Limit Less

# Teaching without limits

## The need for a whole school equity approach

IOP Institute of Physics

Secondary schools in Wales

## Information about the surveys referred to in this document

In 2020, the IOP commissioned Censuswide, an international market research consultancy, to conduct two surveys and a series of focus groups to inform our campaign. The survey was of 3,007 parents and carers of children aged 5–16 in state schools in the UK and Ireland. In 2021, we commissioned Censuswide to conduct a further survey of 2,000 primary and secondary school teachers across the UK and Ireland.

## Information about the quotations used in this report

In the preparation of this report, the IOP asked its members to provide their own stories of lived experience related to the stereotypes and barriers that our campaign aims to dismantle. A similar request was made to subscribers to IOP's Qubit newsletter, who are aged 16–19. A series of requests was also posted on IOP's Twitter account, @physicsnews. The IOP is grateful to everyone who has shared their experiences with us and invites anyone reading this report who would like to share their own experiences to please contact us at campaigns@iop.org.

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# What is Limit Less? And what are we asking you to do?

## To ensure that all young people have the same opportunities, there needs to be a transformation in our schools.

The Institute of Physics (IOP) knows that many young people are put off studying physics after the age of 16, not because of a lack of ability or interest in the subject, but because of prevailing social attitudes that discourage them. There is a widespread misconception that physics is a subject for other people, perhaps people who they think are cleverer, or who come from more privileged backgrounds or particular social and ethnic groups. This leads to many young people deciding that 'physics is not for them'. This view is picked up from all around – be it the education system, from parents and family, and from among local communities and wider society.

This must change. Limit Less is the campaign that aims to encourage and support young people to change the world and fulfil their potential by doing physics. It seeks to challenge the misconceptions and stereotypes about the subject and remove the barriers to young people doing physics beyond the age of 16.

**And we need the help of teachers and senior leaders in our schools and colleges to call for this change in our system.**

Schools and teachers are important influencers of young people and their parents, and we know that your work is crucial to encourage more young people from underrepresented groups to study physics in school and consider a career using physics. We need your voice to help us challenge the government to make this Limit Less dream a reality.

We are asking that you sign up to support the IOP's manifesto for change which you can read in this report. It outlines how schools and nurseries can be more inclusive across the UK and Ireland. There are ten areas of improvement that can help make physics learning, and all education settings, more inclusive.

We look forward to working together to build a fairer and more inclusive environment in schools for all young people through the Limit Less campaign.

# Which young people are we talking about?

The IOP has identified five groups that are currently underrepresented or underserved in the physics community – young people in these groups are less likely to do physics and more likely to face a hostile environment when they do. These groups are:

— Girls

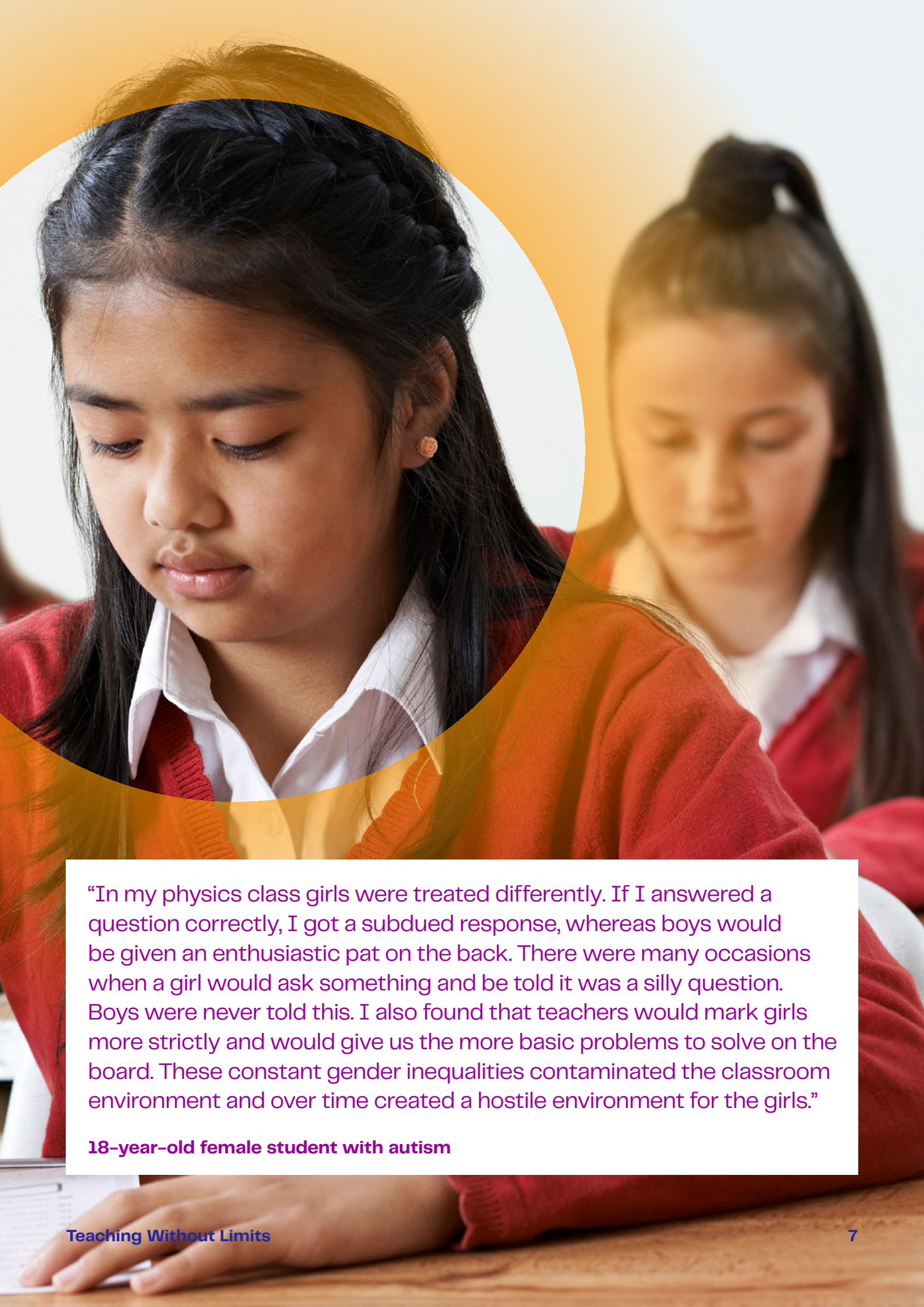
— Young people from disadvantaged backgrounds

— Disabled young people

— LGBT+ young people

— Young people of Black Caribbean descent

This report explores the issues in encouraging young people from these groups to continue with the subject, as well as discussing some of the solutions. It also provides an overview of the available data relating to participation and attainment in physics beyond the age of 16, as well as the significant data gaps for certain groups.



"In my physics class girls were treated differently. If I answered a question correctly, I got a subdued response, whereas boys would be given an enthusiastic pat on the back. There were many occasions when a girl would ask something and be told it was a silly question. Boys were never told this. I also found that teachers would mark girls more strictly and would give us the more basic problems to solve on the board. These constant gender inequalities contaminated the classroom environment and over time created a hostile environment for the girls."

**18-year-old female student with autism**

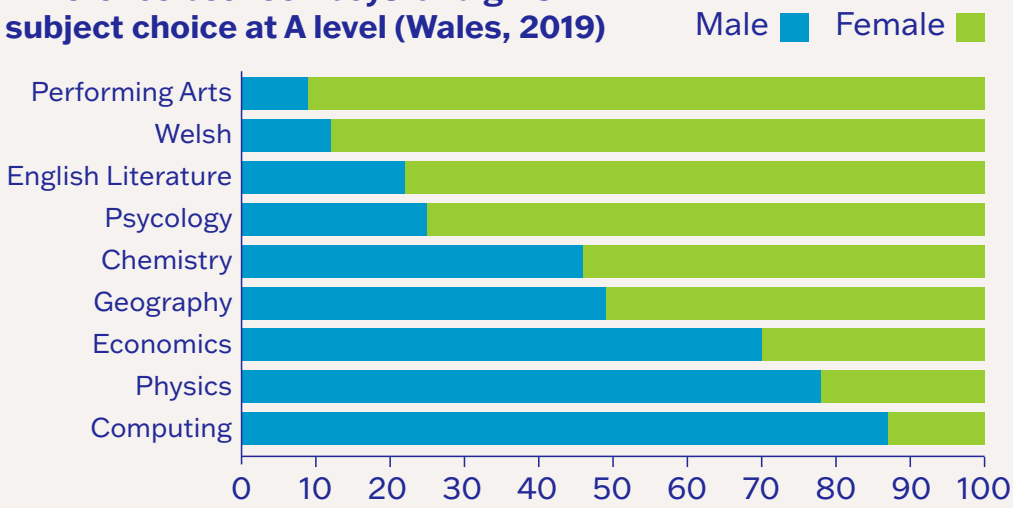
# The facts

## Gender

At A Level, far fewer girls than boys enter physics, even though a higher percentage of girls achieve A*-C grades.

Historically, uptake of physics among girls in Wales was relatively high until the 1990s. However, by the late 2000s it had slipped behind the rest of the UK. The uptake of physics A level among girls in Wales remained stubbornly low; in fact, since 2000 the proportion of girls taking A level physics in Wales had dropped from 25% to well below 20%. More recently Wales saw the biggest proportional increase of physics uptake, both among girls and across the board, of all the UK nations in 2017. Uptake was down in 2019/20, so it is clear that there is still work to be done to ensure parity with the rest of the UK.

**Difference between boys' and girls' subject choice at A level (Wales, 2019)**




Source: JCQ, GCE A Level Results Summer 2019 (Wales only)

**Wales**

In 2019, only 2% (237) of girls chose A-level physics, compared to 9% (738) of boys.

(Source: StatsWales)

## Other Underrepresented Groups

Qualifications Wales does not publish data on characteristics of the candidates other than gender at a subject level. Although the Welsh Government publishes data on the Welsh Multiple Index of Deprivation and the uptake of Free School Meals for different schools, this data is not linked to the individual candidates and the different subjects which they choose. Improved data is required to make objective comments about the uptake of physics, or any other subject, for other underrepresented groups.

How many young people from the underrepresented groups study physics in your school? How could this be improved?

## A word about data

When preparing this report, we wanted to present as complete a picture of the situation in Wales as possible, with data related to each of the underrepresented groups. Unfortunately, this data is either not collected or is not publicly available. The IOP believes that more needs to be done by those responsible for young people's education to collect and publish data related to young people and the study of physics.

# Why is there an issue?

## For many years, the IOP has recognised the inequity in physics which has long existed in education, academia and the workforce.

Since the publication of "Girls in the Physics Classroom" in 2006, the IOP's understanding of the causes of imbalances, and the strategies to help overcome them, have developed considerably. However, despite efforts by the IOP and others to address this problem, the proportion of underrepresented students studying A Level physics in the UK has stayed roughly the same over many years. This is despite the total number of students taking physics A Level in 2021 being the highest since 1992.

The IOP in Wales has especially developed a good understanding of the issues around gender inequality in physics. In particular, the Whole School Inclusion team in Wales has recognised the importance of working with primary schools as children in the Foundation Phase have shown preferences for gendered work roles.[1]

1 Fawcett Society: Gender Stereotypes in Early Childhood: A Literature Review (2019) Culhane, L. & Bazeley, A. Download.ashx (fawcettsociety.org.uk) in BSA: Inquiry on Equity in STEM Education (2020) Download.ashx (britishscienceassociation.org)

The Welsh Government has recognised the benefits of the approach taken by the Improving Gender Balance Wales pilot and has funded the project since 2019. The focus of this project has been primarily on gender to date and has recently expanded to cover all underrepresented groups. However, the project is still in its early stages and significant barriers remain for participation in physics in Wales.

There is also the concern that Welsh first language students may be less likely to progress with physics due to a shortage of physics teachers that are able to teach in Welsh. The IOP is working to ensure that all students have access to a specialist physics teacher.

The personal experiences that have been shared with us by IOP members and other physicists highlight some of the challenges young people from underrepresented backgrounds face within the education sector when hoping to progress to post-16 physics, such as:

"There is a stigma around girls doing Physics. It is hard to get your point across in class, therefore there is more pressure to do well in tests".

**Female Key Stage 5 student, Wales (IGB Wales project)**

"I wouldn't know how to engage my son. It's a big barrier, because if I'm not inspired, I can't inspire him!"

**Mother in focus group, Wales**

"Where I came from (Gwynedd, North West Wales), the closest physics (or mathematics) department is across the border, probably Chester, some 80–100 miles away... The physics resources in Welsh are difficult to find and often are unavailable, which further deters students from studying it further, especially when Welsh is usually the first-language of many students in my community. It prevented them from continuing with their studies. I was only determined to study it because I loved astronomy in my home of Eryri (Snowdonia), a dark sky area."

**Welsh male astrophysics student**

# Our manifesto for change

## The IOP is calling on the governments of the UK and Ireland to:

1. Revise professional standards for teachers to set out an expectation that teachers will address injustice in their professional practice and actively dismantle any sexism, racism, homophobia, ableism and classism from their own work and their schools.
2. Ensure that all teachers are trained to teach inclusively and to tackle injustice so that they can achieve these robust standards. This should be in both their initial teacher education and their continuing professional learning and development.
3. Direct those responsible for school inspections to place greater emphasis on the importance of inclusive teaching and schools' efforts to address injustice.
4. Mandate nurseries and schools to develop whole-school equity action plans that:
   - are informed by ongoing data and evidence collection including students' choices.
   - promote equity and equality for young people in underserved groups.

**In all nurseries and schools, the IOP wants to see:**

5. All staff challenge bias and stereotyping.
6. Educators, parents and students develop and implement whole-school equity action plans that provide an inclusive environment and promote equity and equality for young people in underserved groups.
7. Those responsible for school governance play an active role in ensuring that equity and equality are promoted in their schools and that inequalities are addressed, including appointing a member with specific responsibility for equality.
8. Teachers teach physics and science in an inclusive way that promotes a positive, contemporary view of physics and portrays physicists from a wide range of backgrounds including the underrepresented and underserved groups.
9. All young people and their parents and carers receive a high standard of careers advice that includes physics-related career options and promotes studying physics beyond age 16.
10. More young people from underserved groups benefit from learning outside the classroom, such as in science or STEM clubs.

# A whole school approach to equity

Research by the IOP has indicated that school culture is a substantial factor in determining subject choice. One study, "Closing Doors", showed that 81% of state-funded, mixed schools in England were either maintaining or exacerbating the already poor gender imbalance of progression into English, mathematics, biology, physics, economics and psychology. The study also showed that to reduce the gender imbalance in one subject, the schools needed to look to reduce the imbalance in other subjects, further showing the importance of school culture. The conclusion of the data analysis was that gender imbalances arose from school culture, biases, and gendered expectations of students.

A subsequent study, "Opening Doors", looked at good practice in schools for countering such stereotyping. This research emphasised that to truly challenge biases and stereotyping, work must go beyond the physics classroom. For systemic and sustainable change, commitment is needed from students, teachers of physics and of other subjects, senior leaders, governors, trustees, parents and carers. When such approaches have been used, the impact has been significant. For example, the number of girls taking AS-level physics (broadly equivalent to Higher Physics in Scotland) more than trebled in over two years following a whole-school challenge to address imbalances. has increased drastically – more than trebling over two years.

"A whole school equity plan is ensuring that the school (our community – so that's the parents, the students, and the teachers) are all involved in coming up with a common vision: that every child in the community is entitled to that inclusivity and diversity of the curriculum that allows them to see beyond, not only what they have right now in front of them in terms of their own community but the wider picture, and they can then build upon when they go into society."

**Jamie Drake, Curriculum Director of Science and Social Science, Noel Baker Academy, Derby**

Learn more at: iop.org/WholeSchool

## 86% of secondary school teachers who have whole school equity plans reported seeing positive change as a result of the plans being implemented.

*Censuswide survey of 2000 primary and secondary school teachers across the UK and Ireland*

## A whole-school approach truly involves the whole school – areas to consider are shown below:

| | |
|---|---|
| **Personal practice:** supporting staff to reflect | All teaching and non-teaching staff within the school should be included in such work, trained to play an active role and made aware of the effect of biases, conscious and unconscious. |
| **Student voice:** putting young people at the heart of change | A crucial step is supporting children and young people in understanding and challenging injustice and stereotypes and allowing them ownership of the issues. |
| **Curriculum and learning** | Resources and the curriculum should be audited to ensure equal opportunities. Learners should be able to choose subjects and activities based on their preferences and skills, rather than being guided by their gender, race, sexual orientation, disability or background |
| **Progression, choices and jobs** | Everyone has a role to play in opening learners' eyes to the diversity and range of options available for their future, which should not be limited by their own or others' expectations |
| **Internal and external communications** | Schools communicate with a wider variety of audience including parents, carers, students, staff and the wider community. Processes should be put in place to make sure communication and materials counter stereotypes and do not reinforce bias. |
| **Engagement with parents, carers and the wider school community** | The biggest impact will be made when the whole school community works together. Involving parents and carers from the start can help children and young people challenge inequality in wider life. |

# The Welsh context

The Education landscape in Wales is rapidly changing with the introduction of the new curriculum. Research has been undertaken around the issues of minority group inclusion[2] and gender in STEM,[3] and recommendations have been made for schools to adopt.

## Teaching standards

The Professional Standards in Wales were published in September 2019 and apply to all school practitioners. The outline document does not specifically mention equality, diversity, inclusion, discrimination, race, ethnicity, disability, SEN, gender, sex or sexuality specifically.

The Professional Standards are formally expanded for teachers in an interactive PDF where guidance on inclusion measures is provided.

2 Black, Asian and Minority Ethnic Communities, Contributions and Cynefin in the New Curriculum Working Group: final report, Welsh Government
3 Baseline evidence and research project for gender equality in STEM

A number of the Standards reference inclusion:

**“Real life, authentic contexts”**
QTS descriptor: The teacher demonstrates an understanding of the use of real life, authentic contexts for learning being provided as a natural part of the learning experience. This extends the learner’s cultural, linguistic, religious and socio-economic experience and illustrates applications of concepts and abstracts in practice.

**“Leadership: Taking responsibility for self”**
QTS descriptor: The teacher demonstrates professional attitudes and behaviours, developing positive relationships with learners, parents/carers and colleagues, which illustrate a personal commitment to the fundamental principles of equity and of maximising the potential of all learners.

## Code of Professional Code and Practice

The Education Workforce Council Wales is the independent regulator for the education workforce in Wales.

The EWC's revised Code of Professional Conduct and Practice came into force on 1 September 2019. The Code sets out the standards expected of those registered with the IOP and is intended to support and guide their behaviours and judgements as professionals working in education and training roles in Wales.

**A. Professional Conduct**

*1. Personal and Professional Responsibility*

*1.2 Registrants conduct relationships with learners professionally by:*
*contributing to the creation of a fair and inclusive learning environment by addressing discrimination, stereotyping and bullying;*

*1.6 demonstrate a commitment to equality and diversity*

Major reform has been undertaken on Initial Teacher Education (ITE) in Wales in recent years and all programmes being delivered must be accredited against the Criteria for Accreditation of ITE programmes. These criteria do not provide a prescriptive curriculum but rather a framework in which they should be delivered. This includes requirements for student teachers to develop an understanding of the cultural diversity of the learner population as well as issues around equality and inclusion. Whilst the content of the ITE curriculum is not specified, there is an expectation that programmes are designed to address these areas.

# Inspections

Legislation sets out the powers of Estyn, the school inspectorate in Wales. This includes what Estyn may or must inspect and report on. When inspecting a provider's teaching and learning experiences, inspectors consider "the ways in which the school develops a curriculum that fully reflects the nature of the school's context, including designing learning activities that reflect the cultural, linguistic and ethnic diversity of Wales and the school's local area."

71.4%

**of secondary school teachers in the UK and Ireland agreed that societal issues, such as equity and inclusion, have a place in subject specific teaching.**

*Censuswide survey of 2000 primary and secondary school teachers across the UK and Ireland*

# What you can do

**To build a fairer and more inclusive environment in schools for young people from underrepresented and underserved groups we need your support. Today you can take the following actions:**

## 1. Sign up to the manifesto

Please sign up to the manifesto today so that we can show our politicians that we have widespread support for improving equity and inclusion across the education sector. To sign up on behalf of your school or as an individual teacher, or both, please visit https://campaign.iop.org/manifesto.

With your help we will call on the government in Wales to provide more support for teachers to create inclusive school environments. We will take our messages to MSs, parliamentary groups and officials to get their support in both parliament and in the media.

## 2. Learn more about the Limit Less campaign and share!

Visit the main Limit Less campaign page iop.org/LimitLess to find out more about the campaign, view resources, and read stories from people who were deterred from physics because of who they are.

We have a growing number of individual supporters and would welcome even more. Please share this link with your friends and family and ask them to join as individual supporters, the more people who join our campaign, the more likely we are to change young people's future for the better.

## 3. Tell us about your whole school approach

If your school has already adopted a whole school approach and is building an inclusive environment for all students, we would be very interested to hear from you, both to celebrate your success and so that others can learn from your activities. Please contact us at campaigns@iop.org.

"I had a very positive physics teacher who encouraged me to go to lots of different events and events he organised. I wouldn't have researched my options without his input or believed it was something I could pursue. Before that there was very little information about the subject at primary school and we were never told about science careers. My family have also been very supportive whilst encouraging me to explore my options."

**17-year-old white female physics student from England**