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Interstitial Spaces – a Model for Challenge and Change

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This paper introduces the concept of *interstitial spaces* to examine the boundaries of science, science education, pedagogy, caring, and gender to discuss the different cultures teacher students meet during their education.

Interstitial spaces exist between and within boundaries. These spaces are possible sites within a defined context (a discipline, a practice, a culture) that may be occupied by an actor/agent working as a “carrier” of different cultural practices, knowledge and theories. A “carrier” can use the interstitial space to influence and challenge a “new” context and thus loosen up boundaries, but can also by experiencing new cultures and developing new knowledge integrate these new views into future practices. Thus, interstitial spaces establish a context for a carrier to act in ways to transform and change the cultures of disciplines. On an individual level, instead of feelings of alienation, of not fitting into a culture, the model offers a carrier the position as someone who has the potential and possibility to invoke a change, and this can be empowering.

1. Teacher students in a chafing borderland

Science education has its base in the natural science disciplines and although it has evolved into its own research field, there is still a close connection between the two. Not surprisingly, scientists exert an influence on what science is of most importance to include in the science curriculum for those who learn and also for those who teach science. Concepts, laws, and theories are commonly presented as rigid truths, compared to the way they are communicated and debated within the scientific community itself, and thereby convey a stereotyped positivistic view of science. Moreover, while the curriculum in school explicitly addresses the scientific phenomena and concepts, it also mediates an implicit message of a hierarchy of science practices and who can access and participate in that practice (Harding 1986; Lemke 1990). Nearly four decades, feminists have critiqued the culture of science as a male preserve. Scholars in feminist science studies have examined structures within science that have excluded, ostracized, and/or subordinated women.

Up to-date few studies have examined science teachers’ ideas and attitudes about gender, science and teaching. This paper draws on data collected in a research and intervention project (Challenging science teacher education) aiming to provide insights into how student teachers view gender and science, and what gender assumptions they hold regarding their own and children’s possibilities for participation in science. The latter is particularly important given that

research shows that teachers' ideas and expectations for children impact students' success in science (Andersson 2012, Kahle & Meece 1994, Koch 2006, Stadler 2007).

During their education prospective teachers, with a specialization in natural sciences, will meet different cultures that influence and contribute to their development of a professional identity. One way of interpreting culture is that our social world is constructed through cultural connections or relations that includes or excludes (Hasse & Trentemøller 2009). As members of a culture, its processes and habits are incorporated into our minds and bodies, making them largely invisible to us. When we suddenly come across something that surprise us that is when we cross the borderline to another culture. We enter as a cultural novice to gradually become more and more experienced. In the analysis of our empirical data we have found that the different cultures preservice teachers come across may be an obstacle for science teaching and learning. We have developed and applied a model using the concept *interstitial spaces* to understand and illustrate such obstacles, as well as the process an individual lives through (Hussénius, Scantlebury, Andersson & Gullberg 2014).

1.1. The research and intervention study in teacher education program

In the research and intervening project we are studying how an increased awareness of gender issues in science and in science teaching among preservice teachers influences their identities as teachers, and their teaching of science. A cohort of approximately 120 (K-6) student teachers from two universities in Sweden was followed through the first year of science studies. One aim of the feministic intervention stance was to provide prospective teachers with tools for them to connect with science and science teaching in a non-hierarchical way. This was accomplished with two different but not independent approaches, where the scientific content of the courses was expanded and supplemented. One approach was to introduce gender theories as a way to examine power through theories of gender order (Harding 1986, Hirdman 1990), which includes attention to gender constituted at different levels in society. Another approach was to problematize the view of science as an enterprise with objective knowledge claims, by examining science as a culture of subjective values. This knowledge can empower students and help them to transform and make science education inclusive for young children.

2. Method

Informed by Sible et al. (2006) we wanted to place students' own science experiences and viewpoints at the centre of the curriculum, which affected the planning and organization of teaching. Initially, the students wrote an essay about their science experiences. After an introductory theory session including the history and culture of science, the essays were followed up by an individual observation task, where the students should try to "catch sight of" the scientific culture and get access to the story told in parallel with the knowledge matter conveyed, as well as with group discussions. Another important element of the intervention was the use of cases (Andersson, Hussénius & Gustafsson 2009) to describe a real teaching situation. The students first wrote an individual reflection of the case, then discussed it in groups and finally reexamined and analyzed the case using gender theory. The cases are often emotionally engaging and provide preservice teachers with an outsider's critical and analytical perspective (Moje &

Wade 1997). Also, the preservice teachers were given tasks to accomplish in conjunction with their field experiences in classrooms, that is, they conducted an investigation to detect situations in which gender is of importance and reported their observations both in writing and at seminars.

Our empirical material consists of student essays, written reflections and assignments, recorded group discussions and field notes from lectures and seminars, supplemented with interviews with some of the preservice teachers at the end of their education. Since the data contain many topics and conversations at several different levels, we have used Braun and Clarke's (2006) thematic analysis as our analytical tool. The analysis was carried through in several steps using NVivo to organize the developing different themes. The identification of critical incidents within the empirical material has been one important analysing step.

3. Results - The model of interstitial spaces

Interstitial spaces are imaginary spaces between and within boundaries of different cultures in teacher education, e.g. the boundaries of science, science education, pedagogy, caring, and gender. The concept appeals to us because of the chemical interpretation of the term. In chemistry, interstices are the gaps in solid matter that exist between atoms or molecules. Smaller atoms or molecules that locate within the interstices change the chemical and physical properties of matter. In social settings interstitial spaces are possible sites within a defined context (a discipline, a practice, a culture) that are occupied by an actor/agent working as a "carrier" of different cultural practices, knowledge and theories.

Being a "carrier" means possessing some practices and/or perspectives that differ from those of a specific culture and those belonging to this culture, although the "carrier" is also integrated into the culture. A "carrier" has awareness and a critical perspective of the culture's practices and characteristics that other participants may unconsciously accept as norms. At the same time, a transgressive identity places the "carrier" in a position of being "the other". For example, Kumashiro (2000) uses the notion "the other" for marginalized groups in the society i.e. that are other than the norm, when discussing anti-oppressive education. Since our use of "the other" is wider and not necessarily relates to someone marginalized and/or oppressed, we instead choose "carrier" as a term for someone inhabiting something else than the majority group. Thus a "carrier" can use the interstitial space to influence and challenge that context and thus loosen up boundaries.

4. Discussion and conclusions

The model can be used to understand the tensions, challenges and opportunities it means to be situated and work in contexts where different cultures collide and chafe against each other. Furthermore, the model can be used as a tool to influence, challenge and change. On an individual level, instead of feelings of alienation, of not fitting into a culture, the model offers a carrier the position as someone who has the potential and possibility to invoke a change, and this can be empowering. In the presentation the model will be illustrated with the use of empirical examples.

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