



Science centres, gender and learning

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Abstract

This forum article discusses learning and teaching in Science Centres in relation to gender. The starting point of this discussion is Eva Silfver's paper "Gender performance in and out-of-school science contexts." In response to this article I discuss the discourse of gender in research on Science Centres and museums. Moreover, the text touches on how learning in Science Centres and out-of-school contexts is presented in research. The paper also addresses research into educators working at Science Centres and museums as well as attitudes to the profession among staff at Science Centres and museums.

Keywords Science Centres · Museum · Gender · Critical Museum and Heritage Studies · Learning · Educators

It has been argued that learning outside the classroom is one of the most rewarding pedagogical activities for both teachers and students. This kind of pedagogy can assist the learners in understanding science in a fun, different (Kim 2007), and more holistic manner (Hooper-Greenhill 2007). It is also beneficial for teachers as it avails an opportunity to try new pedagogical methods (Paris 2002). As a former educational officer in museums, I know first-hand how rewarding it can be to work with students in museums and out-of-classroom contexts. I have many fond memories of students being excited about learning science in museums. Yet, as a researcher in Critical Museum and Heritage Studies, and having worked with developing gender- and norm critical pedagogical methods for university lecturers wanting to teach outside the classroom, I also know how challenging it can be to facilitate a learning environment that is inclusive, challenges stereotypes, and provides equal opportunities for everyone (Rodéhn and Mårdh 2016).

Teaching and learning in science centres and museums is far from a simple and straightforward issue and Eva Silfver's article "Gender performance in and out-of-school science contexts" touches on some of these matters. I want to continue the discussion around a few

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This forum article address issues raised in Eva Silfver's paper entitled: Gender performance in and out-of-school science contexts. <https://doi.org/10.1007/s11422-017-9851-z>.

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aspects in the article and I will do so by locating Silfver's article in relation to the larger discourse of museums and cultural heritage. The composite theory of Critical Museum and Heritage Studies will assist me in discussing Silfver's article and framing my arguments. Critical Museum and Heritage Studies critically discusses science centres, museums and heritage in terms of representations and performances. Representations are within this field (and in this text), understood as the medium in which members of a group or a culture exchange and uphold meaning. Representations have the power to define what is considered 'normal' and to determine belongings and exclusions, and are, thus, inscribed in relations of gender and power (Hall 1997). Performance is within this field understood as *a doing* and an embodied socio-cultural process of meaning-making in which e.g., power, gender, belongings and exclusions are acted out (Smith 2006). The composite theory of Critical Museum and Heritage Studies have formed its own theoretical approach to museums and heritage, but it also heavily borrows from theories and methodologies located within the humanities. After locating Silfver's article in relation to Critical Museum and Heritage Studies I will move on to discuss the rhetoric of learning in science centres, and finally touch on aspects concerning the pedagogues, or educational officers, at science centres and museums. In doing so, I will rely on Critical Museum and Heritage Studies, and also borrow from other fields such as gender research and pedagogy. Consequently, this paper is informed by many theoretical approaches.

Locating Silfver's article

In research on science centres, gender, or rather biological sex, is central in many studies. In these studies it is common that researchers discuss different learning outcomes among boys and girls, and often in pre- and post-studies. It is asserted that there is a difference in learning outcomes between male/female and boy/girl in terms of participation (Greenfield 1997), and in science related interest (Christidou 2006). Researchers have also discussed if a hands on approach in science centres can solve the differences in terms of how boys and girls learn science (Heard, Divall and Johnson 2000). Learners are, consequently, divided according to a bifurcated gender system where it is assumed that boys think and do a specific way and girls think and do things a different way. The purpose is often to discuss the male dominance in science and why girls and women are, or feel, excluded, or why they are not attracted to science (see Brotman and Moore 2008 for a review of the research). To try to solve why girls may not be attracted to science, and try to change this, researchers have developed and evaluated different models and solutions (Bamberger 2014). Some researchers, discussing learning in science centres, move beyond this binary gender division and examine different ways in which gender is performed during pedagogical activities. Performances of masculinity (Archer, Dawson, Seakins, DeWitt, Godec and Whitby 2016) and performances of femininity are explored (Godec 2017). Yet, there is a need for further research into gender performances and that is also why Silfver's article is important. This kind of research pushes the discussions further and reveals variations of performances within groups of boys or girls. Moreover, it considers the role that masculinities and femininities play in learning. In turn, this can highlight what consequence learning in science centres have for learners, but also illuminate what challenges teachers face, and, in the long haul, contribute to a more qualitative teaching and learning in other settings than the classroom.

Although studies on gender are the centrality in some research on science centres, I nevertheless, suggest that a critical discussion of gender is largely being ignored (although there are some exceptions). It is not only in the science centre discourse that issues of gender is being ignored, or lagging behind, but research on museums and heritage sites suffers from the same problem. Laurajane Smith (2008) and Anna Reading (2015) suggest that gender has falsely been considered as a woman's problem within the field. Although Smith (2008) and Reading (2015) argue that gender has been ignored in research on museums, there has not always been a complete disinterest in the matter. During the late 1980s and early 1990s, especially during the inception of the *New Museology* movement, representations of women were explored from a feminist perspective (Bergsdóttir 2016). During its early phase focus was placed on how women were represented and research concluded that women were often presented in a very traditional manner (Porter 1988), connected to traditional gender patterns (Porter 1990), and represented from a male gaze (Porter 1995).

Rebecca Machin (2008) exploring science museums argues that research on gender representations in museums has not come to inform representation in science exhibitions. She indicates that there is a lack of conversation between the humanities and natural sciences. I agree with Machin and a closer look at research on gendered representations in museums reveals that it predominantly concerns cultural history museums (Aronsson and Meurling 2005), and to a lesser degree science museums (Samuelsson 2008) and science centres (Davidsson and Jakobsson 2007) or the way that science is exhibited (Bergsdóttir 2017). Although research have illuminated how gender plays a role when science is presented to the public, and although there are researchers that discuss how representations matter in science centres (Fors 2006), discussions on gender representation in exhibitions, apart from some studies, have largely been sidelined. A reason for this is, as Machin (2008) argues, a lack of conversation between the different fields. This has resulted in, I suggest, that many researchers discussing learning in science centres seem to miss these ongoing discussions.

From representations to performances

Although Silfver's article does not deal with representations she could have benefitted from the aforementioned discussions and it could also have situated her contribution more clearly. The discussion on representation, after all, ties in with Silfver's discussion of the students' performing with the Lego cars in the science centre, and I suggest that there is a link between representation and performance that could have been better explored with the help of writings within Critical Museum and Heritage Studies. Machin's (2008) research can be used to explain this link. She shows that there is a connection between the stories that are presented at natural history museums and the gender balance among scientists working there. Machin (2008) shows in a study of the natural history exhibition at the Manchester Museum that the male dominated working environment resulted in male specimens dominated female ones with respect to number, postures, and positions when they were displayed. Her writing can be compared to Donna Haraway's (1984) comment on the androcentric position that natural sciences are narrated from and who they are narrated by. Haraway (1989) critiques the androcentric norm and explains that although science is considered as being objective and neutral, it is, in fact, permeated with gender performances. Cecilia Rodéhn (2016) explains this further in terms of museum practices. She argues that curatorial practices can be understood as performances in which gender representations are made. Curatorial practices are, furthermore, understood, according to Rodéhn, as being

made through the making of representations. If representation is a medium in which members of a group or a culture exchange and uphold meaning (Hall 1997), then it can be concluded that the process of making representations can be understood as inscribing certain ideas about gender in the curatorial practice (Rodéhn 2016). Silfver could have made this connection in her discussion of the Lego car. The car can be seen as a representation that carries gender connotations and when the car is used in the teaching it inscribes social values about gender in the pedagogical activity and in the learning process. I will, for this reason, turn to a discussion of the Lego car.

Toys are more gendered-delimited than ever (Francis 2010). They have, in terms of how they look, how they are colored, how they move, and what structure and design they have been targeted to either boys or girls by the toy industry (Caldas-Coulthard and Van Leeuwen 2002). Children rapidly learn that certain types of toys are for boys and other are for girls (Francis 2010). In addition, toy cars (and real cars) have a long tradition of being marketed to boys (and men) (Caldas-Coulthard and Van Leeuwen 2002). Cars are also frequently associated with technology, technical advances and are something that is also commonly associated to men and masculinity (Mellström 2004). Cars can, therefore, be said to be a carrier of masculinized discourses and this needs to be taken into consideration when discussing the use of Lego cars in science education at a science centre. Cars are not a neutral object and it is important to scrutinize the gender associations to Lego cars, and it is vital to put this in connection to the discussion of the male dominance in science and why girls and women are, or feel, excluded. I suggest that the use of a Lego car in science education strengthen the idea that science is a “boys’ thing” and that science centres are a “boys’ place”, moreover that this severely counteracts the efforts of attracting girls to science.

The connection between cars, boys and androcentric norms in science seem not to be recognized by the science centre in Silfver’s article, which is interesting as it is not difficult to make this connection. There may, however, be reasons for using Lego cars at the science centre. Silfver indicates that the science centre lacked funding and, I suggest, that this may be the reason for appropriating Lego cars in the pedagogical activities. Lego is relatively cheap and the science centres might even be sponsored with the material by the toy company or a toy store. This means that financially deprived science centres are in the hands of the toy industry—an industry that, as showed above, market their toys in gender binary ways and have a tradition of marketing cars for boys. This suggests that science centres to a larger extent need to consider the kind of material that they are using in the pedagogical activities, even when they are being sponsored. It also reveals that the science centres to a large extent seem to lack critical thinking in regard to gender issues. This is no surprise and researchers have argued that when it comes to science museums and science centres there is a tendency to present science in a safe, traditional, and uncontroversial way (Pedretti 2002). This way of presenting science, as discussed above, suggest a continuation of the androcentric ways of doing science.

To be concluded from this discussion is that further investigation into the dominant ways in which sciences is presented is needed in terms of research in science centres. This is also the point of departure for Critical Museum and Heritage Studies as it studies the dominant ways in which heritage/science is told and upheld (Smith 2006). Researchers have acknowledged that it is gendered and largely masculinized (Smith 2008). Investigations on how visitors react to representations have been carried out during the past decades in terms of museums (Macdonald 2011) and science centres (Davidsson and Jakobsson 2007). This has included investigations of how femininity is created in relation to exhibitions and material culture (Godec 2017) but also how masculinity is created (Archer et al.

2016). Researchers have, consequently, shifted focus from reading exhibitions as text and started to investigating performances (Harrison 2013). Researchers are now investigating how visitors and museum educators perform within museums and heritage spaces (Jackson and Kidd 2011), how heritage is performed and how exhibitions and material culture perform themselves, or perform together with people (Waterton 2013). It has been stressed that heritage, or science, is a social process in which cultural heritage and science, comes into being. Heritage is not something that is, but rather something that we do (Smith 2006). In other words, we are doing representations of science in science centres and in doing these representations, science come into being. Representations also direct the kind of gender performances that will take place in science centres or museums (Rodéhn 2018). Translated into science talk, this suggest that science is not something that *is*, but something that is performed, conclusions that feminist science and technology studies researchers have proposed for quite some time (Barad 2007). This approach has also been used within the field of science education where it is argued that doing science is a doing of gender and that this includes a complex negotiation of masculinities and femininities (Danielsson 2009).

Drawing on research within Critical Museum and Heritage Studies, I suggest that students are, when programming a Lego car at a science centre, doing science and they are also doing gender. I suggest that this is a complex negotiation of masculinities and femininities. It is also a process where the material culture must be regarded as an active actor. The teachers, the learners, and the material culture are together with the science centre shaping and upholding what science is, what it could be, and they are also drawing boundaries and defining what science should not be. Considering students as active participants in doing and shaping science—and also in shaping the Science Centre as a place—we need to reflect on what learners *do* and study this *doing* (like Silfver does in her article). I argue, drawing on Smith (2008, p. 173), that a reconsideration of science as a cultural process in which ideas of gender is created and negotiated is necessary. This way of thinking can provide researchers with new ways of engaging with how science is taught and learned in science centres.

Learning, or rather how learning is considered at science centres, is also something that I want to continue to address in the section below.

Learning in science centres

Teaching and learning outside the classroom are, in scholarly publication and in practice, considered very rewarding because it can assist the learners in understanding science in a different, a more contextual and holistic manner compared to learning in a classroom. Learning outside the classroom creates an interest in what is being taught, a real connection to what is being studied (Rennie 2014), and a long lasting memory (Falk and Dierking 1997). For teachers it avails an opportunity to try new pedagogical methods and develop as a teacher (Paris 2002). The positive rhetoric surrounding teaching and learning in out-of-school contexts is almost undisputed. The positive stance in the literature on learning in museums and in science centres, I argue, is a consequence that researchers draw extensively on Vygotsky's and Dewey's pedagogical ideas, especially in terms of object based-, socio-cultural- and experimental learning. John Dewey (1997) suggests that using objects in education not only allows the student to investigate objects, it also creates a long lasting memory of what is being learned. Lev Vygotsky's (1978) ideas on socio-cultural learning and the focus on the social interplay between students have been picked up by science

centre- museum- and heritage scholars. Researchers, drawing on Vygotsky and Dewey, often through the writing of Lave and Wenger (1991) and Etienne Wenger's (1998), produce an effective rhetoric that learning in museums and science centres is something undisputable good. This can be seen in texts by John Falk and Lynn Dierking (2000) when they discuss meaning making, in Elian Hooper-Greenhill's (2007) discussion on learning outside of the classroom, as well as in Eva Davidsson and Anders Jakobsson's (2012) anthology discussing meaning making in relation to objects on display. They all arrive at the conclusion that learning in museums and science centres is positive because they regard learning as a social and democratic practice that offers better ways of approaching, and remembering, what is being taught.

All these researchers fail to factor gender into the discussion. Research focusing on gender representations and performances in science centres are, thus, important because it challenges this rhetoric. Silfver's article shows that learning in science centres involves re-performances of gender hierarchies and power relations. She also suggests that these unequal relations influence the learning outcome. Her result, I propose, is far removed from the otherwise positive stance to learning in science centres. Silfver's results, although she is not articulating it so herself, also challenges Rennie, Feher, Dierking and Falk's (2003) call for a further investigation into how teaching out-of-school setting may contribute to challenging stereotypical power relations when she states that "gender stereotypical patterns still exist when students work with or talk about science/technology". Silfver shows that gendered power relations are not challenged in science centres but, in fact, reinforced. She also reveals the different facets to hierarchal power relations and shows that there is not only a *hierarchy* between boys and girls but many different hierarchies within the groups of boys and girls. I suggest, therefore, that the positive rhetoric surrounding learning in science centres is a false chimera that counteracts further investigations on gender power-relations in science centres.

I also propose that the idea that learning in science centre contribute to a long lasting memory of what is being learned is highly problematic considering Silfver's results. Her result suggests that the visit provides the students with long lasting memories of gender stereotypes and inequalities. A conclusion to draw from this is that this memory could potentially work to exclude learners from pursuing science in the future, and, moreover, work off-putting from visiting science centres. Drawing on the results in Silfver's article it is possible to question whether science centres and museums should be used at all in teaching and learning. That is to say, if science centres are places that further a Eurocentric and androcentric agenda, that largely objectifies and subjugate women and other racial and ethnic groups, are they really beneficial places for teaching and learning?

So, at the risk of being a "feminist killjoy", to borrow Sara Ahmed's (2017) phrase—calling attention to problems and inequalities—and killing the joy of teaching out-of-school contexts with a feminist critique, I suggest that a science centre that reinforces gender hierarchies and other power relations should not be used in teaching and learning. If science centres furthers stereotypes and inequalities then this is not the kind of social practice learners should engage in. If learning at science centres furthers gender inequality, then this learning is far from the democratic learning that is propagated within pedagogical discourses.

If, however, science centres and museums can deal with problems of inequality and stereotypical gender representations, and negotiate gender performances in their pedagogical activities, then, and only then, are they beneficial in teaching and learning. Silfver gives some suggestions on how to deal with the kind of gender performances that she identifies in her article. One suggestion is that researchers and teachers should collaborate more

closely. I would like to add that educators at the science centre should also be included in this collaboration. Educators are often forgotten in this kind of work and I, therefore, want to turn to a discussion about educators at science centres.

The Educators

In her conclusion Silfver writes that:

That the result of this study [...] demonstrate how difficult it must be for pedagogues and teachers to grasp what is happening in the moment, understand why it is happening and then come up with ideas about what to change in order to make good science/technology more inclusive for students.

I want to consider this sentence because Silfver has touched on an important issue that permeates research on museums and science centres; namely the focus on visitors. Since the 1990s significant advances have been made in the understanding of museum education (Hooper-Greenhill 2007). Researchers have predominantly focused on visitor learning (Falk and Dierking 2002), meaning-making (Falk and Dierking 2000), experience and responses to guided tour and other museum activities (Jacksson and Kidd 2011). In addition, various pedagogical models have been suggested in order to improve and evaluate learning (Black 2005). Scholars, nevertheless, seem to overlook what George Hein (1998, p. 135) claims; that the focus on visitor studies makes it difficult to understand museum education since the time visitors spend in museums is so short. Despite Hein's statement, visitor studies continue to dominate the discourse to the point that it has become the new orthodoxy (Macdonald 2011, p. 2). Silfver's article, like most articles on science centres, is part of this convention and it is, thus, necessary to start exploring issues pertaining to educators.

Although educators have a long history in science centres and museums there has been limited recognition and understanding of their work (Tran and King 2007). Many educators are employed on a temporary basis or payed by the hour, and the job is often seen as a stepping stone to another museum position (Rodéhn 2017). I would even go as far as argue that this is a question of gender. In many science centres and museums there is a long tradition of women occupying educational positions and the disinterest in the work could be situated within a hierarchal gender order, where attitudes to gender also affect attitudes to work carried out by women. This, I propose, has resulted in that educators within (science centres and) museums are considered, by themselves and others, as having a low status and that the work that they are doing is not seen as a true job (Rodéhn 2017). This reality, of course, stands in stark contrast to the rhetoric in Critical Museum and Heritage Studies that positions education as the most important task that museum and science centres have (see Rodéhn 2017 for a discussion). Lynn Uyen Tran (2008) and Katie Best (2012) have called for more research into the performance of educators, but this call has only partly been answered. There are some pieces of research that focus on educators' own articulation of their work. However, the articles predominantly focus on how educators and learners interact and not on the educators own understanding of their performance in museums and science centres (Rodéhn 2017).

Silfver's statement, "how difficult it must be for pedagogues and teachers to grasp what is happening in the moment, understand why it is happening and then come up with ideas about what to change" is an important one as it calls for more research into how educators

negotiate gender performances in science centres. This is not as simple and straight forward as it may seem as educators are the interface between collections, exhibitions, pedagogic activities and visitors (Tran 2008). Lynn Uyen Tran argues, furthermore, that educators at science centres undertakes many different activities and have a range of qualifications and that educational credential varies “from those with formal teaching certificates to those with no educational training” (Tran 2008, p. 1). In addition, since science is the main focus in science centres, it is safe to say that very few educators (if any) have an education in gender studies. Considering Silfver’s results it is possible to argue that gender education, or training, are vital for the staff at science centres.

Silfver’s results show that there is a need for further research not only into the performance of educators at science centres, but how they understand and what they do to handle gender. It is also necessary to investigate what support the educators have for further training in dealing with gender performances. In addition, it is also vital to investigate how science centers relate to this, both in theory and in practice.

Conclusion

In this text I have discussed three different aspects that arose when reading Silfver’s article. The first issue pertains to the location of Silfver’s article in relation to an overall discussion of museums and science centres. Researchers exploring science education in science centres, or at (natural and cultural) heritage sites and museums, overlook the fact that there is a vibrant discussion within Critical Museum and Heritage Studies that could, if used, assist in and pushing the research further and provide new ways of investigating how learners engage with science. Science centres and museums are heavily affected by the discourse in Critical Museum and Heritage Studies. Or rather, that there is a dialectic relation between science centres and the discourse in Critical Museum and Heritage Studies. In other words; scholars study and draw their results from the practices within science centres and these results come to affect the practices in the science centres. Scholars, I suggest, need to recognize that science centres and museums are not just other places for learning—they are particular places for learning. I argue that scholars need to consider the specificity of the place, but also the academic discourses attached to it, in order to understand the fullness of the learning that takes place there. If this is not considered then research on science centres runs the risk of constantly rehashing the same arguments and results.

The lack of critical thinking in science museums and science centres, as mentioned above, and the rehashing of research results has created, I suggest, a situation where learning out-of-school contexts is considered as something undisputable positive. I have suggested that studies on gender performances can deconstruct this assumption. Further investigations considering gender representations and performances in museums can work beneficial for theoretical developments as well as for the practical reality in science centres. Lastly, I discuss the pedagogues that work in science centres and science museums. I show how there is a lack of research into their performance and suggest that this is a consequence of their position in the staff hierarchy and that this has gendered implications. Moreover, I suggest that more research needs to be paid how educators perform in museums and science centres and their understanding of gender in order to also further understand students’ gender performances.

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