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Talking science and feminism

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ABSTRACT

This article explores women's attitudes regarding the feminist movement in science, feminist identification, and the 'women in science' label. The data was gathered through in-depth interviews with women studying and researching in the fields of physics and physical sciences at four Dublin universities. Previous studies have not looked into women's participation in feminist collective action in science, as well as their perceptions of the movement and its impact on their science identities. This study sheds light on how women from undergraduate to postdoctoral levels in the fields of physics and physical sciences in Irish higher education where the gender gap is the highest of all science disciplines in Ireland, think about the relationship between science and feminism through their experiences and perspectives. The findings reveal women's support for feminist goals such as gender equality and encouraging women to pursue careers in science. However, how they define and label 'feminist', 'feminism' and 'women in science' varies based on their social circle, involvement in the feminist movement, and their (gendered) experiences within their scientific community.

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Feminism; feminist identity; science identity; women in science

Introduction

Feminism is a controversial concept in and of itself. It encompasses a wide variety of social, political, and ideological movements. It can be difficult to reach a common understanding of the term 'feminism' because the word[1] itself is very multidimensional which encompasses feminist self-identification, feminist consciousness, and gender role attitudes (McCabe, 2005).

While there is a link between feminist consciousness and support for feminism, this does not always transfer into active participation in the movement. Support for feminism is strongly influenced by feminist awareness and self-identification with feminism. These, however, are contextual and performative rather than fixed. Significant changes in women's experiences and expectations may influence their feminist identity, attitudes towards feminism in general, and support for feminism as a social movement.

My goal in this study was not to make judgements on women's feminist identity. Instead, the feminist movement in science has grown so powerful in recent years (both globally and in Ireland) and this may have an impact on the development of women's science identities.

Projects and campaigns aimed at empowering women to pursue careers in science, raising awareness about gender equity in science, addressing gender inequalities and biases, introducing gender-sensitive education policies, and improving women's recognition and involvement in science have been developed and launched, particularly in the last decade. These efforts to promote diversity and inclusion in science offer some reassurance. In scientific fields, however, gender imbalance persists. (UNESCO, 2018).

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In Ireland, women in science and STEM societies with feminist roots, whether supported by an independent organization, a higher education body, a group of scientists, etc., are campaigning and acting for equal opportunities, participation, and representation in science in recent years. I engaged in Women in Stem events and activities in Dublin as a researcher, organizer, and individual interested in science, particularly during my Ph.D. years between 2017 and 2020 but also since then. WITS Ireland (Women in Technology and Science) is an example of this, holding workshops, seminars, and STEM career submissions, as well as weekly coffee meetings for women to network and connect. There are also Women in STEM societies in the universities that participated in my interview process here as well as meetup groups and networks all around Ireland to empower and advance women in STEM disciplines. Women in STEM events are also held at science festivals such as Pint of Science, Science Week Ireland, Let's Talk Science, and Soapbox Science to raise awareness about women's representation in the STEM disciplines.

Several important steps have also been taken to combat gender imbalance in science disciplines. For example, Ireland established the Athena SWAN[2] platform in 2015 to encourage and recognize a commitment to addressing underrepresentation and promoting the careers of women in STEM[3] research in higher education (Department of Education, 2018). This covers women in academic roles, the progression of students into academia, and an equal working environment for staff in higher education. In addition, the intersectionality working groups were established in 2019 by the national Athena SWAN Ireland Committee in accordance with the HEA[4] in order to eliminate gender and ethnicity inequalities in higher education in Ireland (HEA, 2019, June). Furthermore, the Institute of Physics, Ireland's professional body for physics, is a participant in the IOP JUNO programme, which aims to create an inclusive working culture and environment in which students and staff can reach their full potential, as well as raise gender awareness among all staff and students (Institute of Physics, 2017,, September). These are significant initiatives to address the underrepresentation of women in physics and the physical sciences in Ireland. The majority of physics and physical sciences schools and departments adopted Athena Swan and the Juno Project including the ones that participated in this study. However, since women are underrepresented in these specific fields at every level in Ireland (HEA, 2017/18), there is still long-term goal to achieve here. In general, a recent Pfizer survey (Science Foundation Ireland, 2020) indicates a gender gap in STEM engagement between men (15%) and women (7%). Furthermore, according to data from a UCD[5] study (Delaney & Devereux, 2019), among students aged 16–20 who took the Leaving Certificate in Ireland between 2015 and 2017, more than 40% of boys listed STEM course as their first preference for higher education, compared to only 19% of females. With respect to physics, according to HEA statistics (2017/18), the number of male new entrants in physics was 121, while the number of females was 25; at the postgraduate level, the number of males was 159, while the number of females was 81. The study also shows that female completion numbers (including undergraduate and graduate) were 69 compared to 201 for males.

This study has arisen from the real-life social problem of low participation and underrepresentation of women in physics and the physical sciences in Ireland. On the one hand, there are the figures on women entering science (and 3rd level science institutions) in Ireland; on the other hand, there is a strong feminist movement from Irish academic institutions and Women in Stem societies across the country aiming to improve gender balance in science (and STEM) as well as to deliver equal opportunities to women (and to all genders). Generally, 'women in science' refers to women who work in science or who participate in scientific activities. It is also a catchphrase for female scientists. In this study, it refers to women studying and/or researching in the field of science. Within the scope of this study, women in science groups and events correspond to formal and/or informal activities as well as casual meetings organized by women in science societies, higher education institutes, and departments.

By adopting a feminist lens, the purpose of this study is to examine women's attitudes and views towards the feminist movement in science, with a focus on their self-identification as feminists and their perception of the term 'women in science', in order to determine whether the feminist

movement in science influences their science identity development and, as a result, their advancement in science. The term 'attitude' refers to a way of thinking, feeling, perception, and acting towards something. Women's attitudes regarding the feminist movement in science, which is the study's backbone, refer to how they feel about the movement and whether or not they engage in it.

To achieve this goal, I asked the following research question: What is the role of the feminist movement on women's science identity development? To find an answer to this research question, a qualitative study using in-depth interview techniques and narrative discursive data analysis was developed.

Science identity refers to the participants' professional identities within their fields in this study. Constituting science identity in the case of women's science identity development includes performing science, making sense of it, seeing themselves as members of the scientific community, and their perceptions of women and science.

I hope to develop a clear understanding of how women's identification with 'women in science' and 'feminist' affect their position as 'scientists'. Identification with feminists and women in science can provide an important and novel perspective on the development of women's science identities from a gender perspective.

Literature review

Science and feminism

Feminism has been one of the most influential social movements and ideologies since the mid-twentieth century. It includes a variety of egalitarian social, political, and cultural movements, beliefs, and ideologies that promote gender equality and equal rights. In a nutshell, 'it refers to attempts to attain equal legal and political rights for women, while in its broadest sense it refers to any theory which sees the relationship between the sexes as one of inequality, subordination, or oppression, and which aims to identify and remedy the sources of that oppression' (Mendus, 2005, p. 291–292). Butler disagrees with the fixed definition of feminism since she wants to see it as 'alive, becoming more expansive and powerful' (Butler, 2017, p. 462). As Ahmed (2017, p. 1), 'it brings to mind women who have stood up, spoken back, risked lives, homes, relationships in the struggle for more bearable worlds'.

The feminist movement in the twentieth century brought a new perspective on the theory of knowledge, scientific and epistemological investigations, the knowing subject, women's experiences, and their struggle in the public sphere. Especially from the beginning of Enlightenment, in Western philosophy, 'dichotomies work to establish the features of ideal, universally valid knowledge as a product of strictly rational endeavor, and to separate it from opinion, hearsay, particularity, which are associated with (stereotypical) femininity' (Code, 2007, p. 213).

When it comes to gender and science, I agree with Keller (1985) that the issue is not woman or man as single stable gender identities, but the making of woman or man as a social structure, role divisions, a cultural practice, and a binary gender ideology, and how this making influences how women do science, how women are represented in science, and how visible women are to science.

'Feminism loves another science', says Haraway (1988, p. 589). What kind of science does feminism love? For her, it is a science with multiple subjects. She argues that there is no single feminist standpoint because our maps require far too many dimensions for a single metaphor to ground our visions.

What does feminism require of knowledge, and how does it position 'woman' as the knower? What has feminism done to challenge the stereotype of the 'white, middle/upper-class male' as a science knower/agent? What does feminism suggest for creating a new space in science for a diverse range of knowers? If women's experiences and perspectives were integrated into science, would gender bias and masculinity in science culture disappear? If feminism is to be successful, it must begin by 'attacking and displacing the masculine/feminine hierarchy at the root of the western episteme' (Hekman, 1990, p. 26).

Attitudes towards the label 'feminist'

Feminist identification appears to be a complex process that includes both ideological and evaluative components (Liss, O'Connor, Morosky, & Crawford, 2001). A lot of research has been done on the factors that influence women's commitment to feminist ideology. (Williams & Wittig, 1997; Zucker, 2004; Yoder et al., 2011; Cowan, Mestlin, & Masek, 1992; Buschman & Lenart, 1996; Meijs, Ratliff, & Lammers, 2017; Moore & Stathi, 2020). Williams and Wittig (1997) claimed that major contributing factors for feminist self-labelling were positive evaluation of feminists and previous exposure to feminist thought. In line with this study, Moore & Stathi, 2020) reported that exposure to positive stereotypes enhanced feminist self-identification as well as intentions to engage in collective action in support of women's issues.

Buschman & Lenart, 1996) study suggested group consciousness and negative experiences as predictors of support for feminism. Their analysis also showed that the label 'feminism' evokes many more negative responses than does the term 'women's movement' across all clusters. The reason behind the negative perception of feminists may stem from 'stereotyping of the movement in popular discourse' (Buschman & Lenart, 1996).

A survey by Cowan et al. (1992) found that the content of the feminist movement, which she defined as 'the profeminist attitudes towards women's roles', as well as the approval of the context which means regarding 'feminism as a social movement', contributed significantly to self-labelling as Haack (1992, p. 328). According to Cowan et al. (1992), feminist self-labelling is related to an agreement with feminist thinking, the perception of the feminist movement, and perception of the feminists themselves. As a result, their study revealed a strong connection between feminist identification and approval of the movement.

Zucker (2004) made a distinction between feminist activism and feminist view saying that self-labelling as a feminist is related to activism, but not necessarily related to having feminist views. She stated that many women who even if they embrace feminist principles are reluctant to be labelled feminists. For Zucker, one explanation of that, as Buschman (et al.) also stated, was the negative portrayal of feminism and feminists by the popular media. Egalitarians can be categorized within the distinctive group of women who reject feminist labelling but on the other hand who engage in feminist behaviour (Zucker, 2004). Zucker's study suggests that egalitarians have a high level of feminist consciousness, but they take less public action than feminists. For Zucker (2004), exposure to feminism through education, personal relationships, or personal struggles are favourable conditions for feminist identity, however, exposure to mass media where feminists are depicted as 'deviant, man-hating, unrepresentative radicals who threaten the society' (p. 425) and association of feminism with extremism are barriers to feminist identity.

According to Yoder et al. (2010), the feminist paradox is explained by the 'I am not a feminist, but . . . ' viewpoint, in which women reject the label but support the beliefs generally associated with being a feminist. Like Zucker, Yoder et al. (2010) also differentiated feminist self-labelling from feminist beliefs. They found that self-labelling is associated with increased feminist activism, independent of feminist beliefs. This is consistent with the research finding (Liss et al., 2001) that women may be uncomfortable with the label of feminist, preferring to define themselves in terms of their own beliefs rather than as feminists. According to the findings of this study, a high percentage of women who participated in the survey agreed with some of the movement's goals, but they did not identify with a social group that empowered them to make collective changes.

Women's individual and collective identities

Feminist theory today is experiencing a profound identity crisis. From a feminist perspective, not only the category of 'woman' but also the identity itself has been highly debated (Alcoff, 1988; Butler, 1999; Hekman, 2000). Women's gender identity, according to post-structuralist feminist theory, is flexible, fluid, shaped by discourse, and is always open to transformation. According to this viewpoint, the category of woman is discursively and performatively constructed which contributes to the social process of

gendering and fluidity of gender categories (Butler, 1988; Haraway, 1989). Another point of view emphasizes the significance of the role of history and cultural interpretation in the construction of 'woman' as a gender category. According to Fraser (2013), gender identities are discursively constructed in historically specific social contexts. Being a woman, in this view, is influenced by historical experiences, social structures, and relationships. In contrast, an essentialist interpretation of feminism (Alcoff, 2006) holds that 'gender is both positional and material which provides a necessary knowledge base from which to engage in feminist political debate' (p. 289). From this perspective, women's identities are based on common experiences, demands, and goals which are accepted as a unifying basis of feminist politics. From an intersectional perspective, however, this unified category of women is illusory. It undermines women's different positions in terms of race, ethnicity, class, sexuality, religion, ability, and other social divisions.

Women's movements have often organized around an identity and women's experiences, private or public, individual or collective, are always at the centre of the movement. The basic idea of identity, as explained by Yuval-Davis (2010), is the narratives that people tell themselves and others about who they are, and who they are not, as well as who and how they would like to/should be. Both from an individual sense of self and a collective sense of belonging, the construction of identity is a perpetual state of becoming (Yuval-Davis, 2010).

Belonging to gender

Women's individual and collective identities include a sense of belonging (both individual and/or collective sense), self-expression, and performative acts. Individuals can belong in very different ways to their gender or other social identities. Sense of belonging is defined by Yuval-Davis (2006, p. 197) as 'emotional attachment' and as 'a feeling at home'. In line with her definition, I define 'belonging' as an identification and emotional attachment to a particular place, concept, identity, or object. As Yuval-Davis (2011) points out not every belonging is important to people in the same way and the same extent, as perceptions shift in different times and situations. From this perspective, expressing one's gender identity and developing a sense of belonging to it, in general terms, is situated on fragile ground. To put it another way, being a woman can mean different things at different times and in different contexts, as well as in different circumstances. In other words, its meaning can change from one individual to another. As Yuval-Davis argues, following Butler, 'the constructions of belonging have a performative dimension' (2011, p. 15). This view emphasizes the constitutive element of emotions over identity construction.

Unlike individual identity, collective identity entails a sense of connection with others. Gee (2000, p. 86) stated that 'there is a reciprocal relationship between a person and a social group and its core defining activity'. So, the dynamic of these interactions makes 'identity' active, fluid, constantly changing, and transformative, not stable or pre-determined. Gee's identity theory depicts identities as socially constructed, with a focus on the negotiation process of recognizing and being recognized within specific discourses. According to this viewpoint, identity is constantly negotiated through one's interpretation of self and involvement in relevant communities. In the case of women's gender identity development, identity entails performing it, making meaning from it, and viewing themselves as members of a particular community.

People who share a sense of togetherness identify themselves with a group and build the boundaries of the group. When it comes to women's movements and feminism it needs a sense of togetherness, a common conscience, and shared experiences. From this perspective, it is unavoidable for the women's movement to be exclusionary, as 'there is always something left outside once the boundaries of specific identities have been constructed' (Yuval-Davis, 2011, p. 17). However, individuals within the groups can alter the definition of the group identity and make it more flexible and dynamic, but they still share some commonalities because their common experiences and histories, self, or bodily experiences put them in contact with the same things.

As stated by Rupp and Taylor (1999), feminism is more than a gender ideology, it is a collective identity. Not all feminist movements are easily detected (Ahmed, 2017) and they are not always collective. A feminist movement can also depend on an individual's struggles. However, a collective movement is much stronger, and it has more power to change the unequal structures in society and to make public claims on behalf of a group. Thus, the unitary aspects of identity are necessary for the women's feminist movement.

I believe, even if identity is formed by discourses and power relations and always in process, people can still talk about their shared experiences formed around such identities. The construction of 'I', as a *woman*, relies on self-identification, expression, and performance. It is also a part of the collective 'us' as *women*.

Methodology

This study was a part of larger qualitative research which investigated the development of women's science identities in physics and the physical sciences in Irish higher education from an intersectional gender perspective. The data reported in this study was gathered through in-depth, individual, and semi-structured interviews with sixteen women who were studying and/or researching in these specific fields at the time of the study. Seven of the sixteen women were enrolled in undergraduate programme, one on a master's program, six were doctoral students and two were postdoctoral researchers.

The purpose of using in-depth interview methods was to delve thoroughly into the participants' experiences and viewpoints regarding a certain topic, in this case, the feminist movement and its impact on their science identities. Additionally, I wanted to bring their 'experiences and views' to public attention by making meaning of them through their own words because there is a significant gender and diversity issue in science, particularly in physics and the physical sciences in Ireland, and a strong feminist movement working to combat this imbalance. As a result, interviewing was the ideal method for this study because it allowed me to gain a deeper understanding of their perspectives while also providing a warm and welcoming environment for dialogue that could lead to new insights and understandings between me and the participants.

The research was reviewed by the University ethics committee and approval was gained before starting the interviews. The interviews took place in Dublin, Ireland between March and June 2019 and were based on voluntary participation. The volunteers were recruited from four separate universities in Dublin's physics schools, physical science schools, and scientific research centres by contacting faculty/school secretaries as gatekeepers and posting a poster on faculty bulletin boards. The interview questions were prepared by the researcher and reviewed by the project supervisor. The questions were open-ended and semi-structured. Instead of strictly following the research questions one by one I encouraged the participants to speak about the topics that were important to them (which were not off-topic). I was aware that opening up these kinds of spaces during the interview by letting them talk about the issues they wanted, even if they were not included in the interview questions, reinforced dialog between us. As a result, the interactions between me and the participants were informal and centred on mutual sharing and cooperation, rather than the traditional style of formal interviewing.

Every woman was told of the research's focus prior to the interviews. They completed an informed consent form to participate in the interview. All interviews were digitally audio-recorded, transcribed, and hand-coded by the researcher only. Each participant was assigned a pseudonym to give anonymity to them.

Researcher's position and reflexivity

For this particular study, I interviewed women in the fields of physics and the physical sciences about their thoughts on the feminist movement in science, how they identify as 'woman' scientists, and how they feel about the 'women in science' label in general. I wanted to make their experiences academically public by publishing this article. Ribbens and Edwards have claimed (1998) that this is a dilemma that a researcher, as an interpretive authority, experiences: that is, 'researching the private and personal, then seeking to voice it in the public' (p. 15). At this point, I, as the researcher, wanted to control my feelings and social identities to avoid interfering with the interpretation. I also want to emphasize that the researcher's social identity is not a threat to his/her objectivity. I do not suggest attempting to remove it completely. On the contrary, it is an important part of the research process. However, what I am highlighting is that as a researcher, I tried to identify any possible subjective thoughts and biases which might be derived from my own identity, background, or worldview and to control the possible effects of them.

I consider my situation both as an insider and an outsider. I am not a scientist, so never have had experience in building up a 'science identity' in the same way as my participants have. However, I spent the majority of my time in Dublin reading feminist theory, history, and culture of scientific literature, as well as participating in 'women in STEM' societies. My academic background in Gender and Women's Studies shaped my feminist views and led me to question women's under-representation and low participation in certain scientific fields. However, I think that my personal experiences of this kind have never been reflective in the way that interviews with other women could.

Rather than focusing on my positionality, I embarked on this study with the aim of better understanding the perspectives of my participants. In this paper, you will hear the voices of women who participated in this study, as well as my thoughts and opinion (in the background) to bring the gender and diversity problem in the aforementioned academic fields in Ireland to the public's attention.

Data analysis

The data were analysed through using both narrative discursive analysis which includes applying discourse to narrative data (Taylor & Littleton, 2006), and thematic analysis which is the process of identifying patterns and themes within the data (Evans, 2018). Because it focuses on the interactivity of the interview, the performance of identity, and a comprehensive investigation of the discussion, I used a discursive narrative analysis (Taylor & Littleton, 2006). Besides, discursive narrative analysis is in line with the theoretical perspective of this study. From a feminist perspective, I claim that women's narratives are not only derived from their experiences but also, they are produced in social, historical, and cultural context as well as by the teller's and listener's positioning. This way, discursive narrative analysis of women's experiences kept me alert to my role as a socially positioned listener to stories, and researcher in the interpretation of women's stories. At the same time, thematic analysis which was also used in data analysis allowed me to see the differences and similarities across the data.

First, the responses of the participants were analysed for common words and phrases regarding the role of the feminist movement in science in the development of their science identities. Then, the words and phrases were interpreted and grouped through narrative discursive analysis.

Initially, I could not identify a common understanding of the terms 'feminism' and 'feminist identity' among the participants. Their opinions and feelings vary depending on the context and their lived experiences. Then I decided to look for words, phrases, and patterns relating to the feminist movement, feminist identification, and gender and science relationships line by line. I gave codes to the most commonly used phrases by participants in their narratives about feminism, the

feminist movement, feminist identification, and gender and listed them below: women in science, labelling, gender quota, feminism, equality, networking, visibility. Then I looked closely at these codes to find the similarities among them to create a theme. Then I looked closely at these codes to see if any commonalities might be used to create a theme. I developed two themes by combining several codes: 1) feminist attitudes, 2) visibility matters.

Findings

Visibility matters

The participants agreed that women's visibility in science should be increased. As the narratives below illustrate, this might be through collective action, individual awareness, sharing experiences, and speaking up. 'Women in science' events, according to participants, provide an opportunity for networking, advocacy for representation, and awareness.

At the time of the interview, Lara was involved in outreach programs and women in science groups. She stated her attendance at *Women in STEM Conference* during her undergraduate years marked a turning point in her understanding of the visibility of female researchers and professors in her field. *'It was only at that Women in STEM conference that I actually thought about what my life would be like if I had their job . . . because I could finally imagine myself actually doing that'*.

Diane (BA) spoke of a panel organized by the student union in her university where they invited some female professors and speakers in STEM. She said: '*it was good to hear some of my professors talk about where they come from and if they didn't come across any difficulties as women'*. She is an active member of the women in science society in her university. She claims that female networking events provide a safe and motivating environment for women.

At the time of the interview, Lara (Ph.D.) was actively engaged in women in science groups.

> *I have been so involved with women in science groups and women in science events. I am an executive committee member of WITS Ireland and like doing so much work for them and going to so many events where we are trying to battle women's unconscious bias. We are trying to help these women whose confidence is so low and who don't see themselves as scientists.*

Lara is a mentor, a teacher, and a scientist. She believes that mentoring is based on interaction, which means that she encourages and empowers other women while also empowering herself. Lara's feminist and science identities overlap and complement one another, as she explains below:

> *Feminism is a huge part of my gender identity and it comes into play in my, I guess, science identity because that leads me to do all this work with women in science groups.*

Many participants stated that 'women in science' societies benefit them in a variety of ways, including sharing experiences, encouraging professional development, networking, and casual get-togethers. The shared experiences, according to Lou (postdoc), assist women in mirroring themselves as indicated by her personal experience.

> *I was involved in a female Ph.D. support group when I was doing my Ph.D. Finding women that are experiencing the same thing helped me analyse them and myself in the same way, and it makes a really huge difference in me.*

Some participants mentioned that their college hosts a pizza night for 'women in physics' every year. They can meet other women in their academic circle and share their experiences at this casual meeting.

> *Every year the school of physics has women in physics pizza night. I have gone every year since I was the first year. When I was a first-year, they had only two female professors. Just four years later, there were I think five female lecturers that were out at this pizza night. (Molly, BA)*

> *There is a 'women in physics pizza night' organized, which I think is a great thing. Last time, there were actually a lot more girls than expected. So, it had the professors and all the undergrads and the postgrads and then the woman who organized that. She is one of the top professors in the school of physics. (Joan, BA)*

During my conversations with the participants, I realized how vital it is for them to have an increasing number of women in their academic disciplines. Even though development in certain subjects, such as theoretical physics, is slow, it is nevertheless important to avoid feeling 'alone' because this can lead to feelings of isolation. As Kathryn (Ph.D.) said, 'It is hard to explain to someone how you feel weird. If you are the only one you feel like you are representing the whole gender'. Women in science societies can help women feel more integrated and represented, even if they are local and informal.

Samiya and Neha (both PhDs) evaluated women's networking and support groups in science as 'eye-opening' and 'awareness raising'. Samiya expressed that *'sometimes you don't think you are going through something and you don't realize that it is a common issue until you meet other people having the same problem'*. My research, according to Neha, is a platform for her to raise her voice. She expressed:

If I have the opportunity, I would raise my voice, or I would take part in a study like yours.

Apart from a few casual events at their campus, Samiya and Neha both indicated that they did not participate in any feminist science activities. When I asked them for an interview after presenting my research, they thought it would be a great opportunity for them to share their opinions and experiences as 'women in physics'.

Roda (BA) stated that the feminist movement is important for people to acknowledge that *we exist*. '*It is like you have a gossip in one room and it will inevitably go into the other if you have the door open*', she said, emphasizing the importance of collective action.

Science, according to the majority of the participants, requires commitment and hard work. They stated that despite their devotion and hard work, women are not given equal credit in science. For instance, as Carol (postdoc) said, 'we were taught in school that men made all of the greatest scientific discoveries. As a result, women's work must be outstanding in order to stand out and be noticed'. Similarly, Julianne (Ph.D.) claimed that in a lecture, only male names are discussed when describing discoveries. She added 'when people ask what I do, I always think I am a girl, and they don't expect me to do physics'. According to the majority of the participants, boys believe they are better at science topics than girls. As a result, there is a societal assumption that men are better suited to science since science requires certain personality traits such as objectivity, impartiality, and detachment, all of which are perceived as masculine. However, it is not the science itself that distinguishes women and men in terms of scientific abilities, but rather how science and gender are seen in society.

Haack (1992) stated science is a human institution, and it is surely not resistant to societal prejudices. Participants in this study criticized science's culture for being male-centred and ignoring women's accomplishments, rather than the nature of science, as can be seen in the cases above.

Their identification with the 'woman in science' label, according to them, draws attention to the visibility of women doing science, as well as their achievements and contributions to the field by disrupting the masculine image of science. As one of the participants (Diane, BA) said *'just like you can't separate the person from the science, you can't separate the woman from the scientist entirely'*.

Feminist attitudes

Depending on the context, the 'feminist' or 'woman' tagline can be twofold. The participants largely identified as feminists, and they are all in favour of equal opportunities in science for all genders and sexes. However, because of negative stereotypes about feminism, some participants distanced themselves from feminism and the feminist movement in science. 'Women in science' as a feminist label, they believe, harms women's careers in science. However, for some other

participants, it is used to boost the visibility of female scientists, which benefits women's career advancement as well as their science identity development by providing them with a public platform to be seen and heard.

> *If it is a friend of mine who is also a feminist and into gender equality and stuff, I would not mind because they don't see women as a negative word. For lots of people, when they see the tagline women, it is like, oh it is an easier thing. Or oh look, she is getting courageous because she is a woman, not because she is doing stuff. I think that can be quite damaging* (Roda, BA).

Roda stated in the above narrative that the tagline 'woman' can mean different things to different people. She would be comfortable being referred to as a 'woman in science' within a feminist community because people are already aware of what it means. However, as Roda pointed out, the phrase 'women in science' becomes vulnerable when it is used by those who believe that becoming a 'woman' is an 'easy' way to advance in science. Roda called it 'damaging' because the tagline's use of the word 'woman' has a negative connotation in that sense. She further commented:

> *I have been lucky, I live in a nice little liberal bubble and look like all my friends like yay gender equality. But imagine that when I go back into the working world or whatever, and if people like see like the women tag as being a negative thing, then I probably wouldn't like it as much as I do. I don't think that actually means anything different, but it is just whatever people associate with words.*

Roda's narrative mirrors the experience of Aine (Ph.D.) who earned an internship position in the European Space Agency during her master's. One of her male colleagues who was rejected for the same position commented about fulfiling a quota for Irish women because for him there had to be a certain amount of each nationality and gender balance was needed. Aine expressed that it hurt her feelings.

> *You don't know whether you were better than them or just you were fulfilling a quota. That gives you like self-doubt. That is why I think a lot of women start to hate these kinds of positive discrimination things and 'women in science' labelling because they want to be the best because of their own pride.*

Aine's perception of the 'women in science' label changed when she engaged in such activities.

> *I have gone through like a mental shift there and I would say in the last two years where up until that point I was extremely proud and did not want any help. When someone says like, oh, you are a woman in science, I would just be like, I am a person in science. I don't want any kind of word or let's not have a pizza evening just because you have boobs and you also do science. That just really bothered me because it was kind of already putting the attention back onto you when you're just trying to be one of the scientists. You don't want to be labelled with your gender.*

Aine stressed the distinction between a 'woman in science' and a 'person in science' in the following narrative. She was opposed to assigning a gender to a scientist and engaging in activities associated with that gender category because she believed it placed more focus on the scientist's 'gender identity' and 'gendered self' than on the career itself. Aine was worried that her feminist identification might be a roadblock to her career advancement. Her perspective has completely changed since she began participating in feminist talks in her academic community.

> *Now as of recently I have had like more of a shift and this conversation has had so much in our office or conferences by women in science. And it is only through talking to other people that have kind of realised the amount that women previously have fought to get us to where we are and where I don't have to worry about it. I have never realised that it was such a big deal. And we have to kind of continue fighting for the next generation until it is more like a 50/50 balance.*

Aine claimed that the gender balance in astrophysics is better than in other sub-fields of physics. When she earned a higher degree, such as a Ph.D., she became more aware of gender inequality in her academic field. When she realized it, her focus moved to topics of gender and representation, and she became more involved in gender talks in her academic community as a result.

Similarly, Nicole (BA) noted that she was not very active in promoting herself as a woman in science, but she said that seeing online those acts promoting women in science would make her feel 'appreciated'.

> *I am a scientist, but until there is half/half, I think women in science draws attention. Why do I need to say I am a woman in science? There is no 'men in science' because men are everywhere.*

Nicole, like Aine, was interested in the equal representation of women in scientific fields. The 'women' tagline, in her opinion, brings public attention to the need for recognition and equality.

For Molly (BA), the 'women in science' tagline create a space for women to connect with other women to share their experiences and support each other as well as build a role model for the younger generation.

> *I think that my being a woman in science allows me to both connect with other women in science or similar experiences. It allows for a kind of a structure of a support system. Also, it allows younger girls to look up and say, look at these really cool women in science.*

Gender is not a passive category in Molly's narrative. Instead, for the younger generation, it remains an essential identity position for interpersonal relations, personal awareness, and motivation. So, in her situation, the tagline 'women in science' is associated with positive meanings, empowering her science identity.

For some participants, the word 'feminine' and 'feminist' evokes conflicting and inconsistent connections of physics, so feminism or gender-related conversations are not approved by 'people' in their social circle.

> *I naturally tried to stay away from feminism and from the word feminism because just if you just mentioned it, the conversation closes, you know, people don't want to listen to it*. (Demi, BA)

We did not go into detail about who she meant by 'people' in the above narrative, but Lara (Ph.D.) told me a similar story. Men in Lara's social or academic environment do not consider gender imbalance in physics to be a problem, hence they refuse to discuss it, as she mentioned in her narration below. Feminist conversations are only tolerated in 'small liberal' circles where people are comfortable with 'gender equality stuff', as Roda explained in the previous theme.

Otherwise, as Lara's narrative below shows, it is ignored.

> *I know for a fact if I am having a conversation with the guys and I started a conversation with oh, there are not enough women in physics, women are put down . . . all of them like oh, I don't want to talk about this. Whereas if I start the same conversation with women, they are dying to have a conversation with you. So, if you are in a setting where you are one of the few women amongst a lot of men and you are the woman who is saying all of this gender equality stuff it is like you are talking ridiculous because they are like everything is fine.*

Women, therefore, create their own spaces to discuss the challenges they face. When you are a minority in a community, the majority who have not experienced the same challenges may try to silence your voice, according to Lara. As a result, in science, where men outnumber women, if you are the only woman in a group addressing gender equality, you will almost likely be ignored. As a result, women develop their own spaces in which to discuss the issues they confront.

Demi noted below that to most people outside of the feminist circle, the feminist movement in science seems to be 'exclusive' rather than 'inclusive', and that it is seen as a 'little party' for women only.

> *I think that because of the kind of the feminist movement, a lot of people would look at those events and things like, all right, so men are excluded. It is just women and science. It is their little party because they are kind of scientists. I am not familiar with a lot of things, you know, because I am just living on a daily basis and I never reached for women support groups and maybe they would be very good and maybe they would give me more motivation. I just kind of stay away from them because as I have said before, even if I have a feminist attitude to some issues, I still stay away from feminism in general because of what it means nowadays.*

Despite her distancing herself from feminism and feminist activities such as 'women in science' societies or 'women support groups', and the fact that she often constructs herself as a woman 'having masculine traits' in order to place herself as a physicist, Demi still has feminist attitudes towards some issues in science, such as gender stereotypes and underrepresentation of women in science.

'People have a strong problem with the word feminism', according to Reese (BA). As a result, some may interpret the tagline 'women in science' as a feminist. When a 'female scientist' or 'woman in science' is mentioned, they may react negatively. According to Reese, the women's distinct experiences in science distanced them from the gender-neutral term 'scientist'.

> *Sometimes you just want to be a scientist, but your experience is different because you are a woman and that is why you call yourself a woman in science. I suppose context matters so much with that because some people could be like, oh, you are being awarded for this because you are a woman. And she is like, no, I am being awarded for this as a scientist and I am also a woman.*

After analysing the conversations with some of the participants, I found that 'gender labels' for women can be harmful to them if the focus is on their gender rather than their career. The phrase 'women in science' is contextual and situational, according to Reese. If a woman's gender identity is overemphasized, her 'science identity' is hidden beneath her gender identity. As a result, scientific success is overshadowed by gender identity.

> *When a woman wins something in science, it is considered as history and it is like, oh, you did a great job that nobody could. I am not proud to be called like that, you know, like a female scientist. I am not a name to be kept in the museum. I want to see myself as a normal scientist, an energy scientist*. (Shalini, MSc)

Shalini was suggesting in the above narrative that when a woman accomplishes something significant in science, it makes headlines with an emphasis on her 'gender/sex', as if science were an occupation for men. For Shalini, women's achievement is regarded as exceptional when they are visualized as 'female scientists' rather than 'normal scientists'. I did not ask Shalini what she meant by a 'normal' scientist, but in this case, it applies to a gender-neutral profession. Shalini believes that portraying women in this manner (putting so much focus on their gender identities) undermines their scientific identity.

Findings and discussion

In this paper, I sought an answer to the research question 'What is the role of the feminist movement on women's science identity development?' Several previous studies (Abowitz, 2008; Yoder et al., 2010; Buschman & Lenart, 1996; Toller, Suter, & Trautman, 2004; Leaper & Arias, 2011) investigated the level of support to feminism among college women across all academic fields, as well as the impact of feminist labelling on their well-being and activism. These studies found a strong relationship between gender-related beliefs, prior experience with feminism, feminist awareness, and stereotyped evaluations of feminists and feminism. However, such studies have not paid attention to the connection between science or feminist identity issues. This study, on the other hand, focuses on women in physics and the physical sciences to investigate how the feminist movement (and, by extension, feminist identity) has affected their scientific identities which, from this aspect, is novel in feminist science studies.

This research suggests that the feminist movement's equality and visibility practices place a strong emphasis on women's agency in science. Even though some of the women who participated in the interview did not explicitly mention feminism, they all stated that they support equality, diversity, and equal representation in science. Some participants openly identified as feminists, while others avoided feminism due to its negative connotations. Their support for the feminist movement in science, as well as their participation in women in scientific societies and groups, does not vary according to their age, discipline area, or level of study/research. Individual variances in their attitudes and participation are based on their particular experiences and perspectives.

Based on the data, I concluded that those who identified as feminists were active members of 'women in science' societies and were concerned about issues such as sexuality, gender roles, gender norms, and equal occupational opportunities even outside of science fields. My findings show that participants support feminist goals whether or not they identify as feminists (for example, equal representation, eliminating unconscious biases and stereotypes, support networks, female role models, awareness of the challenges faced by women in science, and promoting equal opportunities). Participants who had a positive opinion of feminists and feminism were more likely to self-identify as feminists. This result appears consistent with prior research that has found this relationship (Liss et al., 2001; Reid & Purcell, 2004). The data shows that some women are hesitant towards the label, even if they agree with fundamental tenets of feminism which is in line with the result of the study done by Meijs et al. (2017). The avoidance of feminist identification stems from a negative view of feminism in their social and professional circles.

According to the findings, women who self-identified as feminists or who belonged to a liberal feminist friend circle had a smoother identification with the subject position of 'women in science' than women who avoided the 'feminist' label. 'Women in science', according to the majority of them, is a two-fold identity politics. On the one hand, it gives women a platform to speak out and raises their visibility. On the other hand, focusing too much on their gender rather than their profession may cast a shadow over women's achievements. According to the participants, the 'woman in science' phrase is beneficial for public attention, but it could also be regarded as an 'easy way' to get to a particular position in science.

The findings also suggest that labelling oneself as a 'woman in science' has real-life consequences. It shapes their image and their positioning within their scientific community, the way their colleagues respond to this image (for example, some people may react to gender labelling). On the one hand, they claim it connects them with other women scientists, which is helpful for networking, sharing, and mutual support. On the other hand, they claimed that positive gender discrimination in science, may induce women to have 'self-doubt'. Through my analysis, I have argued that women's science identity resides in a critical balance of conflicting discourses of being a 'woman' and a 'scientist'. The 'women in science' label and feminist identification ease the conflict between their science and gender identities for some of the participants by allowing them to develop a more flexible image of 'scientist' and 'woman'. The discourse of 'woman in science' represents othering processes for some participants, as if 'woman' has a conflicted and separate relationship with 'scientist'. Thus, within the discursive practices of what it means to be a woman and what it means to be a scientist, what it means to be a 'woman in science' is continually reconstructed and reinterpreted. Furthermore, I got the impression from my conversations with the participants that when the term 'women in science' is used to highlight the low representation of women in science, the identity of women in science is strongly supported.

The findings reveal that identifying as a 'woman in science' and engaging in 'women in science groups' are two separate things. Women may feel more 'integrated' and 'represented' if they engage in certain groups or events, according to those who have done so. As previously mentioned, the participants by the great majority emphasized the importance of sharing, supporting, and collaborating within their scientific communities. They believe that 'women in science' societies can provide them with a supportive network where they can share their experiences and learn from one another. Interviewees who are actively involved in women in science societies on a national or local level (such as small casual gatherings in their department or supporting larger organizations such as WITS Ireland) emphasized the significance of seeing a role model (senior women working in science) at women in science conferences and meetings, as well as the number of women professors in their casual gatherings (like pizza evenings for women in physics in the Physics School). The findings show that meeting other women from their disciplinary field (especially at the senior level) at women's meetings has a positive impact on their science identity development.

The findings suggest that participants' support for the feminist movement is dynamic rather than static, meaning that it is influenced by their set of activities, behaviours, and experiences, as well as how they define feminism at any given time in their lives. Looking at the participants' narratives, it is clear that the negative image of feminists and feminism has an impact on their identification with the terms. Their involvement in women in science societies, on the other hand, increases awareness of feminist issues discussed in relation to gender equality in scientific fields.

I have concluded that the participants' comprehension of the term 'woman in science' promotes awareness of the current issue of women's underrepresentation in science and increases the visibility of women scientists. Their identification with 'women in science', on the other hand, varies depending on their involvement with feminism and feminist politics, their interactions with feminist groups, the salience of gender identity in their environment (if liberal), and their (gendered) experiences within their scientific community.

Limitations and the future directions of the study

Feminism is a multifaceted concept with several different meanings and associated identities. This study did not address different types of feminism in women's self-identification. Pathway to feminist identity and attitudes to the feminist movement in science may differ for women depending on their social/cultural identities, context, and their lived experiences. Multiple factors that may lead to women's self-identification with feminist identity may be considered in a future study.

Because the study only took place at four Dublin institutions and was limited to physics and physical science departments, the narratives presented in this study may not be applicable to all scientific disciplines. Furthermore, because the sample only includes 16 women, the lived experiences and viewpoints of the women in this study may not be representative of all women studying, researching, and working in the field of physics and physical sciences in Ireland. From this standpoint, this is small-scale local research that only depicts a small part of the larger picture. Readers may, however, see commonalities between the participants' and their own experiences, or develop insight and understanding of the participants' lived experiences and viewpoints described in this study.

Furthermore, in terms of the number of women in physics and physical sciences, the HEA publishes rates of entrants and graduates (at the undergraduate and graduate levels) every year, but it does not show the number of postdoctoral and Ph.D. researchers, as well as senior professors in science. Thus, I did not provide any statistical data on the number of women in physics and physical sciences in Ireland. As a result, the data cannot be used to draw any numerical comparisons between all female scientists in the academic community (including undergraduate and graduate students) and the participants.

This study is based on interview data from women who volunteered to participate, which could lead to a volunteer bias. To reduce volunteer bias, I mentioned during the recruitment process that confidentiality and anonymity would be ensured. The interaction between myself and the women, on the other hand, was not devoid of our respective subjectivities. I recognized our biases, subjectivities, and where we were 'standing' in this research process rather than disregarding them. However, in the future, a larger study with a larger number of randomly selected individuals could be conducted to eliminate volunteer bias.

The participants included undergraduate and graduate students as well as postdoctoral researchers. A similar study with senior women scientists may be conducted in the future to better understand how women's perceptions of feminism and attitudes towards the feminist movement in science differ depending on their age, the historical period in which they grew up, and their level of professional seniority.

Notes

1. This article is derived from the author's doctoral thesis, *'Science and Gender Relations: The Development of "Science Identity" of Female Students and Early Career Researchers in Physics and Physical Sciences in Higher Education,'* which was submitted to Trinity College Dublin in 2021.
2. ATHENA SWAN refers to scientific women's academic network. It is a global framework for promoting and supporting gender equality in higher education and research.
3. STEM refers to science, technology, engineering and science.
4. HEA is the Higher Education Authority in Ireland. It is Ireland's statutory policy-advising authority for higher education.
5. University College Dublin.

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Notes on contributor

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Ethics approval

This study received ethical approval from the authors' academic institution.

Consent to participate

Informed consent was obtained from all individual participants included in the study.

Consent for publication: The participants have consented to the submission of the case report to the journal.

Data availability statement

The data for this article are confidential. The data generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

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Annexe
Profile of the participants

Pseudonym	Level of Study	Degree of Study	Age	Ethnicity &Country of Origin
Carol	postdoc	Astrophysics	N/A	Argentina
Lou	postdoc	Geoscience /Earth science	31	France
Lara	PhD- 2nd year	Astrophysics	24	Ireland
Aine	PhD- 3rd year	Astrophysics	26	Ireland
Julianne	PhD- 1st year	Astrophysics	22	Ireland
Neha	PhD- 4th year	Visual Optics/physics	29	Bangladesh
Samiya	PhD- 4th year	Visual optics/ physics	35	Saudi Arabia
Kathryn	PhD- 1st year	Nanoscience	23	Ireland
Shalini	MSc	Energy science	22	India
Diane	Undergraduate- 3rd year	Physics and chemistry	21	Ireland
Molly	Undergraduate- 4th year	Theoretical physics	22	United States of America
Joan	Undergraduate- 2nd year	Theoretical physics	20	Ireland
Roda	Undergraduate- 2nd year	Physics	20	Ireland
Nicole	Undergraduate- 3rd year	Physics with astronomy	21	Ireland
Demi	Undergraduate- 4th year	Physics with energy and environment	22	Lithuania (raised in Ireland)
Reese	Undergraduate- 3rd year	Physics	21	Pakistan (raised in Ireland)