STATE OF THE ART OF GENDER IN STEM

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Summary

The present document constitutes a specific mapping of how gender is addressed in the current STEM curricula in 14 EU countries. It is based on the analysis of the official 9th grade curricula for physics and biology for the 14 countries, and informed by official guidelines for teachers and head teachers as well as EU publications and research reports. Bearing in mind that the present report has several important limitations related to the collection and analysis of these documents, its three main findings are the following:

First, two dominant discourses are identified in the science curricula of the 14 countries: An abstract discourse, based on the internal logic of the discipline, and a socio-scientific discourse, based on the human and societal applications of the discipline. Across countries, the abstract, discipline-based discourse is most strongly present in the physics curricula, while the socio-scientific discourse is more present in the biology curricula. Nonetheless, the majority of countries employ the abstract, discipline-based discourse in their curricula. This has implications for the gender-inclusiveness of those disciplines.

Second, there seem to be few official guidelines available for teachers on the gender-inclusive teaching of science. The majority of the documents that do exist take a postmodern feminist approach to science education, or to education more broadly. In other words, the majority of teacher guidelines implicitly or explicitly consider the differences in between science learners of the same sex to be as important as the differences between the two sexes, and make corresponding recommendations for teaching practices. While this in itself is encouraging for the status of gender-inclusive science education in Europe, the scarcity of such documents seems discouraging.

Third, guidelines for gender-inclusion in out-of-school science education seem almost non-existent; from the 14 EU countries, just one document was found.

Taken together, the gender-polarised nature of the dominant discourses of many European science curricula and the relative scarcity of guidelines for teachers and other educators on how to conduct gender-inclusive teaching seems to indicate that there is work yet to be done to make science education gender inclusive across Europe. However, the findings presented in the present report may be subject to change over time, as Hypatia's knowledge-sharing network becomes better.

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Introduction

In the coming years, with Europe's knowledge economy developing and new technologies on the rise, skills in science, technology, engineering and mathematics (STEM) will be needed for a broader range of careers than ever before. It is therefore imperative to attract and recruit more youth to STEM study programmes - not just to increase the *numbers* of STEM-trained professionals, but also to increase the *diversity* of STEM-trained professionals.

A major stumbling block towards attracting and recruiting a diversity of youth to STEM education is the gendering of STEM in specific ways. As discussed in previous Hypatia reports (e.g. Achiam & Holmegaard, 2015), science education initiatives both in and out of schools may be based on implicit suppositions about who the science learner is; these suppositions work to attract and include learners with certain characteristics while excluding others.

The objective of the present report is to examine the relationship between gender and STEM in the 14 European countries that are part of the Horizon 2020 project Hypatia. We investigate this relationship through the analysis of documents related to STEM education in the 14 countries with a specific focus on ninth grade learners (15-year-olds). We have chosen this age bracket as a means to delimit our investigation, but also because ninth graders in many countries are at a point where they are beginning to make decisions about their study pathways.

The 41 documents we include in this investigation are of three types: 22 *primary documents* that directly prescribe the content of science education (national science curricula), 15 *secondary documents* that address the ways in which science education is carried out in practice (such as guidelines for teachers), and finally, 4 *tertiary documents* that report on the status of gender and science education across nations or regions (such as EU reports). A full list of the collected documents is given in Annex 1.

Gender and STEM

In the present report (as in the Hypatia project) the term *gender* refers to the differences between women and men that have been learned, are changeable over time and have wide variations both within and between cultures (European Commission, n. d.). This means that gender does not correspond in a straightforward way to biological sex; nor is it just a personality characteristic. Gender is something that is constructed and continuously negotiated across an individual's personality, interactions with others, communities and culture (Risman & Davis, 2013). This again means that in STEM education, learners' gendered identities are generated and negotiated through the active uptake of the discourses and practices of the particular scientific disciplines. In the words of Hughes (2001, p. 278):

> If being a scientist is congruent with gender subjectivities available within dominant discourses and practices of science, a scientist identity is relatively easy for a student to construct. However, if the subjectivities are not compatible, a scientist identity is uncomfortable and may be rejected.

In the present document, we investigate the dominant discourses and practices of STEM as expressed in the national curricula and other science education documents of 14 European countries (Figure 1).

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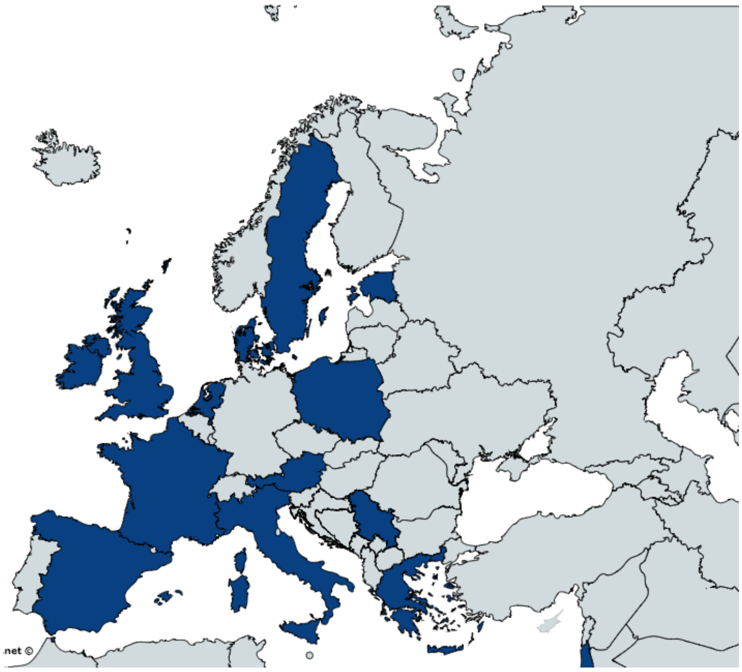

Figure 1. The 14 countries whose national curricula are included in the analysis: Austria, Denmark, Estonia, France, Greece, Ireland, Israel, Italy, the Netherlands, Poland, Serbia, Spain, Sweden, and the United Kingdom.

Although curricula are just one representation of STEM, there is evidence to show that inequalities in science curricula are often reproduced in science education, with measurable effects among learners (Hughes, 2001). Thus, we consider science curricula as a proxy for STEM education in the 14 countries. The dominant discourses that are expressed in these science curricula are thus considered to be an indication of the gender inclusiveness of STEM education in the European countries that participated in the study.

It is important to note, however, that the gender inclusiveness of the curriculum is just one factor in whether science education itself is gender inclusive; the educators' practices and the structure of the lessons or activities strongly co-determine the gender inclusiveness of any science education initiative (Sørensen, 2007). For this reason, we also consider guidelines for teachers and other educators as indicators of the gender inclusion status of STEM.

Scope and limitations

This report is a first attempt to carry out a specific mapping of how gender is addressed in the current STEM curricula in the 14 participating EU countries. Collecting the science curricula of these 14 countries was relatively straightforward. However, time and financial constraints meant that we were only able to carry out very basic translations of the curricula documents; we were not able to conduct investigations of specific societal and cultural characteristics that are necessary for more in-depth analyses of how gender is constructed and shaped by curricula in the 14 countries. Thus, the present document aims at broad comparability across countries rather than in-depth analysis.

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Another issue was the collection of other kinds of science education gender inclusion documents. Specifically, we have no way of ensuring that our collection was exhaustive, and even though the partners and third parties of Hypatia have close connections to the science education environments in their respective countries, we acknowledge that relevant documents may have escaped their attention, and ours. Furthermore, one of the project partners raised the point that gender inclusion programmes may be built into teacher education rather than being explicated in official documents.

These issues obviously limit the generalisability of the present report; it should thus be seen as a first document, the findings and implications of which will be further developed over time. Indeed, one of the intended outcomes of Hypatia is a closer connection between science educators at schools, museums, science centres, industry, and research institutions. These connections have already been growing through the first months of Hypatia, gradually resulting in an efficient knowledge-sharing network. Accordingly, we expect many more gender-inclusion documents to be discovered and shared as we move forward. These additional documents will be assimilated into our collective work in Hypatia, and will inform the major deliverable D2.4: Institutional Communication Guideline.

Data collection

The material studied in the present report was submitted by the partners and third parties of Hypatia, who represent a total of 14 European countries. The partners and third parties are all science centres or museums with an in-depth knowledge of the structure of science education in their respective countries, and we asked them to submit to us the following documents:

- The current national curricula for the subjects biology and physics for grade level 9 (15-year-olds)
- Any written guidelines teachers and head teachers receive in their country on how to approach the topic of gender in science classrooms
- Any existing structures in place nationally to support science centres, museums, research institutions and industry in communicating STEM in a gender-inclusive way

We asked the partners and third parties to consult their contacts in schools, research, and industry to verify whether any documents or guidelines pertaining to gender inclusion exist. Furthermore, we ourselves conducted a search for relevant documents at the European level. The resulting 41 documents are listed in Annex 1.

Analysis

As mentioned in the preceding, we consider science curricula to constitute a (sometimes self-contradictory) discourse on what counts as science. As discussed by Hughes (2000) and Sørensen (2007), science curriculum discourses do not describe classroom practices *per se*, but they do strongly co-determine them. We therefore consider the science curriculum to provide an accurate, if not an in-depth, baseline of the nature of the dominant science discourses in each country. Accordingly, the first step of our analysis entailed the identification of the discourses

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that were present in the national biology and physics curricula for each of the 14 countries, and an analysis of these discourses with respect to the gender subjectivities available in them.

In the following step of the analysis, the dominant discourses identified in the curricula are discussed in a broader societal perspective, using the available additional material (teaching guidelines and other gender inclusion documents) from each country, as well as current gender inclusion research literature.

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Dominant discourses in science curricula

The analysis of the science curricula from the 14 European countries showed clear evidence of two dominant discourses: A contextual *science-from-issues* approach, which emphasises the human, socio-scientific aspects of science; and a more abstract approach, in which science is decontextualized and framed in terms of its more abstract, disciplinary domains (cf. Hughes, 2000). In general, the abstract, disciplinary approach to science is more strongly present in the physics curricula, while the science-from-issues approach is more widespread in the biology curricula. However, there seems to be a co-variation between the perspectives taken in the respective national curricula. In other words, the countries that exhibit a socio-scientific perspective in the curriculum of biology tend to exhibit it also in the physics curriculum (Table 1).

Table 1. The perspectives of the physics and biology curricula, respectively, of the 14 participating European countries.

		Mainly internal, disciplinary logic	Both internal and external logics	Mainly external, socio-scientific logic
Austria	Physics			X
	Biology			X
Denmark	Physics			X
	Biology			X
Estonia	Physics	X		
	Biology		X	
France	Physics			X
	Biology			X
Greece	Physics	X		
	Biology		X	
Ireland	Physics	X		
	Biology	X		
Israel	Physics	X		
	Biology	X		
Italy	Physics	X		
	Biology		X	
Netherlands	Physics			X
	Biology			X
Poland	Physics	X		
	Biology		X	
Serbia	Physics	X		
	Biology	X		
Spain	Physics	X		
	Biology		X	
Sweden	Physics			X
	Biology			X
United Kingdom	Physics	X		
	Biology		X	

In the following, we provide specific examples of the two perspectives (the abstract, disciplinary approach and the science-from-issues approach) from the curricula of the 14 countries.

Physics curricula

Of the 14 countries included in this study, Austria, Denmark, France, the Netherlands, and Sweden frame their physics curricula explicitly in terms of its socio-scientific applications. An example of this human/societal framing is given in the Swedish physics curriculum:

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> Knowledge of physics is of great importance for society in such diverse areas as the supply of energy, medical treatment and meteorology. Knowledge of energy and matter provide people with the tools to contribute to sustainable development (Skolverket, 2011, p. 120).

This human/societal perspective is clearly evident in the way the core content of the Swedish physics curriculum is defined (Figure 2).

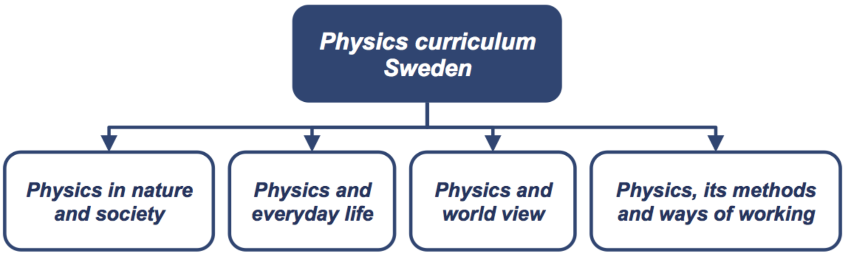

Figure 2. The core content of Swedish physics curriculum has clear links to the human and societal relevance of physics.

In contrast, nine countries (Estonia, Greece, Ireland, Israel, Italy, Poland, Serbia, Spain, and the United Kingdom) largely frame their physics curricula in terms of its internal disciplinary logics. An example from this end of the spectrum is given by the Estonian curriculum for physics:

> In studying through the subject of physics, students acquire an understanding of physical processes and the possibilities of applying laws of physics to the development of technology and biological functions; to gain a world view and to value developments in physics, and advances associated with historical developments in science; appreciate the role of physicists in the history of science as well as the meaning of physics within the general cultural context and its application within this (Ministry of Education and Research, 2011, p. 3).

Although this description reflects both physics-internal ('applying laws of physics') and physics-external ('appreciate the meaning of physics within the general cultural context') perspectives, the description of core physics content for Estonia seems mainly governed by a physics-internal perspective (Figure 3).

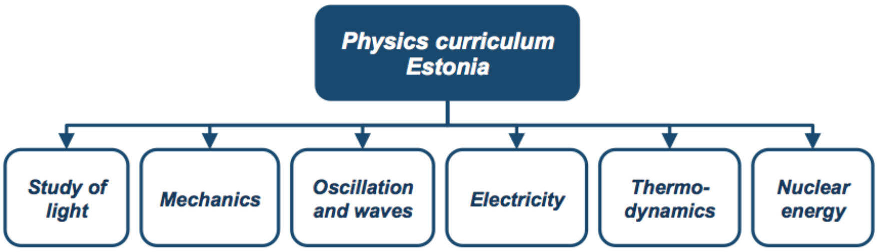

Figure 3. The core content of the Estonian physics curriculum is mainly recognisable in terms of the internal disciplinary logic of physics.

In summary, the majority (9 of 14) of the European countries included in Hypatia define their physics curriculum mainly or completely in terms of the internal logic of the discipline, while a

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minority (5 of 14) of the countries define their physics curriculum in terms of the discipline's external or human/societal applications.

Biology curricula

The biology curricula of the 14 countries do not fall into the strongly dichotomous pattern of the physics curricula. Specifically, five countries (Austria, Denmark, France, the Netherlands, and Sweden) frame their biology curricula in terms of its societal applications, six countries (Estonia, Greece, Italy, Poland, Spain and the United Kingdom) frame their biology curricula in terms of both logics - human/societal and disciplinary, and the remaining three countries (Ireland, Israel, and Serbia) frame their biology curricula from a mainly disciplinary point of view.

For example, in the French curriculum biology is seen from a human/societal perspective in the following way:

> In high school, [biology is] a way to motivate and qualify the further scientific training after college and to prepare for higher education; [it is] also involved in health, security, and environmental education for any student who chooses an orientation towards non-science subjects (Ministère de l'Éducation Nationale, 2010, p. 1).

This orientation towards the discipline's societal applications is also reflected in the core content (Figure 4).

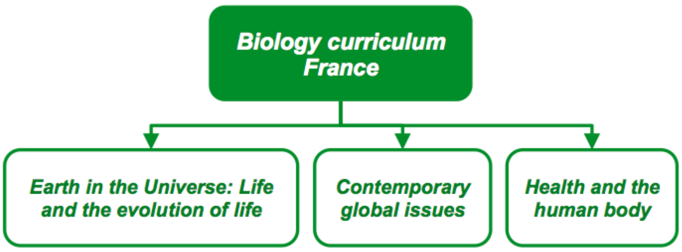

Figure 4. The core content of the French biology curriculum is mainly defined by human and societal perspectives.

An example of a biology curriculum with both human/societal and discipline-specific perspectives is given by Italy:

> At the end of high school course the student has disciplinary knowledge and the typical methods of earth sciences, chemistry and biology. These subject areas are characterized by the concepts and methods specific to them, but they are all based on the same scientific investigation strategy that also refers to the notions of 'observation and experimentation' (Ministero dell'Istruzione dell'Università e della Ricerca, n. d.).

Although this description of the subject is mainly oriented towards the discipline-specific subthemes of biology, the core content shows some evidence of a human/societal perspective as well (Figure 5).

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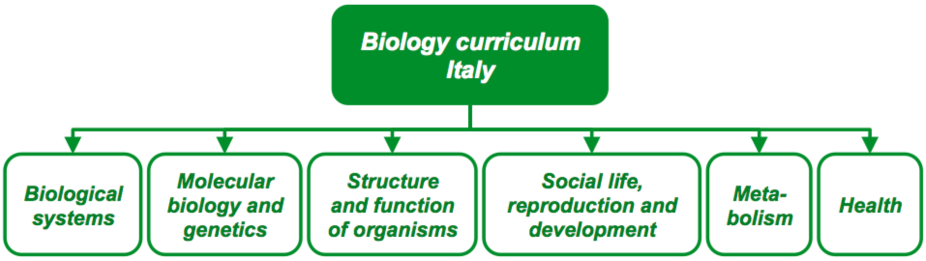

Figure 5. The core content of the Italian biology curriculum is defined by both disciplinary (e.g. metabolism) and human/societal (e.g. health) perspectives.

Finally, the countries of Ireland, Israel, and Serbia have biology curricula that are largely defined by an internal disciplinary logic. Even though these three countries define the core content of biology strictly in terms of a disciplinary logic (see e.g. Figure 6), nonetheless, all three countries also include human/societal perspectives in their descriptions of the discipline.

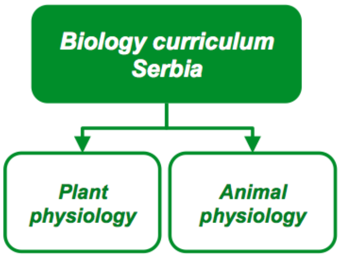

Figure 6. The core content defined in the biology curriculum of Serbia is based on an internal, disciplinary logic.

In summary, the biology curricula of the 14 European countries all include human and societal perspectives; some take a strongly human perspective while others take a mixed approach, including both discipline-external and discipline-internal perspectives in their definitions of biology. Thus, the socio-scientific perspective is more ubiquitously present in the biology curricula than the physics curricula of the 14 countries (Table 1); this may be evidence of a widespread 'humanised' perception of the biological sciences (Hughes, 2001).

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Implications for science education

What are the implications for science education of the nature of the dominant discourses in the physics and biology curricula of the 14 European countries? First of all, as we have alluded to in the preceding, the distribution of discourses (socio-scientific versus discipline-based and abstract) in the curricula of physics and biology is not at all unusual. As described by Hughes (2000), in society at large there is often a symbolic association of abstract, 'hard' science with the masculine, as well as a corresponding disassociation from the social world of human subjects; further, there is often a symbolic association between the 'softer' sciences, including biology, with the feminine. Indeed, this pattern is present across a number of western, industrialised countries as evidenced by reports such as the Relevance of Science Education (ROSE) study (cf. Sørensen, 2008). As a consequence,

> Because gender is asymmetric—that is, masculine and feminine are not equal and opposite—feminine aspects tend to be devalued and regulated to maintain the status of physical science and its teachers. Prevailing masculine cultures in science are thus difficult to challenge (Hughes, 2000, p. 427).

In other words, the pattern of dominant discourses in the physics and biology curricula in the majority of the countries included here have implications for the gender identities available to science learners, and thus, for the inclusion and exclusion of science learners in those countries. However, it is important not to simply conclude that in these countries, girls are included into biology and excluded from physics, and that boys are excluded from biology and included into physics. Indeed, assumptions like these may perpetuate the one-dimensional, essentialist stereotyping of girls and boys, women and men, that that fits no one in particular (Brickhouse, Lowery, & Schultz, 2000) and exclude and alienate those who do not fit into the categories of male or female (Alsop, Fitzsimons, & Lennon, 2002). Therefore, we must consider the differences in science engagement among learners of the same sex as equally important as the differences between the two sexes (Sinnes, 2006).

Another point worth mentioning is that although the science curriculum co-determines classroom practices, these practices are also influenced by other conditions (Sørensen, 2007). Such conditions include specific instructions or guidelines for science educators on how to conduct science education in gender-inclusive ways. In the following, we discuss such guidelines.

Gender inclusion guidelines

We received a total of 15 gender inclusion guideline documents for teachers and other science educators from Austria, Estonia, France, Israel, Italy, Ireland, and the United Kingdom – 7 of the 14 countries participating in Hypatia. Of these, most addressed education in general, and only few dealt specifically (or had sections that dealt specifically) with science education. We consider these latter documents to be especially important here, since science education represents a specific problem for gender inclusion, as evidenced by recent studies such as PISA and ROSE. In addition, we received one document from the United Kingdom specifically directed towards science centres and museums. We acknowledge that more relevant documents may exist that have escaped the attention of the Hypatia partners and third parties; this constitutes a potential bias in our findings.

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The gender inclusion guidelines for science educators take a range of different approaches to gender; including *equality*, *essentialist*, and *postmodern* approaches. As described in earlier Hypatia publications (e.g. Achiam & Holmegaard, 2015):

- An **equality** feminist stance assumes that girls and boys are similar in their engagement in science (or other disciplines), and that obstacles external to the teaching situation cause girls to participate to a lesser extent than boys (Sinnes & Løken, 2014).
- An **essentialist** stance reflects a belief that either by nature or through nurture, girls and boys have developed sex-specific characteristics and skills, and that these should be recognized and acknowledged in their own right in education situations (Nash, 2000).
- A **postmodern** stance challenges the notion that that female and male learners are united, respectively, by biological sex, and holds that the differences in science engagement among learners of the same sex are as important as the differences between the two sexes (Sinnes & Løken, 2014).

In the following, we give examples of gender inclusion guidelines for educators from Austria, Estonia, France, Israel, Italy, Ireland, and the United Kingdom that illustrate these different approaches, and discuss their implications.

Equality feminism

We found evidence of an equality feminist approach in several documents. One example is given by a report on study choice prepared by the Institute of Physics in the United Kingdom:

> Our schools are closing doors to both male and female students by apparently failing to challenge whatever external factors that drive school children to make such gendered choices (Institute of Physics, 2013, p. 3).

This statement seems to imply that the reason girls and boys make gendered choices of study subjects is located outside the education system, and that it may be a shortcoming of schools to fail to challenge these external factors. Another example of an equality feminist approach is given in a strategy paper on gender and diversity from Austria:

> Gender-neutral selection of teaching materials, examples and problems should be the basis for all subjects (Alker et al., 2011, p. 2).

Again, there seems to be an implication that external factors (e.g. textbooks, examples, and problems) are important for achieving gender inclusion in schools. Certainly, there is evidence that external barriers to some extent affect learners' participation in science; however, there is also evidence that simply removing these barriers is not sufficient to ensuring the inclusion of a broad diversity of learners in science (Allegrini, 2015). **It is thus difficult to imagine how a teaching approach founded in equality feminism, and simply based on removing obstacles, could counteract the exclusion effects of a physics or biology curriculum that is strongly framed in terms of an abstract, internal disciplinary logic.**

Difference feminism

A recent study of teachers' opinions on gender-adequate teaching in twelve European countries (De Witte & Holz, 2013) showed that across countries, teachers tended to treat students differently, based on their sex. Although the authors warn that these results should not be taken

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as representative, still this study may indicate that many teachers have an essentialist perception of girls and boys: That girls and boys have essential sex-specific characteristics and skills, and that these should be recognized and acknowledged (e.g. Nash, 2000).

We found a similar essentialist perception in several documents. In one example, the Institute of Physics in the United Kingdom makes the following recommendation:

> [D]ifferences between girls and boys, and the teaching styles that suit each should be recognised and followed (Institute of Physics, 2012, p. 8).

In the one document we received that specifically addresses gender inclusion in science centres and museums, we find a similar perception. One of the report's recommendations to increase the participation of girls and women in physics and engineering is the following:

> Bust the myth that all engineers and physical scientists are male by ensuring over half your visiting scientists, physicists, engineers and experts are female, for all your projects. Ensure you replicate this in all printed material, on the web and on social media (Fidler, 2014, p. 19).

These approaches seem to reflect a strong distinction between the needs and capabilities of women and men. Although there is evidence that science appeals to women and men in different ways, this may have more to do with the relative invisibility of women in scientific knowledge-making and their marginalisation in research than any deep-seated differences between the sexes. Indeed, research shows that the 'essential, hardwired differences' between girls and boys are probably a majority opinion, rather than a scientific fact (Choudhury, Nagel, & Slaby, 2009; De Vries, 2004; Ryan, David, & Reynolds, 2004).

As it is the case with equality feminism, difference feminism does not question the status of science itself. Accordingly, **a science educator with a difference feminism approach would probably not question the dominant discourse of the scientific subject they were teaching – whether that discourse was based on a internal disciplinary logic or an external socio-scientific logic. The inclusion and exclusion effects of that science subject would thus remain unchanged.**

Postmodern feminism

A majority of the submitted documents on gender inclusion took a postmodern feminist approach to teaching. A policy document from France provides an example:

> Biases and gender stereotypes that are rooted in the collective unconscious are the direct source of discrimination and, as such, must be fought from a young age. Thus, the diversity which is specified by law and set out in existing practices remains a necessary but not sufficient condition for real equality between boys and girls, and later women and men. It must be accompanied by strong government action to all stakeholders in the educational community and the partners of schools (Ministère de l'Éducation Nationale et al. 2013).

Although this document addresses general education, and not science education in particular, the authors are strongly conscious of the hidden mechanisms behind stereotyping. A similar consideration is evident in Estonian, Irish, Italian, and Israeli documents, as exemplified here by the Estonian *Handbook for Teachers*:

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> Appearing in various spheres of life, gender inequality is not due to biological differences in individual choices - it has structural reasons. [...] Knowing that gender is socially constructed provides an opportunity to examine how and why past and present societies have influenced what is deemed proper (gender) behaviour. It also allows each person to understand her or his own behaviour as a woman or a man (Papp & Hunter, 2013, p. 14).

Postmodern feminist approaches, such as those exemplified in the preceding, question the association between masculinity, objectivity, and science. From a postmodern feminist perspective science is not assumed to objective, rational or dispassionate (characteristics that typically skew masculine); rather, it is assumed to be governed by the social, cultural, and societal context in which it is practiced, like any other human endeavour (Brotman & Moore, 2008). Postmodern feminism thus encourages teaching practices that provide opportunities for science learners to participate in scientific discourses in a variety of legitimate ways (Phipps, 2007). This means that **science educators who are encouraged to take a postmodern feminist approach to teaching are potentially able to counteract the exclusion mechanisms of a physics or biology curriculum that is strongly framed in terms of an abstract, internal disciplinary logic.**

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Concluding remarks

Across the 14 European countries, the curricula of the science subjects biology and physics are framed in terms of two dominant discourses: An abstract discourse, based on the internal logic of the discipline, and a socio-scientific discourse, based on the human and societal applications of the discipline. The abstract, discipline-based discourse was found to be most strongly present in the physics curricula, while the socio-scientific discourse is more present in the biology curricula. We concluded that this framing may exclude a variety of learners from participating (or wanting to participate) in those subjects, because there are no suitable gender identities available to them within that framing.

One way to counteract the effects of the gendered framing of science in the curricula is through the practices of the teachers and other educators. As eloquently stated in the Italian *Gender Manual* (Gamberi, Maio, & Selmi, n.d.), if schools wish to create an educational awareness of the fact that social processes have different impacts on women and men, then they must be able to explore and challenge their own science curriculum from this point of view. In other words, the dominant discourses that frame science curricula should and could be reinterpreted and reformulated by teachers. Indeed, the existence of gender inclusion guidelines for educators (such as those included in this study) is evidence that the call for national policies for gender inclusive teaching practices (set out in reports such as *Gender differences in educational outcomes: Current situation and measures in Europe* (European Commission, 2010)) is beginning to be heard.

However, we interpret the relative scarcity of official gender-inclusion guidelines submitted to us in the project Hypatia to mean that relatively few of such documents exist. On the other hand, the postmodern feminist approach to education that is taken in those documents is encouraging. Taken together, the gender-polarised nature of the dominant discourses of many European science curricula and the relative scarcity of guidelines for educators on how to conduct gender-inclusive teaching seems to indicate that there is work yet to be done to make science education gender inclusive across Europe.

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Annex 1: Complete list of documents

In the following, we list the documents that were submitted to us by the partners and third parties in Hypatia, and that we ourselves collected. An overview is provided in Table 2.

Table 2. Overview of collected documents.

	Science curricula	Teacher gender inclusion guidelines	Out-of-school inclusion guidelines*
Austria	X	X	
Denmark	X		
Estonia	X	X	
France	X	X	
Greece	X		
Ireland	X	X	
Israel	X	X	
Italy	X	X	
The Netherlands	X		
Poland	X		
Serbia	X		
Spain	X		
Sweden	X		
United Kingdom	X	X	X

*This includes documents that address gender-inclusion specifically in out-of-school science education (e.g. in museums, science centres, industry programmes, etc.)

As mentioned in the preceding, more documents may exist than those that have been reported here; Table 2 is thus not an exhaustive list of existing European documents on science education and gender inclusion.

National science curricula documents

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The Y Factor: Youth voices for women's equality. (2014). Through the looking glass: A guide to empowering young people to become advocates for gender equality. Dublin: National Women's Council of Ireland.

European-level science education gender inclusion documents

Central European Centre for Women and Youth in Science. (2005). Why gendered science matters. Czech Republic: EUROSFAIRE.
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