Metadata of the article that will be visualized online

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Article CopyRight - Year		The Author(s) 2025
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Schedule	Received	13 April 2025
	Revised	
	Accepted	13 June 2025

Abstract

Autism is a complex neurodevelopmental condition which can affect communication, attention, perception, and cognitive processing, and thus has an impact on learning in higher education. This study investigated the experiences of geosciences students in U.K. higher education, using a novel qualitative methodology designed to be inclusive for autistic participants. Forty self-identified autistic geosciences students, across at least 16 U.K. universities, took part in semi-structured asynchronous discussions, sharing their self-perceptions, experiences of learning in geosciences, university life, support in higher education, and other issues that they wished to discuss. Data were analysed using reflexive thematic analysis, generating three themes: (1) Being me; (2) Interacting with the world around me; and (3) Facilitating change. Participants stressed the need to recognise the diversity of autism experiences and presentations, and suggested a number of recommendations that would improve their learning and wider higher education experiences. The outcomes of this study provide actionable recommendations for all higher education institutions to develop more inclusive practice for autistic students.

Keywords(seperated by –)

Autism–
Inclusive practice–
Neurodiverse–
Higher education–
Geoscience–

Discover Education

RESEARCH Open Access

Autistic voices in higher education: lessons from U.K. geoscience students to inform inclusive practices for neurodiverse learners

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Abstract
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Keywords Autism, Inclusive practice, Neurodiverse, Higher education, Geoscience

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1 Introduction

Autism is a lifelong developmental condition which impacts how individuals communicate and interact with the world around them [1], simultaneously recognised as a form of neurodivergence and protected legally as a disability by policies such as the U.K. Equality Act [2]. Disabled students are known to be disadvantaged across Higher Education (HE), in terms of attainment, retention and continuation [e.g. 3, 4] but are progressing into HE in increasing numbers [e.g. 5, 6]. In addition to important characteristics such as ethnicity and gender, disabled individuals are an under-represented group in HE [7] which declines in size between undergraduate through to academic staff. This likely reflects fear of negative repercussions associated with full disclosure or the challenges of

progressing through an academic system which many disabled individuals feel is hostile, ableist, and inflexible [8–12], leading to increased risk of dropout [13, 14].

There is little data indicating a prevalence of autism within HE [15], but given that approximately 1% of the U.K. population has an autism diagnosis [16], and that autism spectrum conditions are understood to be frequently under-diagnosed and under-reported (often due to long waiting times for assessment [17], and/or non-disclosure), it is likely that a significant proportion of university students may be affected by autism (e.g. at least 4% of England university entrants) [18].

Most statistics consider 'disability' as a homogeneous category and fail to recognise the different challenges faced by students with different types of disability. Currently available Office for Students (OfS) data on the awarding gap (previously referred to as an attainment gap) between full time U.K. disabled and non-disabled students indicates a progressive increase in equity in the number of 'good degrees' (first or upper second class) between 2015 and 2022 [19–22]. However, consideration of the specific data on subdivisions of disability since 2015 indicate that, although most disability groups have contributed to the overall reduction in this awarding gap, individuals with social or communication differences (termed impairments in OfS reports) such as autism remain significantly more disadvantaged than their peers (Fig. 1). The most recent data for 2021–2022 indicate a gap of between 4.1 and 6.5% points between this and any other group of disabled students, suggesting that autistic learners still represent a disadvantaged minority in HE despite broader efforts to support disabled students.

These data highlight the need for further exploration of innovative approaches to identify and provide relevant support for autistic learners. For example, we recognise the merits of the social model of disability [e.g. 23, 24] as a lens, in which we acknowledge

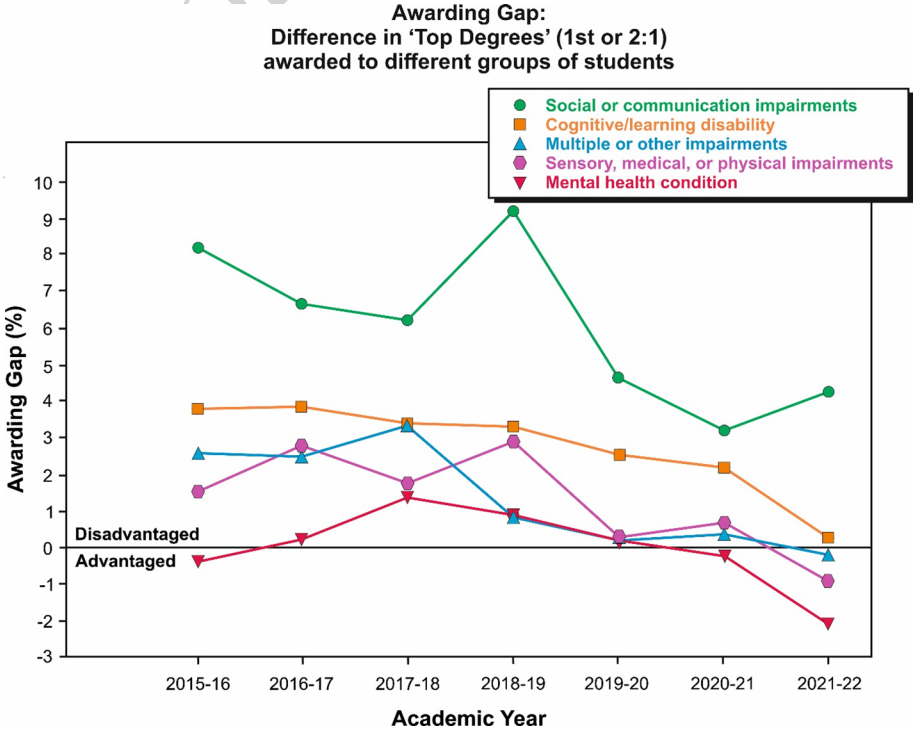

Fig. 1 Difference in 'Top Degrees' awarded to full-time undergraduate students, displaying the trends for different groups of disabled students. Data from Office for Students [19–22]

that the disadvantages and barriers experienced by autistic students are the product of an inaccessible HE system and learning environment, rather than a result of autism itself. Historical research into autism in HE often focuses on deficit models, rather than seeking to understand ways in which autistic students may experience learning positively [25]. Changing the way that we think about autism and autistic individuals in this context may provide a more comprehensive approach in which the individual is not assumed to be the problem.

This study aims to supplement existing discussions around autistic learners in HE by gathering and amplifying the voices of autistic students, transmitting without transmuting their lived experiences to other participants of the HE system and integrating them directly into broader discussions on inclusivity. We adhere to the principle of "nothing about us without us" by placing autistic voices at the very centre of the discussion [26, 27]. We adopt a subject-specific approach, working with individuals from geoscience-based subjects; this was selected as an area that several authors have direct experience of (as students and educators), and as a suitably pedagogically-diverse area of HE (see below) for practitioners from all disciplines, subject areas, and contexts to draw useful insights and practices (see below). The authors hope to inform the continued development of inclusive teaching practices, not only by highlighting the challenges and barriers which inhibit and exclude autistic individuals in HE, but also by identifying the success stories and positive impacts of inclusive practices where autistic individuals felt most able to engage with their education. Furthermore, we intend to raise the overall awareness of autism in HE and beyond, encouraging all participants in the HE sector to better understand and accept this form of neurodiversity by providing a safe means of autistic people having their voices heard [28]. Autistic individuals often do not feel comfortable expressing themselves or explaining their needs, reducing the likelihood of self-advocacy within this minority—access to these critical perspectives therefore requires careful and appropriate solicitation [29–31]. These individual journeys through geoscience-based HE will be used to enhance overall awareness of potentially contrasting paths and unique experiences that autistic people face. In line with this approach, we have given careful thought to our use of language throughout this article, with a view to being as inclusive as possible. In general, we have chosen to utilise identity-first language (autistic student) rather than person-first language (student with autism), because this better reflected the language used by our participants within the study and is more in line with the recognised preferences of many autistic people [32–34]. We recognise that autism is a complex form of neurodivergence, experienced differently by different people, and we respect the rights of individuals to refer to themselves as they wish. We also note that identity-first language is generally preferred by proponents of the social model of disability [e.g. 35].

2 Background

2.1 Autism in the 21st century

Whether autism is considered a form of neurodiversity (e.g. ADHD, dyspraxia, dyslexia) or as a disability [36, 37], it is important to recognise that autistic individuals are each unique. For example, they may possess a heterogeneous collection of conditions and co-morbidities that can vary considerably in their presentation and symptoms (e.g. attention deficit hyperactivity disorder (ADHD), dyslexia, dyscalculia, depression, and AQ2

anxiety [38–40]. Similarly, they may also differ markedly in how they experience the world around them and process information (e.g. intense interests, sensory sensitivity, auditory and language processing difficulties [41].

Within HE, autism is under-represented and under-disclosed, despite it having no impact on intelligence [42]. Many frequently-cited 'autistic traits', such as problem-solving skills, thinking 'outside the box', are generally perceived as being conducive to success in academia [43–45]. It is suggested by some sources that some of our most significant scientific achievements are derived from the contributions of individuals who may have been autistic (e.g. Isaac Newton, Henry Cavendish, Albert Einstein [46–48]. Despite this, there is evidence to suggest that autistic learners often withdraw from their education prematurely, both within the U.K [49]. and elsewhere (e.g. U.S.A [14]., although this is not always the case (e.g. Netherlands [50]). According to OfS data, less than 40% of autistic HE students in the U.K. complete their university education, making them 10 times more likely to drop out than the overall rate of 6.3% [51, 52]. Challenges with peer interaction and social communication may present a significant barrier to academic success by inhibiting access to networking and discussion-based opportunities (as well as an associated impact on wellbeing [53] and may even render some aspects of education or research unviable (e.g. health and safety considerations during fieldwork [11]. This potential inability to engage with their education has been indicated to result from learner marginalization, depression, loneliness, a perceived lack of support when compared with learners without any reported disabilities [e.g. 54–57].

2.2 Geoscience as a case study

The geosciences are an area of HE facing scrutiny for a lack of diversity, relating primarily to areas such as ethnicity and gender [e.g. 58–60]. Studies which have targeted disability in geoscience are often focused on physical, sensory, or other hidden disabilities [e.g. 61–63], and it has been recognised that more can be done to both support and retain neurodiverse individuals in this area [e.g. 64, 65].

In stark contrast with this apparent lack of diversity, the geosciences are particularly diverse in terms of the learning environments and methodologies one might encounter as both learner and teacher—teaching might employ a variety of pedagogic approaches and could take place in lecture theatres, seminar rooms, laboratories of various types, and in the field [66, 67 and references therein]. Similarly, fieldwork can take many forms (e.g. location with accessible infrastructure vs. remote and difficult terrain) and the duration of the work varies (e.g. single day and/or residential field course).

Collectively, this presents a range of important considerations for the design and delivery of education for all learners, as well as those whose needs may be different. As such, this study focuses on learners within the geosciences to provide a legitimate contribution to the continued evolution of a discipline which is in pronounced need of diversification, whilst simultaneously maximising the transferability of the study's results—it is envisaged that the overall breadth of teaching approaches and environments found in the geosciences should make the experiences of those engaging with it broadly applicable, in whole or in part, to many other aspects of any other discipline.

3 Method

This study adopts a qualitative approach to explore the experiences of autistic individuals studying geoscience within HE, employing a methodology tailored to best fit the needs of autistic individuals that also allowed the various topics under scrutiny to be explored in depth and addresses the need to provide more input from autistic people themselves within research of this nature [31]. The study was necessarily inductive in its approach in order to better capture and preserve the original 'message' of the participants without compromising their contributions with preconceptions or personal biases, and to be as inclusive as possible to any experiences which are not prevalent in the literature.

3.1 Positionality statement

The research group comprises a group of neurodiverse individuals (including autistic, dyslexic, and neurotypical people), many of whom work in HE. Some of us are academic geoscientists, while others are involved in teaching and research in other disciplines (e.g. psychology, forensic science, health sciences), and some of us work in professional services roles, either supporting students, liaising with businesses in a work-based learning environment or delivering academic development. Where some of us have relative "insider" experiences of our own, this enabled us to relate to and empathise with our student participants in a way that provides insight into the nuances of their data. We were able to reflect on similarities and differences to our own experiences of teaching, and previously as students ourselves. Where we have "outsider" experiences, coming from other disciplines or as neurotypical individuals, we were able to question and support the development of ideas, in a way that ensured that we were understanding participants' views and surfacing concepts that may be taken as read by "insiders". Thus, collaboratively, we were able to interpret data and construct themes that are both sensitive to our participants and credible to our readers [68].

3.2 Participants

A call for participation, including information on the study, participant responsibilities, and an associated sign-up form was distributed via a range of appropriate e-mail mailing lists (e.g. SEDA), and social media (X, formerly Twitter). The acceptance criteria were that potential participants were autistic (diagnosed or self-identifying) and were either currently studying a geoscience-based subject at a U.K. higher education institution (HEI) or had graduated from the same within the last three years. This call attracted 87 expressions of interest. Of these, 40 participants representing at least 16 U.K.-based HEIs, were selected randomly and offered the opportunity to participate. This number of participants reflected a compromise between depth of analysis and breadth of the sampled population. Participants were rendered anonymous and divided into four groups of between 9 and 11 participants per group.

Participants ranged in age from 18 to 41 years (mean = 23 years, s.d. = 4.7 years), and identified as originating from a diverse range of ethnic groups, including White (72.5%), Black, Black British, Caribbean (17.5%), Asian or Asian British (5%), Mixed or multiple ethnic groups (2.5%), and undisclosed (2.5%) (Table 1). Of the 40 participants, 32.5% were male, 40% were female, 20% were non-binary, and 7.5% preferred not to say. All participants were studying a geography, earth, or environmental science (GEES) subject, with representation from Geology (32.5%), Geography (30%), Environmental Science

Table 1 Demographic information for the study participants

Participant number	Age (years)	Gender identity	Ethnic group	Level of study (FHEQ level)
1	26–30	Undisclosed	White	8
2	21–25	Non-binary	Asian	5
3	21–25	Male	Black	7
4	Undisclosed	Female	White	4
5	18–20	Female	White	6
6	18–20	Non-binary	White	4
7	21–25	Non-binary	White	6
8	21–25	Male	White	6
9	21–25	Non-binary	White	4
10	21–25	Male	Black	5
11	18–20	Agender	White	5
12	21–25	Nonbinary	White	4
13	21–25	Female	Asian	7
14	18–20	Female	White	5
15	26–30	Male	Black	6
16	18–20	Female	White	4
17	21–25	Undisclosed	White	5
18	18–20	Undisclosed	White	4
19	18–20	Male	White	4
20	21–25	Female	White	6
21	26–30	Male	Black	6
22	26–30	Male	Black	6
23	21–25	Female	White	7
24	18–20	Female	White	5
25	21–25	Male	White	6
26	26–30	Male	Mixed ethnic background	4
27	18–20	Female	White	4
28	18–20	Female	White	5
29	31–35	Male	White	6
30	31–35	Female	White	7
31	18–20	Female	White	6
32	18–20	Female/non-binary	White	4
33	26–30	Male	Black	6
34	Undisclosed	Male	Black	6
35	18–20	Female	White	5
36	18–20	Female (with non-binary history)	White	4
37	21–25	Female	White	6
38	18–20	Non-binary	White	6
39	36+	Female	White	8
40	26–30	Male	Black	6

The data have been summarized to maximise anonymity. Levels of study are derived from the U.K. Framework for higher education (FHEQ), in which level 4 equates to first year undergraduate study and level 8 corresponds to ph.d study

(22.5%), Natural Science (10%), and Geoscience (5%). The participants were studying at FHEQ level 4 (first year undergraduate—27.5%), level 5 (second year undergraduate—20%), level 6 (third year undergraduate—37.5%), level 7 (masters—10%), and level 8 (doctoral—5%).

3.3 Procedure

The data of this study are derived from a novel, online adaptation of the well-established World Café qualitative methodology, in which group discussions are facilitated by allowing participants to move freely from table to table, with a different topic being discussed on each [69]. The instant messaging social platform Discord was utilised to host the study, providing a secure online space to create chat rooms and facilitate text-based communication between multiple individuals. Adapting the methodology to an online environment, as devised by [70], was intended to provide maximum inclusivity for the study participants [71, 72].

All study participants were provided with all required information on the project and the researchers managing the project, their responsibilities as participants (including rules for participation), our responsibilities as researchers and what we will do with the data derived from the project, how they as participants can raise concerns or complain, sources of available support, and an instruction guide on how to navigate the Discord platform as part of the project. Once provided with this information, participants were required to provide written informed consent to participate via an MS Form before being permitted to continue. They were then provided with a link to access a discussion forum space for their group, hosted on Discord. Prior to entering the Discord server, all participants selected an anonymous username and avatar/picture which had no identifiable characteristics and were used for the duration of the study. Participants were reminded that their anonymity was imperative and any breach of anonymity would result in immediate removal from the study. Questions were presented within different channels on the Discord server, in groups of related topics. Within each server, following introductions, participants were directed to five separate channels in turn, each focused on a single topic, and containing between five and seven related questions. The five topics were:

- Who am I?;
- Experiences of Geosciences;
- University Life and Coping with the University Environment;
- Support;
- Final Questions.

Over a period of 1 month, participants were provided sequentially with 27 questions within the five topics (see Online Resource 1) to prompt them to share and discuss their thoughts, feelings, and experiences on each of the topics with the group. Participants could revisit discussions that were presented earlier in the study if they wished to, similar to the ways in which a World Café allows participants to move between tables at their own volition. This enabled participants to respond to questions in their own time, to edit previous answers, and to respond to other participants who may have visited the forum after them, if and when they wanted.

All Discord servers were managed and moderated by members of the research team, and participants were encouraged to respond to each other and interact. Moderators occasionally responded to participants, or asked additional probing questions, to stimulate further discussion. Furthermore, all moderators monitored the responses to identify any potential indication of undue distress so that the research team could intervene directly, if necessary. From the onset of the study, participants were provided with the opportunity to liaise directly with any members of the research team if they had any

concerns, questions, or wished to withdraw from the study. Additionally, a support sheet was provided which signposted participants to a range of general and specialist sources of support.

Upon completion of the data collection phase, participants were thanked for their participation and gifted a £40 voucher. This research was undertaken following the guidelines of the Keele University Research Ethics Committee, and in accordance with the Keele University Research Ethics Policy. Favorable ethical opinion for the study was received on 24/02/2023 from the Keele University Research Ethics Committee (REC Project Reference 0330).

3.4 Data analysis

The data were exported from the Discord servers and collated for reflexive thematic analysis, following the approach of Braun and Clarke [73–75]. The full dataset was analysed inductively by a sub-team of 6 of the project authors, aiming to draw on the expertise and diverse backgrounds of the research team. The first author initially transcribed the full dataset from the four Discord-based servers into a single document. The entire sub-team then independently familiarized themselves with the full dataset before meeting to collectively discuss our initial thoughts. Coding of the data was undertaken by assigning units of meaning (codes) to the data on a comment-by-comment basis. Codes typically ranged from a few words to multiple large paragraphs, reflecting the coding practices of grounded theory in which short codes can serve to organise and summarise data, while more detailed 'memos' can provide further interpretation and aid with the later organisation into themes [see 76]. The four Discord servers were distributed amongst four members of the sub-team, with individual members regularly engaging in collaborative analysis. An additional analysis of the dataset was undertaken separately by two additional members of the sub-team to provide an independent 'control' and evaluate the credibility of the process. Following coding, all of the codes were collated by the first author and evaluated to identify individual units of meaning which were present in each sub-team member's codes but which might have been labelled differently, yielding a standardised code list for the entire dataset. Themes were then constructed by the sub-team through the collation of individual code schemes and subsequent interpretation of the overarching meanings presented by the participants, generating narratives that explain the lived experiences of the participants. The themes were finally refined through collective discussion among the team.

4 Research findings

The researchers identified three main themes from the data (Table 2). The first theme "Being me" captures how the participants viewed themselves, their identity, and how they felt they were perceived by others. The second theme "Interacting with the world around me" highlights ways in which the participants discussed how their social environment could be made more inclusive and foster a sense of belonging. The third theme "Facilitating Change" presents the ideas and feelings around the people who are perceived to have the power to influence positive and negative experiences in learning environments and facilitate the desired change. The study results are summarised on this basis below. To maximise the strength of the study participants' voices, these are supported throughout by quotes taken directly from the data (Tables 3 and 4, and 5 for

Table 2 Main themes and subthemes identified from the dataset

Main theme	Subtheme
Theme 1: Being me	Affirmative identity
	Academic expertise
	Social challenges
Theme 2: Interacting with the world around me	Learning environments
	Teaching approaches
	Support mechanisms
Theme 3: Facilitating change	Diversity within diversity
	Training and understanding

themes 1, 2, and 3, respectively). All of the quotes are presented in the own words of the study participants, using their own preferred language and terminology. Minor changes have been made to maximise the readability of the quotes (e.g. spelling and grammar) but this has not altered the underlying meaning of the participant responses.

4.1 Theme 1: "being me"

4.1.1 Affirmative identity

Participants discussed in detail how being autistic had fundamentally shaped their identity and how they approach social and academic activities (Fig. 2). Across the conversations, they expressed a strong 'affirmative' identity [77]. Some participants noted a sense of social justice that distinguished them from others (Q1). A strong sense of altruism within the autistic community was described, either via their willingness to contribute to this study (Q2) or through their decision to engage in geoscience-based HE (Q3). In both instances, participants described being driven by a desire to do something positive for the autistic community and/or the environment.

4.1.2 Academic expertise

Experiences of 'fitting in' were discussed regularly; for example, most participants identified with the concept of having a 'special interest' in their chosen area of study, an affinity to a specific topic which they felt impacted positively on their academic activities. This allowed participants not only to apply their knowledge beneficially to their studies but also to relate to others and develop positive relationships with students and staff members (Q4). The subject of the Earth, the climate crisis, and associated geoscience-related topics (e.g. minerals, fossils) or spending time/working outside in the 'great outdoors' were particularly prominent as areas for which the participants had genuine passion.

Another example of a perceived strength was the academic value of their ability to 'hyperfocus'; participants explained how they are able to avoid distractions and pursue a specific topic, activity or idea in great detail, whilst gaining both reward and enjoyment (Q5). Many participants also highlighted their capacity to think outside the box to help with problem solving skills and the ability to integrate and contribute alternative ideas that others might not provide (Q6).

These comments indicate how the participants often saw their autistic traits as key strengths from which they could draw pride and gain academic distinction. The discussions revealed a shared identity, or even culture around being autistic (as well as being autistic and studying the geosciences), with many participants relating directly to, and engaging positively with, each other's experiences. This suggests a perceived safety for

Table 3 Participant quotations relating to theme 1: being me

Quote number	Quote
Q1	"Autism also allows me to have a strong sense of justice and commitment that cannot be found in most neurotypicals."
Q2	"…I think it's really important that I use such opportunities to contribute my experience to the understanding of autistic people's educational and life journey"
Q3	"…I find the intersect between people and their environments the most interesting. I hope that I'll leave the world a better place than I came to, either by educating myself/others, or through creating/instigating more sustainable practices."
Q4	"…nearly always, there is a person to who I can relate because of my special interests, and therefore, because of the great diversity of people at the university, it was possible to make friends. I think it has also helped me in some cases with academics as well because I am very passionate about this area, and my passion has often carried me through this subject when I struggle with it."
Q5	"I can hyperfocus on tasks and subjects which makes studying just one topic for a long time not only easy but pleasant. I think it leads to a passion to learn about whatever I'm focusing on."
Q6	"It allows me to see things from a different perspective and think outside the box. I often have ideas and insights that haven't even crossed other people's minds."
Q7	"I get concerned about people thinking I'm weird when I'm really into a topic, e.g. I am very enthusiastic about sediment and rivers but I think my level of enthusiasm is probably beyond most of my course mates due to [my] special interests."
Q8	"I find it hard to understand social cues and nonverbal communication, which often leads to misunderstandings and makes it a lot harder to communicate which affects my relationships with people, even friends"
Q9	"…I sometimes struggle to communicate/assert my needs. It also means I'm prone to burnout so I can become more exhausted than my peers."
Q10	"I feel like being autistic has made it difficult for me to interact with my professors and my supervisor as I don't really know what level of formality is correct to use with them."
Q11	"I try as much [as possible] to limit the chances of me communicating with staff, this is because I really have not been able to articulate my thoughts so that [they are] well understood in the few experiences I've had. This has affected any attempt to strengthen any relationship with staff other than their primary roles to me."
Q12	"I believe that having autism has affected my interactions with teachers and staff. And this has both positive and negative aspects. On the positive side, some teachers and staff are willing to go above and beyond to make accommodations for me and make the learning process as seamless as they can. On the negative side, some teachers also tend to treat me differently, and one even said that I make his work complicated although he apologized and gave the reason that he was having a stressful day."
Q13	"Not 'fitting in' is really hard, not feeling like I belong anywhere."
Q14	"I'm one of those people who can feel excluded because of the clubbing/drinking/night life aspect of uni. I've found a friend this year who enjoys the same things as me which has helped as we can do everything we like to do together, but when we're not together, I can feel quite lonely… … I actually would say my flatmates not being able to go out drinking to clubs/pubs during 1 st year in 2020/21 meant we got to be closer as we all had more time to bond and I wouldn't have gone out with them."
Q15	"I was lucky that I was 'adopted' by my tutorial group at the start of first year and this is how I have made all of my friends on my course"
Q16	"…since coming to uni, I've been accepted more since getting a good group of friends… …perhaps it's because people are more grown up at uni, and if they aren't, I don't have to be in contact with them."
Q17	"…I don't know them and am uncertain of the exact social dynamic, and am consistently left to be one of the few, or only one, actually doing anything."
Q18	"…I was told by the staff that I have no employability strengths (like everyone else got at least one!!). They told me they thought I wasn't trying hard enough and that I was being too quiet the whole time…"
Q19	"…my mental health made me take a leave of absence and when I came back I changed supervisor. I later asked them for help and they said I lost that right when I left them and had I stayed, I would have known that answer. My peers also noticed that they were treating me different in classes than to my peers by asking me over complicated questions which made me feel overwhelmed and stupid."

Table 3 (continued)

Quote number	Quote
Q20	"They act like I'm stupid for even saying that I'm autistic when all I'm after is some understanding. I used to be called a spaz and a retard too. It's very hurtful and it tends to happen more from older people than my peers now."
Q21	"I thought I had to be and act like a certain type of person and that if I couldn't do what other people could, I was stupid and pathetic which was really exhausting mentally."
Q22	"…it's easier to appear normal…"
Q23	"Of course, people would still pick up something 'different' no matter how much I perfected the character I thought would be best accepted as 'normal'."
Q24	"I've been masking most of my life in order to survive in social situations and [this] has caused a lot of difficulty with my sense of self."
Q25	"To be honest? I think I still mask even when I'm alone, or with others that I rationally know are the same/safe to be with, so am still very much undergoing/learning self-acceptance."
Q26	"I have been told MANY times that I don't come across/seem like I have autism, which is probably because I mask most of the time. So, I'm seen as 'quirky' or 'unusual'."
Q27	"I've had people tell me I can't be autistic because I look normal too and it's so annoying because it's called a hidden disability for a reason! I also had a manager at my old job tell me I was "very high functioning", and I turned to her and said, "that's not a thing, and I'm just good at masking."

many participants who were more comfortable disclosing their autism with other autistic people than with non-autistic people.

4.1.3 Social challenges

In addition to academic expertise, participants also described extensive social challenges related to being autistic. Social interaction between autistic and non-autistic people presents unique challenges (the Double Empathy problem [78]), and while some autistic traits enabled many positive experiences, some created considerable challenges. One participant described how their hyperfocus and their special interest sets them apart but could have negative social consequences as others may think they are 'weird' (Q7). A sense of additional labour in social interaction was often described (Q8). This prompted discussions around a tendency to become quickly exhausted and frequently experience 'burnout,' whereby participants reported becoming overwhelmed to the extent that it significantly impinged on their capacity to function socially and/or academically (Q9).

The same social communication challenges can impact participants' ability to develop working relationships with teaching staff – although some participants indicated no specific difficulties, others reported anxiety relating to precisely how they should communicate with staff members (Q10). In addition to the practicality of communication with teaching staff, the same anxieties were often linked to the fundamental fear of not being fully understood (Q11). Others describe a more bimodal experience, with some staff members with whom they feel safe and understood, and others who they feel do not understand them, dismiss them, or with whom they may even clash (Q12).

Friendships and social interactions were commonly raised. Responses highlighted a strong sense of belonging to a given cohort (e.g. a group of learners belonging to a specific year group or programme of study), with a simultaneous struggle to identify with that cohort personally or engage in wider social activities (Q13). This was particularly clear in responses relating to fieldwork, where participants reported feeling excluded from evening social activities, sometimes related to social drinking, leading many to focus on their studies rather than feeling a 'need' to socialise. Even outside of this context, the stereotypical 'social drinking and clubbing' culture often associated with

Table 4 Participant quotations relating to theme 2: interacting with the world around me

Quote number	Quote
Q28	"There were many large lectures during my first year which were quite overwhelming—I couldn't always sit in the same place and I wouldn't always be around the same people."
Q29	"…being asked directly in lectures is terrifying though, I don't like being put on the spot in such a large group and the feeling of anyone looking (especially directly) at me"
Q30	"When lectures are in different rooms to usual or in different buildings, I get extremely nervous and can't focus on the lecture for the first half as I am trying to de-stress myself from all the new input and decisions I had to make (e.g. where to sit, size of lecture theatre etc.)"
Q31	"… Floor plan maps would be really useful and I have asked if there are any available but there doesn't seem to be… …They would probably make things a lot easier for all students but for me it means the first week of term is just that little bit less overwhelming."
Q32	"I have benefitted more from expository lectures; this is because I am able to really detach myself from any other activities in the class and be focused on the lecturers for a long time. I quickly get immersed in the concepts."
Q33	"…they're my personal idea of hell and I've skipped or straight up left so many lectures because the lecture space was so overwhelming; it's not disability friendly at all."
Q34	"I feel a bit more relaxed in smaller tutorial rooms during seminars due to the fact I can move, fidget and talk a bit more which calms me down. …being able to interact with friends rather than sitting in silence has been important for me to feel less anxious and is more conducive to a better learning environment in my opinion."
Q35	"I preferred smaller seminar set ups, however it was sometimes difficult to stay calm when feeling pressured into discussions or to answer questions when I haven't quite processed them."
Q36	"…[I] struggle when I am in a small classroom setting with desks as I feel more exposed and not as hidden in a lecture row."
Q37	"I love working in practical environments like labs and in the field! I feel like working with my hands helps me take in information and come up with ideas a lot better."
Q38	"…it puts a lot less pressure on needing to focus on every single word said and allows me to take in information at a pace that suits me."
Q39	"I tend to struggle with the lighting in labs, I am not sure if the lighting itself is different or if it's just because most of the surfaces are usually white."
Q40	"I thrive being outdoors and like the aspect of hands-on learning. It is often easier to ask questions to the lecturers and build rapport that cannot be done in the same way in a normal classroom setting. I have found that fieldwork has brought me closer to my peers and the staff on the trips and it revives my love of the subject material."
Q41	"Residential trips are just horrifying - I'm stuck with judgemental people for several days and I'm out of my routine completely."
Q42	"Not knowing exactly what we will be doing or where we will be going. It's normal to get a booklet about the overall field trip and assessment stuff (if there is any), but there isn't often things like pictures of the accommodation or detailed daily plans."
Q43	"Most fieldwork I have been on included long days out in the field, then activities in the [evening] (both social and academic sometimes) and then shared accommodation. This means that there's no free time or safe space to decompress and recharge which is extremely draining."
Q44	"The food was a worry for me but knowing what the menu was in advance helped me plan if I could eat the meal or not and decide If I needed to buy snacks instead due to limited food palette."
Q45	"I only like certain food and normally we aren't told in advance what the food is and so I normally live off cereal bars."
Q46	"…on trips I tend to have a large space in my suitcase for my safe foods. This helps but again is sometimes not possible when there is weight and size restrictions on luggage."
Q47	"During periods where I don't feel willing or able to see other people or am struggling with the logistics of leaving the house, online classes can be great because I can just turn up from home and it is up to me how much to engage (e.g., am I going to turn my camera on, am I going to say anything)."
Q48	"I find it easier to ask questions online and would never during an in-person lecture."

Table 4 (continued)

Quote number	Quote
Q49	"I hate online lectures. They are a nightmare. You can't ask questions easily or get the lecturer to slow down and there's always some sort of technical issue which makes it even more overwhelming to deal with. Face to face is much easier for me… …I find it more comfortable to take lectures in-person- even though it's a sensory nightmare because I can ask questions easily and stay back to speak to the lecturer one on one."
Q50	"Sometimes being 'forced' to get up and ready for a day brings me a lot more motivation to continue working and I generally feel a lot better with my neck not bent over a screen all day."
Q51	"This is also due to the guidance sheets not being very clear and struggling to read between lines – e.g., 'it would be good if you do this' does not to me sound compulsory but when I received my marks they were taken off as I did not add the thing; instead it could have been worded 'To gain marks in X add this as it shows…'"
Q52	"At my university there isn't a standardised marking system so I find it confusing to keep up with advice - a good thing in a piece of work for one teacher may be a bad thing for another… …I haven't really come up with a coping strategy so to speak and just try not to let things get to me."
Q53	"I've had difficulties with a lot of assessments, especially if instructions aren't clear. The best way for me to be able to feel like I'm going to do ok at an assessment is if the instructions are super clear in what they're expecting, so when instructions are vague or open-ended I struggle with knowing where to start."
Q54	"While I do like doing the odd "fun" assessment that is a bit different or creative like a poster or a video, I appreciate that on my degree the bulk of the marks come from writing geological reports which have a very consistent format and are delivered in a logical way so uncertainty is limited. I enjoy thinking creatively, but too much uncertainty in briefs can sometimes lead more so to anxiety than curiosity."
Q55	"I find presentations very stressful due to the anxiety that comes from being the centre of attention and having everyone looking at you. I focus too much on how I'm standing and if there is enough emotion in my voice and if I'm making enough eye contact and forget what I'm actually supposed to say. Then if I am asked any questions, I don't have time to mentally process them and so my answers are not well thought out and often come out jumbled which makes me seem like I don't know what I am talking about."
Q56	"My experiences with group projects (unless I have chosen who I am working with) have always been negative. The workload has always been unequal, there are communication barriers, unexpected changes, either no one or multiple people wanting to take charge, etc."
Q57	"I was assisted from student affairs to get settled in my accommodation, later through departmental registrations that can overwhelm an autistic student, I was also introduced to all services & the staff to see who were specialized with autism & autistic students…"
Q58	"The mentor support just feels like I have nothing to say each session and she just sends me random resources about autism that's already stuff I know. I'm not sure what would be more useful though."
Q59	"My university has little to no support available, the mental health support is quite frankly a joke - as soon as I mentioned I have mental health difficulties due to my autism they told me they couldn't help and I should contact the doctors instead…"
Q60	"I had to ask for each one, and I had to go out of my way to find them before learning that provisions had already been made in school."
Q61	"I haven't had much support from my current uni. One problem I have with the system here is that every bit of support or accommodations must be requested by me, nothing is really built in. When I'm managing fine I don't really need any support but when things get tough for me I burn out really badly and then reaching out for support and communicating what's going on actually requires [more] energy than I currently have. So, I end up least able to ask for help when I need it most and I don't know how to get around that. All the onus is on the student to communicate problems which is tough when part of your condition is a communication disorder."
Q62	"…doing presentations is really difficult for me and a lot of the marking areas include clarity of speech and interaction with audience. This just isn't possible for me, but I was able to submit a recording instead… …having the option to do this I think has been really important because it means my ability to communicate does not stop me from presenting my knowledge and hard work into researching the subject area just like in any other form of assessment."
Q63	"I have an ILSP (individual learning support plan)… …it specifies that I should have a quiet space to do exams in rather than the main hall, but a lot of the accommodations on it are either not really relevant or aren't implemented."

Table 4 (continued)

Quote number	Quote
Q64	"Honestly, I don't know if any of the academic staff actually read my learning support plan as they never really communicate with me about it, so I'm not sure if they even know what accommodations I have on there."
Q65	"I have trouble with deadlines too and there is a provision for that in my reasonable adjustments where I can request [extensions] but I always overthink when and how to ask my lecturers/tutors for them so I never actually do despite having handed in plenty of late work this year."
Q66	"I'm not one who always asks for help when I need it for fear of disrupting people or causing inconvenience even though I have a genuine need for help."
Q67	"In some modules, I feel the support is there, and I can go to the lecturers for whatever I need, but in some cases, the lecturers don't care. They give the impression that I'm making their life more complicated by being neurodivergent."
Q68	"Most time[s] I felt supported and some other time[s] I felt all alone in the crowd. Some lecturers did understand me while some others [had] difficulties understanding me."
Q69	"Some lecturers are very adaptive and will take the time to discuss my needs before teaching with me so they can better understand how I can get the most out of my course… …My lecturers that are adaptive really just ask what I need and accommodate as much as possible. People forget how helpful having a conversation with someone is about their needs."
Q70	"…some staff have not been as accommodating, when I have asked for resources in a different format, such as a PowerPoint file instead of a pdf, they have outright refused, making it a lot harder for me to use some of my specialist software."
Q71	"Some teachers adapted and some didn't, I think it's to do with how much education/experience they have with autism and disabilities in general."
Q72	"I think it's probably a matter of a general lack of understanding of autism in the world. People who've had some experience with autism tend to have a bit of a better understanding. It's probably a matter of increasing awareness and knowledge of autism, and eliminating stereotypes as well as they can be misleading."
Q73	"…it depends on the lecturer, some will go above and beyond to accommodate you, some will only do the bare minimum, and the rest won't even try."
Q74	"Telling [my family] how people talked or reacted to me also helps me understand where I stand with other people as my parents and siblings can tell me what the intention behind what the person was saying/doing means."
Q75	"I've tried general therapy before but I seem to understand myself quite well and not really benefit from someone telling me the same things in therapy."

university life was raised as a potential challenge, and an aspect of life that some participants felt excluded from (Q14).

Friendships were often described as being limited to small but close groups. Difficulties in finding a group of peers that is accepting of autism was highlighted as a potential challenge (Q15), with negative social behaviours such as bullying, discrimination, and stigma being reported from others. Participants reported experiencing less direct discrimination in HE than in their previous educational institutions, linking this with the rapid change in both learning and social environments between further education (FE) and HE (Q16).

Accounts of bullying, harassment, hostility, or unwillingness of peers and/or educators to offer support, either passive or targeted, were common, and often appear to stem from the difficulties of each party in understanding the other. The dataset includes examples of autistic learners feeling othered, unable to fully participate alongside their peers, particularly during group activities or fieldwork (Q17). Examples of exclusive learning design were also discussed - one example describes an employability-related activity in which participants were marked on their body language and eye contact, leading to an autistic participant being scored poorly for a perceived lack of effort (Q18).

Table 5 Participant quotations relating to theme 3: facilitating change

Quote number	Quote
Q76	"And of course there is the saying 'when you've met one autistic person, you've met one autistic person', we're all different!"
Q77	"Higher education needs to start considering diversity not only in race and ethnicity but also neurodiversity, this makes room for efficient planning of higher education to be more inclusive. There should be efforts to improve awareness on understanding neurodiversity especially among staff and lecturers."
Q78	"It would be great to have some training for all members of faculty and student support teams so that everyone who may interact with autistic students have up to date knowledge and understanding. I think it would be great to include some training and resources for students as well to broaden awareness across university. Having greater knowledge around the diverse presentations of autism would definitely help autistic students access their learning more easily and means assumptions aren't made from outdated stereotypes."
Q79	"Training and understanding is most important as well as not applying a blanket approach to autistic individuals, some might need more understanding about rooms being too bright for them to concentrate and others might find the social atmosphere of seminars to be too difficult but by actually asking us what can be done to help and have an honest conversation that can produce change that would fit each individual's need."
Q80	"I think better education awareness of our experiences, and listening to actual neurodivergent people, not just for teaching staff, but support staff and the wider student body too. How our neurodivergence intersects with mental health and disability too, as we often have co-morbidities in my experience. It's complex, but information helps to rehumanise and preserve our dignity if it becomes more normalised/less stigmatised + stereotyped."

More extreme examples report cases in which individuals have experienced clashes with their teachers due to communication difficulties, leading to withdrawal of academic support (Q19). In the most severe examples, participants report being subjected to verbal abuse and belittling language (Q20).

In response to many of the negative aspects of life in HE described above (and those predating it), participants described their perceived requirement to avoid disclosure or to 'mask', a term used frequently in the autistic community to describe the deliberate suppression of fundamental aspects of self and identity in order to appear more 'normal' and avoid negative attention, a form of 'social camouflage' [79–81]. Participants articulated the complex learning process and underlying motivation that required them to develop their 'mask' (Q21), and also described the exhaustion and negative emotional impact that the process could have on them (Q22). Although some felt that they could blend in enough to avoid stigmas associated with autism, others expressed an almost inevitable failure of the mask to hide them entirely (Q23).

Some participants described a genuine confusion brought about by masking, causing them to struggle with their sense of self and personal identity (Q24), even expressing a need to mask for their own benefit, despite being among people that they regard as safe, or when alone (Q25). In addition to these difficulties, some participants highlighted the detrimental effects of highly effective masking, which caused them to question the validity of their autistic selves, and which led to feelings of frustration, guilt, and imposter syndrome as people dismiss legitimate needs as unnecessary. This ranged from passive (e.g. a general refusal to accept autistic identities (Q26)) to more direct (e.g. patronising and belittling language (Q27)).

Overall, the participant contributions within this theme highlight a profound self-awareness, a sense of themselves that creates a community of individuals through shared experience. Many of the key challenges within this area relate to the apparent need to stifle or repress this identify to better fit one's surroundings, an aspect of the autistic

Fig. 2 Participant quotations highlighting their perceived identities and how they approach social and academic activities. The background colour and apparent physical characteristics of the silhouettes are arbitrarily chosen as representative and do not in any way reflect the characteristics of the participants themselves

experience that was explored further when the participants were asked about their interactions with their surroundings.

4.2 Theme 2: interacting with the world around me

4.2.1 Learning environments

Many participants highlighted ways in which their interactions with the HE system were either supported or challenged (Fig. 3). One key aspect identified was the way in which each participant interacted with different learning environments. For example, the traditional lecture theatre was almost exclusively presented as a potentially challenging or hostile environment (Q28). Participants cited factors relating to sensory difficulties derived from the environment itself (e.g. surrounding noise, crowd density, dim or overly bright lighting, temperature), or the manner of delivery (e.g. difficulty processing information, struggling to keep pace with the teacher, being singled out) (Q29).

It was also pointed out that having lectures in different rooms or buildings to the norm, likely due to timetabling considerations, could itself impact significantly on learning and anxiety (Q30). This prompted comments on the accessibility of information that participants could use to navigate their teaching environments, locating the various teaching spaces that might be employed throughout their degree (Q31). Despite this, some

Fig. 3 Participant quotations sharing some of the support or challenges they have experienced when engaging with their education. The background colour and apparent physical characteristics of the silhouettes are arbitrarily chosen as representative and do not in any way reflect the characteristics of the participants themselves

participants indicated that they enjoyed the didactic style of lectures, even if the environment itself was potentially extremely uncomfortable, suggesting that they enjoyed the *style* of content delivery but not the *structure* and *location* (Q32).

Although some factors are beyond their control, participants offered a proactive range of key variables or coping strategies which could potentially lessen their difficulty with this environment, including having classes with fewer learners, ensuring that lectures do not exceed a specific timescale (e.g. 60 min), sitting at the back of the room, viewing recordings of the lectures, not being called upon or singled out to answer questions, and having friends which accompany them to the lecture. Nevertheless, one participant described actively avoiding this form of teaching to minimise their stress and anxiety (Q33).

Learning environments such as seminars and tutorials prompted mixed responses, with some participants preferring them compared with lectures, but others describing many of the same difficulties as outlined for lecture settings. Smaller group sizes were described as a positive in terms of social anxiety (e.g. less crowded environment, able to work directly with friends) and sensory sensitivity (e.g. lower background noise levels) (Q34). However, for some participants, this gave them nowhere to hide or forced them to work with peers that they didn't know (Q35), leading to feelings of being exposed or

pressured into speaking in front of the wider group, and exacerbating their self-consciousness (Q36).

Many participants expressed a preference for hands-on, practical learning, highlighting laboratory-based (e.g. computer lab, dry-lab, or wet-lab) learning as being more comfortable and engaging (Q37). Participants cited factors such as the freedom to choose their work colleagues, ability to work at their own pace, having more personal space, and being able to 'actually see what they've been taught' (Q38). Nevertheless, previously described challenges such as sensory difficulties and anxiety were cited as challenges here—some participants described reliance on sound-cancelling headphones or the support of their peers to manage these environments (Q39).

Fieldwork (one-day or residential field trips) was highlighted as the learning environment that participants enjoyed the most, but with which they experienced perhaps the most significant difficulties. Participants cited their love of the outdoors and passion for the subject, the value of their self-identified traits for this style of learning (e.g. attention to detail), and the social element of working closely with peers and teaching staff (Q40).

By contrast, various challenges were described; participants shared their profound anxiety stemming from the deviation from their 'safe' daily routine and uncertainty regarding daily schedules and planned activities (Q41). Beyond this, the fear of being forced into groupwork with people they don't know, and the requirement to work and/or live in unfamiliar, 'unsafe' spaces without any specific guidance or materials to help them prepare were also raised as key challenges (Q42).

A key point that was evident in the data was the inability to recharge – participants described the fundamental requirement to mask all the time during fieldwork, but accommodation arrangements during field trips frequently preclude personal, private accommodation. Evening teaching sessions after a day in the field are common, meaning that participants did not have a safe, private, and quiet space in which to recharge their 'social battery', leading to anxiety relating to the mask 'slipping', feelings of being trapped, mental fatigue, and exhaustion (Q43).

Of similar importance in the data were difficulties surrounding food, which were particularly prominent during field-based learning—selective eating is an academically well-established (but perhaps lesser-known to the general public) characteristic of some autistic children but is less well recognised or understood in autistic adults [82, 83]. This topic was raised extensively by the participants, who described the anxiety surrounding the uncertainty of what foodstuffs would be available to them during time away from home, particularly when undertaking overseas trips where access to their 'safe foods' could be inhibited or removed (Q44). Some participants described having to limit themselves to specific types of food that were available to them on the trip in question (Q45). When uncertain as to what foodstuffs would be available to them, one participant recounted their choice to bring their own stock of safe foods in their luggage during residential field courses (Q46).

Experiences of learning in an online environment compared with traditional face-to-face settings were mixed; some participants expressed a strong preference for online learning, citing factors such as the enhanced ability to control their own engagement (e.g. controlling their camera or engaging with typed discussion) or their environment, the ability to engage in their learning without social interaction or to stim without feeling self-conscious or distracting others, and the presence of accessibility features (e.g.

closed captioning) (Q47). This learning environment facilitated communication between learner and teacher, with the ability to ask questions anonymously in an online environment proving more comfortable than asking in person (Q48).

By contrast, other participants reported pronounced difficulty when engaging in online learning, with the most frequently reported challenges being difficulty concentrating, camera-related anxiety, and communication challenges relating to not being able to see peers and staff members (Q49).

Interestingly, many responses indicated an understanding of a basic need for face-to-face learning to facilitate opportunities for social interactions with peers, despite simultaneous acknowledgement of the challenges that had already been described for lectures, seminars etc. Effectively, the participants recognised the importance of, and fundamental need for, some form of social interactions, whilst also highlighting their difficulty in acquiring it (Q50).

4.2.2 Teaching approaches

Although the dataset indicates a general preference for practical teaching environments and approaches compared with more passive, didactic teaching, there remain some broader aspects of education which transcend the individual characteristics of a single learning environment. For example, participants often discussed the importance of clear instruction, describing their frustration with vague guidance or inadequate preparation materials (Q51). Similarly, the data reveal challenges surrounding a lack of consistency and standardisation which is common in HE, perhaps more so than in secondary or further education, leading to confusion and frustration when individuals achieve different academic outcomes for two pieces of formative or summative assessment that have been created via the same underlying processes and principles and *should* therefore receive the same feedback (Q52).

Many participants described a lack of clear instruction and having to guess what the lecturer wanted as a source of significant difficulty. For many, this also played a role in assessment format, with assessments such as poster submissions potentially being particularly lacking in clear and unequivocal direction and guidance/direct feedback (Q53).

Overall, the dataset indicates a wide range of perceptions of different assessment types and, although there were no specific formats which could be singled out as exclusively positive or negative, there remain some broader preferences which can be extracted. There was a general preference for practical assessments, written reports, and coursework which, if provided with appropriate instruction and guidance, participants felt gave them both structure and the time and space to undertake the work at their own pace (Q54).

By contrast, assessments based around oral presentation were almost exclusively described as being variably challenging, with the most frequently reported difficulties relating to the anxiety of speaking in front of an audience, and the challenges of formulating ideas 'on the spot' and articulating them verbally to an audience, particularly during any potential time for questions (Q55).

Perceptions of other assessment types were less unanimous – for example, the time constraints and environments of written exams were described as stressful, as well as the potential subjectivity of exam questions. By contrast, some participants expressed preference for exams due to the lack social interaction or the opportunity to structure their

thoughts. Similarly, group projects were highlighted as being enjoyable and engaging when the other members of the group are receptive and/or known to the participant, but if this was not the case, some participants reported difficulties relating to having to bear an unfair portion of the workload or struggling with a communication barrier (Q56).

4.2.3 Support mechanisms

Almost all of the participants who engaged with prompts relating to the support mechanisms available to them described interaction with some form of university-based disability, mental health, and/or counselling service. Reported experiences were variable but frequently positive, with participants describing the value of support structures for their degree experience and outcomes (e.g. allocated support mentors, assistive technologies, learning support plans) (Q57).

However, some participants described negative experiences, citing factors that ranged from a lack of support or expertise to the feeling that the support was insufficient or inadequate. One of the only two participants who described having not engaged with these services expressed their intense dissatisfaction and disillusionment with them (Q58), whereas the other reported an inability to access support due to a lack of a formal autism diagnosis (Q59). The need to seek out institutional support was raised frequently as a point of difficulty, with many participants describing a lack of relevant signposting, or the signposting being targeted exclusively to those with autism diagnoses. The process of applying for support was described as overwhelming, and when faced with challenges such as unresponsive third parties, participants were discouraged from continuing (Q60).

The participants highlighted how this lack of signposting caused profound challenges, requiring them to seek out their own support and undertake variably complex application procedures when they struggle primarily with social interaction and communication, causing some to be unsure of what support was available or to shy away from seeking support altogether (Q61).

Practically, many participants discussed the importance of reasonable adjustments to their ability to engage with education, with extra time and overall flexibility for assessments (particularly presentations), deadline extensions, recorded lectures, provision of learning materials in advance, and the ability to seek clarification of instructions being the most frequently described. Additionally, they commented favourably on adjustments which targeted sensory difficulties specifically (e.g. noise-cancelling headphones, dimmed lighting, quiet rooms for assessments) (Q62). Accessing these adjustments was not always presented as a challenge, although their successful implementation was often described as problematic, noting that adjustments on their formal record were not necessarily relevant or actualised by the relevant members of teaching staff (Q63). The underlying cause of this problem was suggested to be linked to staff members being unaware of the adjustments or unsure of how to adequately implement them (Q64).

This problem is compounded by the participants' reluctance to actively pursue their adjustments with their teachers, with some indicating a preference to go without their support due to unsurety of how to communicate this with their teaching staff (Q65). Generally, participants reported a fear of causing disruption or bringing attention onto themselves, preferring to go without support than to cause a fuss (Q66). Many participants also described informal support provided by their teachers, the common

experience being a deeply inconsistent degree of support depending on the individuals involved (Q67). Notably, this was not restricted to organisational difficulties, with some participants describing a more fundamental lack of understanding (Q68). It was frequently reported that some members of staff 'understood' the participant and provided a highly beneficial level of support, adapting their teaching or making allowances and 'going above and beyond' to increase their comfort (Q69).

By contrast, the same participants also described other teachers who were inflexible, unaccommodating, or intolerant, potentially even refusing to make minor adaptations to teaching materials when asked (Q70). Many participants linked this experience to the degree of experience and/or training that an individual staff member might have (Q71, Q72, Q73).

Outside of their host institutions, most of the participants indicated friends and family as their most valuable source of support, with almost all of those who engaged in this discussion describing entirely positive opinions of the impact to their university experience and academic performance made by family members, friends, and peers. This support notably includes encouragement but also advice and assistance with communicative challenges such as the interpretation of other peoples' actions or statements (Q74). Alternative forms of external support such as NHS provision and therapy were discussed, although the latter was not always viewed as being helpful (Q75).

4.3 Theme 3: "facilitating change"

4.3.1 Diversity within diversity

A key observation that was drawn from the dataset was the breadth of experiences, opinions, preferences, and needs expressed by the study cohort. This demonstrates a pronounced element of 'diversity within diversity', a fundamental idea that, even within a group of forty individuals unified by the term 'autistic', there exists forty unique individuals with their own ideas, preferences, requirements, and co-morbidities. This was identified by the research team by the participants themselves (Q76), and has significant implications for this third theme, in which we explore how the participants felt positive and lasting change can be facilitated.

4.3.2 Training and understanding

When discussing changes that could make HE more inclusive and accessible, the most common topic extended beyond more practical issues and granular approaches described above, and was instead related to training, with many participants expressing a profound desire for increased awareness of autism and the many ways in which autism (and neurodiversity) can manifest (Q77).

Although teaching staff (academic and professional) were frequently highlighted as in need of training, participants also frequently noted that the same training should be applicable to their peers as well, citing the value of challenging the outdated stereotypes relating to neurodiversity and existing stigmas (Q78). It was also noted that it would be important to recognise the diversity and complexity of autistic people, as discussed above. One participant stressed that taking a blanket approach to try and address all autistic learners would not work, and that it was the broader understanding of this 'diversity within diversity' that would be most powerful as a means of supporting autistic individuals (Q79).

Similarly, it was raised that any potential training should be informed by direct communication/collaboration with autistic individuals and should also consider the intersectionality of autism with other factors such as mental health and other associated co-morbidities. Specifically, this participant highlighted the critical importance of change through their use of language such as 'rehumanise' and 'preserve our dignity' (Q80).

Finally, participants expressed what they would like to communicate to the wider HE community; what they would most like for everyone else to understand about them and what key message they would like us to transmit on their behalf. The responses were poignant and in addition to highlighting a passion for positive change, also demonstrated a general desire for *understanding* amongst the participants, a want to feel accepted by, and contribute to, their respective academic communities (Fig. 4). Participants made sincere pleas to be heard, to be taken seriously, and to be accepted for who they are.

Fig. 4 Participant quotations which highlight a desire to be understood. The background colour and apparent physical characteristics of the silhouettes are arbitrarily chosen as representative and do not in any way reflect the characteristics of the participants themselves

5 Discussion

The themes and thoughts explored above provide an in-depth view into the perceived positive and negative aspects of autism. In-so-doing we provide a demonstration not only of how the implemented method was able to access these data, which might otherwise remain hidden from the wider HE community, but also the potential value of these data to the same community as it takes steps to become more inclusive and more accessible to a wider audience [e.g. 84]. The experiences of the 40 autistic individuals who participated in this study are both sobering, in their honest and frank descriptions of the challenges that they have encountered, and hopeful, in that most of the participants appeared to be altruistically open to change and continued communication (via appropriate and comfortable mechanisms) with the rest of the HE community. Here, we discuss more broadly the key themes identified in this study, situating our data within the wider context of autism research.

5.1 Identity and belonging

The strength of personal understanding and affirmative identity was made clear throughout the dataset, with participants demonstrating a capacity for deep self-reflection, and having a firm understanding of themselves, their identity, their autistic community, and their own personal strengths and weaknesses [cf. 85, 86]. This arguably stands in contrast to some existing notions of autistic people being fundamentally deficient in self-awareness (see [87]) and instead offers some linkage with the proposition that this perceived lack of self-awareness may instead reflect negative self-beliefs and the associated impact on perception of competence [e.g. 88] or a mismatch between internal feelings and the perception of what should be felt based on neurotypical norms [89].

Despite the apparent strength of identity and traits demonstrated in the dataset, many participants expressed feelings of 'not belonging' in HE (and prior to HE—see [90]), a commonly reported experience of autistic individuals due to being surrounded by social, material, and procedural mechanisms which are centered on neurotypical norms and expectations, with little room built into them for appreciating different ways of 'being' and different ways of doing things [80, 91]. Participants frequently reported that they didn't always feel understood by their teachers and/or peers, which echoes existing studies that identify a sense of 'otherness' [92, 93]. As observed by other studies, this experience can originate from a relatively passive and general lack of understanding found in HE [51, 94] through to application of outdated stereotypes and stigma [e.g. 95–97], or even the experience or fear of discrimination and prejudice [e.g. 98–102]. This has significant importance for the overall wellbeing and academic performance of an autistic learner as the ability to construct and maintain a positive disability identity may be tied directly to disclosure, which is required to access accommodations/adjustments in HE [e.g. 103–105].

5.2 Diversity within diversity

It is important to acknowledge that whilst we are presenting the results of this project as the "voice" of autistic individuals, there is significant diversity within this group (as there is in all groups). In addition to various protected characteristics, other diverse characteristics, such as those with other forms of neurodiversity, additional conditions and/

or ailments and those diagnosed under different systems, are more often overlooked. Yet their unique manifestation of autism is no less real and often brings with it added challenges.

This diversity within diversity means it is recognised that the themes derived from the data and therefore the recommendations suggested will not fit all experiences and will not solve all exclusive and problematic activities within education in HE. What is important to emphasise is that the reason any individual feels excluded or encounters barriers is due to the structure/system imposed on them, therefore our recommendations are mostly centered around making a more flexible, proactive (rather than reactive) and varied HE.

5.3 A call for change

The numbers of autistic learners in HE are predicted to continue to climb in the coming years [30, 106–108]; however, these learners are known to have less success in key areas such as graduation and employment compared with their non-disabled or some differently-disabled peers [109–114]. A considerable body of research and scholarship has been dedicated to the enhancement of accessibility and inclusivity across the HE sector, particularly in recent years. For example, the Decolonising Movement which has swept across the U.K. since its start in 2014, is also pushing for greater inclusivity in the curricula, in all forms, delivery, assessment, content, etc. Although a lot of the decolonising the curricula work has been against racism [115], decolonising the university has involved recognition that universities are spaces where some are made to feel alienated, where sometimes students do not see role models like themselves, and where structures of power, particularly epistemologies of power, are reinforced [116]. Decolonising the curricula, the university, and beyond, should also encompass including the diverse learning needs and preferences of our autistic students. Within decolonising work, there is growing awareness of the need to unlearn privileges, as Spivak tells us [117], and of course, in the unlearning process, learn to listen, to those who have been long subalternised.

Nevertheless, despite this ongoing push for inclusivity (which was praised by the participants of this study), it was still expressed that a key component to significant progress and tangible impact on the experiences and attainment of autistic learners is the fundamental understanding of the ways in which autistic people experience the world. As such, there is not only a clear and pressing need to explore how we can better accommodate this body of learners on a practical level, but also a requirement to fundamentally understand them, and to *integrate* this understanding into changes in teaching practice. Training is known to offer a means of enhancing understanding but does not necessarily lead to associated changes in teaching practice [28, 102, 118].

The data presented in this study, and that of the similar studies upon which we hope to build, demonstrate a desire amongst autistic learners to have their voices heard and to see meaningful change. The response rate to this project's call for participants, which greatly exceeded all expectations, adds weight to this and implies that these learners may not see any other opportunities to voice their opinions. As such, we implore all of those who are involved in HE, regardless of role titles (e.g. academic, professional, senior leadership), to engage not only with the growing body of research which illuminates the lived experiences of autistic learners in HE, but also with autistic learners themselves. It has

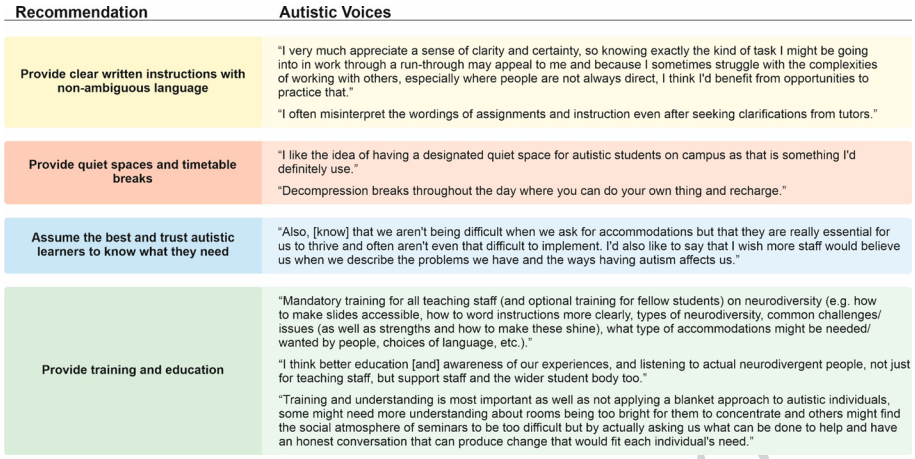

Fig. 5 Continued

been demonstrated by this study and others that autistic learners are often uncomfortable with, or unsure of, self-advocacy, and so it is important to provide the setting and circumstance in which this otherwise quiet minoritised group might feel more comfortable and willing to have its voice heard more clearly.

5.4 Recommendations and implications

Our participants articulated clearly the importance of accommodating their individual needs, rather than making generalised adjustments on the grounds of a generic diagnosis of 'autism'.

However, there were some short- and long-term recommendations that were consistent between participants, offer no significant downsides to non-autistic students, and that we feel merit emphasis here (Fig. 5):

1. Listen to autistic students and discuss with them how best to accommodate their specific requirements. Work with them to create autistic-friendly spaces and forums in which autistic students can contribute their voices.
2. Offer information about the learning environments in which teaching and student support are situated, including maps where possible, and ensure that any change to routine is communicated as early as possible. Work with autistic students to design learning and learning spaces differently.
3. Build in predictability, especially when the usual routines are disrupted, such as during field trips. This can mean including photographs of venues, providing menus, and offering programmes of activities in advance of trips. Rethink the design of our teaching to include this as standard.
4. Provide training and education for staff and students within universities, to help them to better understand the complexity of needs and the diversity of autistic individuals.
5. Ensure that assessment briefs and other types of instructional materials given to students are written in clear, non-ambiguous language. For example, tell students what is required, rather than suggesting that something might be good practice.
6. Where possible, provide quiet physical space and timetable space to allow autistic students time to recover from overwhelm during intense learning or social experiences, especially on field courses where an unfamiliar environment can add to stress. Embed these design principles throughout our curricula.

7. Assume the best; if an autistic student leaves class, appears to disengage, asks for additional support, or seems not to understand, it is likely that they are encountering a challenge, not that they are being difficult. Trust them to know what is best for them.

Figure 5 Selected summarised recommendations of this study and associated supporting participant quotes.

6 Conclusions

This study has revealed the potential impact of inclusive teaching practices for autistic learners, the importance of understanding diversity within autism, and the significant challenges autistic students face when navigating traditional HE systems. Although focused on participants in geoscience-based HE, the presented insights and practical implications are broadly applicable across disciplines, offering a roadmap for fostering inclusivity in HE generally. Inevitably, the size of the participant population represents a key limitation of this study—although we chose to maximise the population size based on our capacity to fully evaluate the dataset, forty participants may not have allowed us to fully capture the full experiences of a much larger population of autistic learners. Similarly, this study does not consider other factors which could potentially play a role in the lived experiences of the participants, such as socio-economic background, circumstances of birth, and upbringing. These factors could be considered as part of future research to better explore the intersectionality of autism with other factors. Finally, we must acknowledge as a potential limitation the thematic analysis process, in which our understanding of the data is inevitably influenced by the background and experiences of the individuals undertaking the analysis, with each viewing the data set through their own lens. However, as described above, we hope to have limited any impact of this effect through the diversity of the research team.

A key takeaway of this study is the significant diversity that exists within the overarching term 'autistic'. The advantages and disadvantages of a wide range of teaching approaches and learning environments are discussed from the autistic perspective, but the profound individuality of each participant demonstrates that there is no 'one-size-fits-all', and effective mitigation of barriers to learning must come from a deep level of understanding and must be, to some extent, bespoke to each context. This study presents a powerful call for change from the hearts and minds of autistic individuals in HE, with mandatory training being almost unanimously presented as the most powerful means of addressing the exclusivity of the current HE system to autistic people. More than this, the participants ask to be heard, to be understood, and to have a voice in their education.

In the broader sense, this study adds additional evidence to the arguments in favour of working directly with minority groups to integrate their voices into decisions which impact their lives. In addition to this, the success of the specific methods utilised here highlight a potentially powerful means of engaging with autistic learners and allowing them to share their voices in manner that is comfortable for them. As such, we suggest that an asynchronous, anonymous, and discussion-focused approach, such as that employed here, should be considered by future studies in this area.

The findings of this study are a call to action not only for those within geoscience disciplines but also and the wider HE community to embrace inclusivity and equity, ensuring that autistic students are not merely accommodated but are empowered to excel.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1007/s44217-025-00639-8.

Supplementary Material 1: This resource includes a table showing each of the questions which were asked to the study participants as part of the study (please see supplementary file)

Acknowledgements

The authors wish to thank each of the participants of this study, whose honesty and courage we hope to transform into lasting and positive change for autistic people. This project would not have been possible without the support of Filippo Nereo, who provided the first author with both encouragement and opportunity to develop and run the project when other parties withdrew project support. The project was initially supported financially by a Teaching Innovation Projects (TIPs) grant from Keele University. An earlier form of this manuscript was greatly improved by the comments of two anonymous reviewers, to whom we are grateful. We also gratefully acknowledge Sarbartha Chakraborty for editorial handling.

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Funding

Partial financial support was received from the Keele Institute for Innovation and Teaching Excellence, Keele University.

Data availability

Data is provided in the manuscript and in supplementary information files.

Declarations

Ethics approval and consent to participate

This research was undertaken following the guidelines of the Keele University Research Ethics Committee, and in accordance with the Keele University Research Ethics Policy. Favourable ethical opinion for the study was received on 24/02/2023 from the Keele University Research Ethics Committee (REC Project Reference 0330). This project is not a clinical trial. All study participants were provided with all required information on the project and the researchers managing the project, their responsibilities as participants (including rules for participation), our responsibilities as researchers and what we will do with the data derived from the project, how they as participants can raise concerns or complain, sources of available support, and an instruction guide on how to navigate the Discord platform as part of the project. Following this, all participants provided written informed consent to participate in this research. None of the participants were under the age of 18.

Consent for publication

As part of the above consent process, all study participants provided written consent for the research results, including their anonymised data, to be published before being permitted to participate.

Competing interests

The authors declare no competing interests.

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Received: 13 April 2025 / Accepted: 13 June 2025

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