by the programme in order for the teaching and learning activities to succeed.

Two core concepts in Bernstein's analysis of the pedagogic discourse are classification and framing. Classification concerns the relation between the different components of the curriculum and between what is within and what is outside the curriculum. If there are strong boundaries between different elements of the curriculum, the internal classification is strong. A strong external classification is when there are strong boundaries between what is within and what is outside the curriculum. More open relations between elements are considered weak internal or external classification.

Framing concerns who has the control over, inter alia, the pace and sequencing of the teaching and learning. If the framing is controlled by the teacher the framing is strong. An apparently larger degree of control by the students is considered weakly framed. In this paper, we will use Bernstein's concepts of classification and framing to discuss how the curriculum and pedagogic discourse of STEM higher-education programmes include or exclude particular students.

Methods

The paper is a part of a larger project (Authors, 2012) following students in their transition from secondary to tertiary level. Of the original 134 students, 20 entered a STEM higher-education programme. The students were interviewed between one and five times during their first year at university. A narrative approach was used in the interviews (Andrews, Squire, & Tamboukou, 2008). All interviews were transcribed verbatim and coded using AtlasTI . The codes were theoretically generated based on the concepts of classification, framing, and the implied student. The paper analyses the students' experiences and conceptions of the pedagogical discourse. From an exclusion/inclusion point of view this approach is highly relevant and adds to analyses of how discourse is expressed in rules or how it could be interpreted through observations of teaching and learning activities.

Results

The students' experiences of the first year at STEM higher education reveal a dominance of strongly classified programmes. Generally, the students experienced it difficult to establish a relation between the different modules. Neither was this relation explicitly stated by the programme. Often, the students also found it difficult to relate the content of the modules to the overall programme they attended. This was not least the case for the auxiliary modules in mathematics that were endemic to many of the programmes (e.g. biochemistry, physics). The general experience of the framing among the students was that of strongly framed programmes. The pace, in particular, was experienced as set by the teachers and difficult to keep up with, and the sequencing was also predominantly defined by the teachers through lectures and assignments. Furthermore, not only the sequencing of the individual modules, but also of the whole programme was strong. In general, the students had to wait for a semester or more before they finally met the content they had originally applied for.

As such, STEM higher-education programmes apparently presuppose that students are able to endure a learning experience where the relevance and coherence of the programme is obscured by the strong classification and where the strongly framed curriculum means that students have few opportunities to pursue points that appear interesting to them.

There are, though, a few examples of different student experiences. These students experienced modules including project work in groups on topics that the students had chosen themselves. These modules appear to weaken the classification, externally in relation to both applications in the outside world and to the life worlds of the students as well as internally in the relation between the modules and the overall purpose of the programme.

Conclusion and discussion

Students' experiences of higher-education STEM programmes firmly suggest that they are strongly classified and strongly framed. Consequently, the teaching will tend to focus inwards on the course content unconcerned of what relation there might be to other parts of the programme. The strong framing of the programmes, furthermore, requires the students to subordinate themselves to the logic and preferences of the teachers rather than encouraging them to engage in an exploration of the field and content in a more independent manner. In both cases, the curriculum provides a limited and fixed space for the students to relate themselves to the programme and construct a viable sense of identity.

Therefore, the implied student of the STEM programmes is patient, obedient, and capable of enduring a long period of teaching and learning that apparently make little sense and limited relevance to the students' original motivation for entering the programme. Students unable to submit themselves to these implied requirements are at risk for being excluded by the programme. Conversely, the programmes include students who can persist in spite of their difficulties with recognising meaning or interest. The study suggests that the curriculum include some and exclude other students. Whether this selection process leaves the programmes with the kinds of students they wish for is however not a part of this study.

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