# Online learning for university students on the autism spectrum: A systematic review and questionnaire study

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Online course delivery is increasingly being used by universities to deliver accessible and flexible learning environments. As this mode of delivery grows it is important to consider the equity of the learning experience for all students. As online delivery may reduce challenges and stressors present in face-to-face delivery, it could be suggested that it may promote student learning for specific student groups, including those with a diagnosis on the autism spectrum. However, little is known about the experience of learning online for students on the autism spectrum. This article presents findings from two studies: a systematic review of the literature and a survey of students on the autism spectrum studying online. From the systematic literature review, only four previous studies were identified reporting on this topic. Findings from two studies identified that the online environment provided both facilitators of and barriers to the learning experience for students on the autism spectrum. Although the online environment provided flexibility for learning, how design factors are employed in online delivery may unintentionally create barriers to the learning experience for students on the spectrum. An outcome from this study has been the creation of a suite of resources to assist with course design and delivery.

*Implications for practice or policy:*

- Consider the impact of course design on students with diverse learning profiles.
- Not all students disclose their diagnosis, so ensure methods of accessing support are clear.
- Work proactively to ensure that interactions with instructors and are responsive and flexible to facilitate the online learning of all students.

*Keywords*: higher education, autism, further education, university, online

## Introduction

Online learning as a mode of offer has developed significantly in recent decades with changes emerging in both its nature and reach. The big, universal good often associated with online learning has been its capacity to overcome educational inequity by providing access and flexibility to students in higher education (Hill & Lawton, 2018). Technologically enabled learning "plays an important role in advancing higher education availability for under-represented student populations" (Becker et al., 2018, p. 30) via increased access, but such access does not on its own mean equity has been achieved. While it is recognised that there is still a significant need to improve access to online learning globally – with a variety of socio-economic, cultural, and infrastructural barriers to overcome (Becker et al., 2018) – debate suggests that there is also a need to explore and challenge the notion that digital access to higher education equals digital equity. For example, factors such as context-appropriate usage of technologies and tools and lack of scaffolding for students about the best way to use those technologies may affect how successfully students engage with their learning environments (Ellis & Goodyear, 2019). Nevertheless, the affordances gained through developments in platforms and infrastructure have enabled online learning to shift from being thought of

as meeting digital equity goals through simply providing access to information towards being used as a collaborative learning space that fosters open communication (Garrison, 2017).

Institutional decisions to increase the number of online offerings across the Australian higher education sector are reflected in the proportion of commencing domestic student enrolments studying online increasing from 17.5% in 2010 to 22.8% in 2016 (Stone & O'Shea, 2019). This growth has occurred within the context of universities concentrating on the student experience across all modes offered and how to provide a learning environment that retains more students through to completion of their studies. This focus on retention includes institutional activities across various domains including learning and teaching, learning support (such as academic skills), support services (such as well-being and financial services), and physical and digital infrastructure. As any and all of these domains can have an impact on digital equity and equity more broadly, there is now a drive across the Australian higher education sector to better understand the demographic profile of students in order to identify and implement appropriate services and learning designs.

## Context

In this environment of heightened awareness of digital equity issues and institutional retention activities, it is important that researchers and academics do not assume that all students experience online learning in the same way. Factors which help or hinder online learning may differ between subgroups of students, with previous studies exploring the specific experiences of mature-age students (Stone & O'Shea, 2019) and students who are first-in-family (Stone, O'Shea, May, Delahunty, & Partington, 2016). The teaching team of a postgraduate online degree program at an Australian university noted that students with a diagnosis on the autism spectrum were reporting different experiences and difficulties with their course (unit of study) materials and interactions from those of the rest of the cohort. The teaching team then began looking for learning and teaching scholarship to help them address what they were observing in their classes and noted that, within their initial scan of the broad body of research into online learning, there was not much detail available about the experiences of students on the spectrum. They therefore instigated a research project to explore more deeply what was "out there" in the literature and at the same time sought feedback from students on the autism spectrum to learn what works well for them in the online learning space and what barriers might exist.

The following sections of this article will provide some context around the particularities of students on the spectrum in the higher education setting, report on those two research components, and undertake a discussion of the findings in order to identify some actionable strategies for designing online learning for students on the spectrum.

## Students on the spectrum in higher education

Autism spectrum disorder (ASD) is a high incidence disability diagnosed in one in 68 individuals (Centers of Disease Control and Prevention, 2012). The recent increased prevalence of autism has, in part, been due to the increased recognition of autism in those with average or higher intellectual ability (Centers of Disease Control and Prevention, 2012). An increasing number of students on the spectrum are enrolling in universities (VanBergeijk, Klin, & Volkmar, 2008), but whilst at university are at heightened risk of academic or personal failure and, when compared to other disability categories, have lower graduation and employment rates (Pinder-Amaker, 2014; Shattuck et al., 2012; Taylor & Seltzer, 2011).

Autism is characterised by social communication difficulties and restricted behaviours and interests which impact to differing degrees on a person's level of functioning (American Psychiatric Association, 2013). In addition, adults on the autism spectrum may experience co-occurring mental health conditions, with meta-analysis estimating lifetime prevalence rates of 42% for any anxiety disorder and 37% for a depressive disorder (Hollocks, Lerh, Magiati, Meiser-Stedman, & Brugha, 2019). These characteristics, however, may also be coupled with strengths which may contribute to academic success, for example, intense interest in the topic and attention to detail (Barnhill, 2016). This results in a heterogenous population who may be experiencing a variety of challenges in one or multiple aspects of their higher education experience.

Students on the spectrum who enrol in university may be able to cognitively manage the academic requirements of higher education but may experience difficulties in other areas, which impact on their

ability to meet academic demands (Gelbar, Smith, & Reichow, 2014). Some of these difficulties may be related to the social communication differences or difficulties, which may make tasks such as group work or public performance challenging and stressful; they may result also in individuals on the spectrum feeling as if they do not fit in socially (Anderson, Stephenson, & Carter, 2017; Cai & Richdale, 2016; Fabri & Andrews, 2016; Gelbar et al., 2014). Increased stress may also be caused by a variety of other factors, including sensory differences (Fabri & Andrews, 2016; Jansen et al., 2018), travelling to and from university (Fabri & Andrews, 2016), and managing changes or cancellations in timetables (Fabri & Andrews, 2016; Jansen et al., 2018). Not only can these experiences result in increased stress for students on the spectrum, but they can also affect their satisfaction with the overall university experience.

Given that such social and environmental factors may negatively impact on learning for students on the spectrum and that many individuals on the spectrum report having strengths in learning and studying using technology (Odom et al., 2015), it would be reasonable to assume that students on the spectrum would be attracted to, and would excel in, online courses. Online learning provides flexibility in terms of time and place for learning and allows for asynchronous engagement in discussions with students and teaching staff (Biggs & Tang, 2011), potentially reducing stress by providing the student with the opportunity to respond in their own time. Utilising the asynchronous capability of online learning may address a number of barriers identified by students on the spectrum by reducing the social demands and helping to control or manage sensory sensitivities.

Online learning, however, is not simply the same as learning face-to-face without the social or sensory challenges. Student strategies required for successful online learning include self-regulation skills, self-discipline, time management, organisation, planning, and self-evaluation (see review by Kauffman, 2015). Skills such as these have been shown to be difficult for many students on the autism spectrum (Fabri & Andrews, 2016), and the level of success they have in deploying these skills may influence their online learning experience. The success of the online learning environment relies on a number of factors beyond the specific skill sets that students employ, including the pedagogical framework upon which the course design is built. For neurotypical students, it is known that success in online learning depends on both the students' independent engagement with the learning content (Serdyukov & Hill, 2013) and the success of establishing a functional virtual community (Garrison, 2017). Hence, a positive interplay between learning approaches, engagement, and online learning environment design is crucial. However, it is not known if these statements are true for students on the autism spectrum because although research into online learning is not new, little is known specifically about the area of online study for individuals on the spectrum. Given the increase in numbers of students on the autism spectrum enrolling in higher education, research is warranted in identifying factors that create supportive learning environments for these students.

This article seeks to contribute to that body of work by reporting on two studies: firstly, a systematic review of the available literature, and then a survey of students on the spectrum who are studying online. This article is thus shaped by the following research questions:

*Study 1 – A systematic review of literature*

1.1 What are the experiences of students on the autism spectrum studying online in tertiary education settings?

*Study 2 – A survey to further knowledge on the experiences of university students on the spectrum studying courses online*

2.1 What factors influence the decision for university students on the spectrum to study online and, once enrolled, what proportion of university students on the spectrum discloses their diagnosis and/or accesses support?

2.2 How do students on the spectrum rate the importance of their interactions with course staff, other students, and their learning materials or learning management system when studying online?

2.3 How do students on the spectrum describe their experience of studying online and what barriers or facilitators do they identify to successful online learning?

## Study 1: Systematic review of literature describing the online learning experiences of university students on the autism spectrum – Method

The protocol for this systematic review was registered online with PROSPERO (https://www.crd.york.ac.uk/prospero/), an international register for systematic reviews with health-related outcomes (registration number: CRD42019121537). Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) standards were followed for all stages of this systematic review.

### Eligibility criteria

It is recommended (e.g., by COSMIN, https://www.cosmin.nl/database/) that systematic reviews focus their searches on a well-defined group and outcome. Therefore, the inclusion and exclusion criteria for this review required studies specifically to report on university-level online learning for students on the autism spectrum. Studies were included within this literature review if they met the following inclusion criteria: (a) study must report on the perspectives or experiences of students who have a diagnosis or who self-identify as being on the autism spectrum; (b) study must report upon online study for tertiary (university) students; and (c) if there is a mixed-diagnosis or mixed-age sample, the data for the autism group of interest are reported separately. Reviews, opinions, dissertations, editorials, book chapters, grey literature, and descriptive pieces were not included in this systematic review. Research focusing on vocational or employment-related educational activities was also excluded.

### Search strategy

Searches were conducted within the electronic databases PsycINFO, Web of Science, ProQuest, ERIC, and A+ Education during December 2018. Search terms were chosen with the aim of capturing as wide a selection of studies as possible and included those related to autism ("autis*", "Asperger's", "ASD", "pervasive developmental disorder", "spectrum"), tertiary education ("tertiary", "university", "college", "higher education", "post-secondary"), online study ("online", "e-learning", "e-courses", "distance learning", "web-based", "digital learning"), and a focus upon documenting student experiences ("interview", "self-report", "survey", "questionnaire", "perspective", and "experience"). Search terms within each category were combined with the Boolean operator "OR" and the resulting combined categories with "AND". The search was restricted to articles in English.

### Review strategy

Electronic searches resulted in 690 records being identified (see Figure 1). Following removal of duplicates, the titles and abstracts of 594 articles were assessed against inclusion criteria by the primary rater; a random sample of 20% was double reviewed by a second rater who was blind to the first researcher's ratings. The double reviewing resulted in 100% agreement.

Where inclusion or exclusion could not be determined by the title and abstract alone, the full text was assessed by a primary rater (co-author LM), with all of these articles double reviewed by a second rater (co-author DA) blind to the other researcher's ratings. There were no disagreements at this stage. The data were extracted from the included articles by the primary and secondary raters. In addition, once studies were identified, an ancestral search was conducted of reference lists to ensure no relevant research had been missed. No additional studies were found, leaving four studies that met the criteria for the current review.

### Data extraction and synthesis

Data from the included articles were independently extracted by the primary and second rater and disagreements were resolved by both raters revisiting the article and discussing the information presented. There were no cases where a third rater was required to resolve disagreements. For each article, information recorded included details of the research team (including geographical location of study), sample characteristics (including diagnosis and course being studied), method of data collection, and key findings.

### Assessment of study quality

The studies were assessed to ensure they met a minimum quality standard. Case studies were appraised using the Centre for Evidence-Based Management (https://www.cebma.org/) checklists for critically appraising case studies or cross-sectional surveys (statistical analysis questions were excluded for studies which did not conduct statistical analyses). A global quality score was calculated for each article, giving one point for each item the article addressed up to a maximum score of 12, as reported in Table 1.

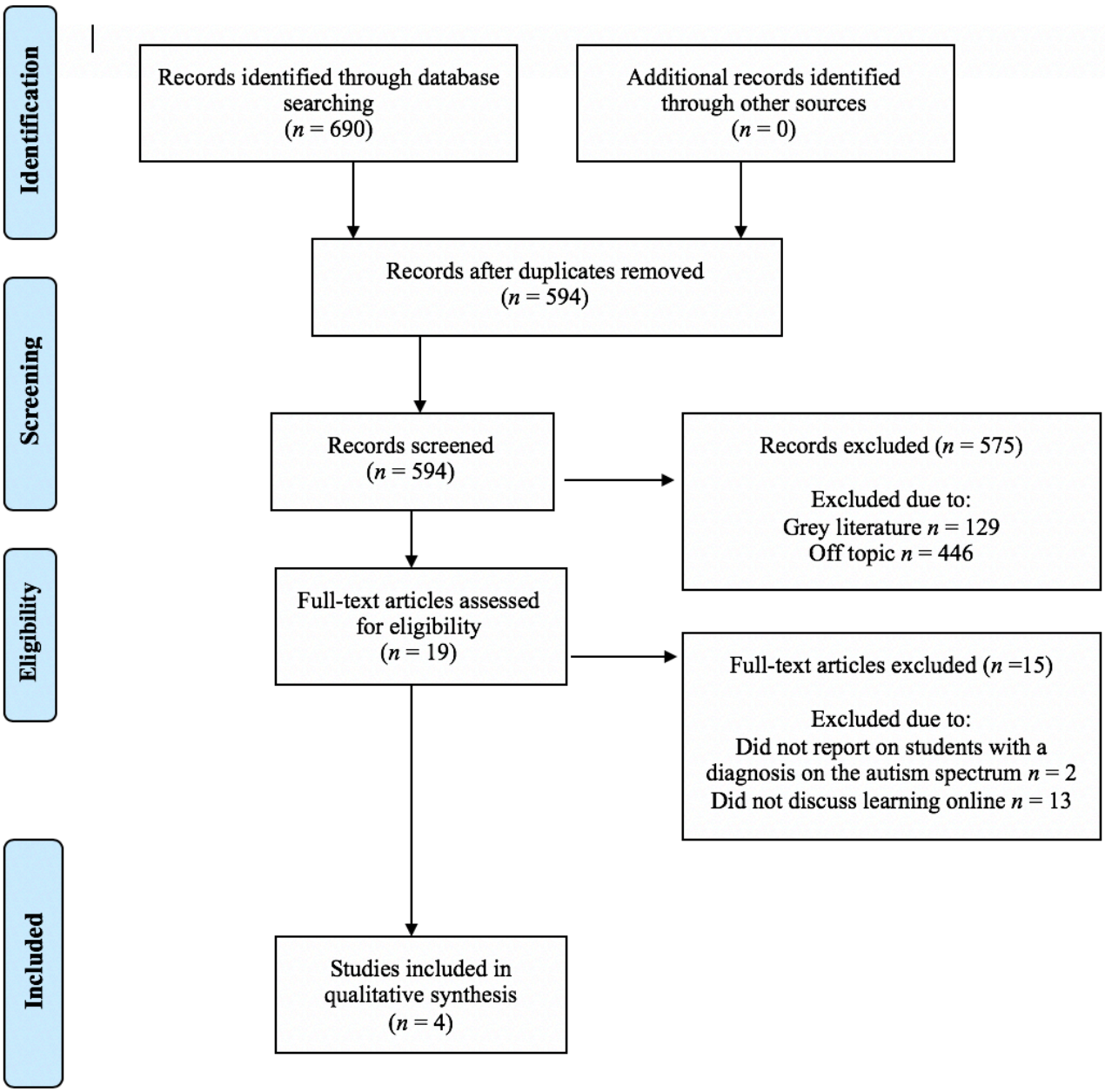


*Figure 1.* PRISMA flow diagram for results of systematic review

Table 1
*Studies included in the review*

| Study | Location | Study design | *N* (% male) | Age | Diagnoses | Courses studied | Quality score (max 12) | Key findings regarding online learning |
|---|---|---|---|---|---|---|---|---|
| Anderson, Carter, & Stephenson (2018) | Aus | OLQ | 48 (48%) | 17–24: 56%<br>25+: 42% | ASD: 100% | UG: 92%<br>PG: 8% | 7 | 39.6% (*n* = 19) of sample studied online. Of those, 47.4% (*n* = 9) preferred online study; 21% (*n* = 4) preferred traditional course delivery |
| Downing (2014) | Aus | CS | 1 (100%) | 33 | ASD | UG, VET | 5 | Student struggled when presented with multiple options or resources, found aspects of the online environment confusing and frustrating, expressed need for more clarity; listened to each recorded lecture 20 times and found them soothing |
| McDowell (2015) | UK | CS | 1 (100%) | -- | ASP | UG | 7 | Student exhibited some difficulties with face-to-face interactions but was successful in engaging in collaborative group work in an online environment and taking on a leadership role |
| Meyers & Bagnall (2015) | Aus | CS | 1 (100%) | 51 | ASP, ADD | UG<br>-- | 9 | Student reported high levels of disorientation in the online environment; feeling lost and having too many choices. This is described in terms of navigational disorientation, contextual disorientation, and procedural disorientation |

*Notes.* ADD: attention deficit disorder; ASD: autism spectrum disorder; ASP: Asperger's syndrome; Aus: Australia; UK: United Kingdom; CS: case study; OLQ: online questionnaire; UG: undergraduate; VET: vocational education and training.

## Study 1: Systematic review of literature describing the online learning experiences of university students on the autism spectrum – Results

The data extracted from the four included studies are summarised in Table 1.

### Research location, participants, and study design

The research from these four articles was conducted in two countries, with the majority of studies ($n$ = 3; 75%) being conducted in Australia and one ($n$ = 1; 25%) in the United Kingdom. The majority of studies ($n$ = 3; 75%) were reports on a single participant (hereafter referred to as a "case study") and reported on undergraduate students. The one study which reported on a cohort of students (Anderson et al., 2018) reported on a purpose-designed online questionnaire from both undergraduate and postgraduate students (albeit postgraduate students were only 8% of the total sample). Despite this focus on undergraduate students, two of the three case studies were mature students and 42% of Anderson et al.'s sample were over 25 years old. The three case study participants were all male. Anderson et al.'s sample, being 48% female, is not reflective of the gender ratio reported in recent systematic reviews of gender distribution in autism (males:females 3:1; see Loomes, Hull, & Mandy, 2017).

### Disclosure of diagnosis

The case study in Downing (2014) had not disclosed his diagnosis of autism to the university as he did not see it as a disability. Anderson et al. (2018) reported on a mixed sample of those who had and had not studied online, 25% of whom had delayed disclosing their autism diagnosis to the university, with reasons for delaying disclosure including wanting to try to manage university without support, not knowing how to disclose and/or the process of disclosing was too difficult, and not believing that disclosure was necessary.

### Online compared to face-to-face learning

All four studies compared the participants' experience of online learning to experiences of learning face-to-face. In Anderson et al.'s (2018) survey questionnaire, almost half (47.4%) of the 19 students with a diagnosis on the autism spectrum who were studying online preferred online study. In two of the three studies reporting on a single case study, the student felt that face-to-face learning provided clearer direction, which resulted in more confidence in the learning process. This is summarised through Meyers and Bagnall's (2015) case study stating "So, online learning doesn't give you the same degree of confidence that face-to-face learning does" (p. 212); and Downing's (2014) case study stating "On-campus I am shown what is to be learned and I am able to set about learning it. The paths are clear, efficient and not hidden behind e-portfolios, Wikis and Blogs" (p. 20). Both Meyers and Bagnall's and Downing's case studies highlighted that it was harder to seek clarification or ask questions of the instructor in the online environment compared to the face-to-face setting.

### Process of learning online

The case studies in both Meyers and Bagnall (2015) and Downing (2014) reported studying for long periods of time for their online courses, but not feeling as if they had studied efficiently. For Downing's case study, this could be due to getting distracted by items within the learning materials (e.g., spelling errors, conflicting dates), whilst for the case study by Meyer and Bagnall there were examples of navigational, procedural, and contextual disorientation.

The need for clarity in both instructions and presentation of material was highlighted within Meyers and Bagnall (2015) as well as Downing (2014). These two case studies explained that multiple links or options as well as multiplicity of resources can result in feeling lost and overwhelmed. As reported by Downing, their case study had "an overwhelming need for clarity and detail in the learning environment … it is imperative that it is clear what he is expected to do and what is optional … The critical requisite is the provision of sufficient detail for Steven to know the purpose and structure of each strategy" (p. 21).

### Use of online learning tools

The use of online learning tools varied among the case studies. Online discussion boards were discussed in all three case studies. Downing's (2014) case study identified difficulties in the asynchronous discussion boards due to becoming distracted by trying to understand the way the other students behaved. Meyers and Bagnall (2015) noted that their case study engaged in the university learning management system, the library, Google advanced search, and email, but did not use the discussion boards or forums. In contrast to these findings, McDowell (2015) noted that his case study was uncomfortable and withdrawn during the face-to-face learning observations, but when online, he was able to interact with his peers in the discussion boards.

## Study 2: The experiences of university students on the spectrum studying courses online – Method

### Recruitment procedure

Ethical clearance for this study was granted through the Griffith University Human Research Ethics Committee, approval number 2018/025. Students who identified as being on the autism spectrum and had studied at least one subject online during their studies were recruited through an announcement in the monthly university "research participation opportunities" email sent to all students of the university. Invitations to students were also sent through the "announcements" page of a range of online courses hosted within the research team's department.

The invitation to participate included a link to the online consent form and questionnaire. Participants completed the questionnaire online and could save and return to their answers over multiple sittings if needed. In total, 28 participants began the questionnaire online, but seven had to be excluded as they did not complete any questions beyond the demographics section.

### Participants

After exclusions, the sample consisted of data from 21 individuals who identified as being on the autism spectrum. The demographics of the sample are presented below in Table 2. Of note is that the sample was predominantly female ($n$ = 19; 90.5%), which is the opposite of the typical gender ratio in autism (see Loomes et al., 2017).

Table 2
*Demographic statistics*

| **Demographic** | | ***N* (%)** |
|---|---|---|
| Gender | Female | 19 (90.5%) |
| Age (years) | < 24 | 8 (38.1%) |
| | 25–34 | 5 (23.8%) |
| | 35–44 | 3 (14.3%) |
| | 45+ | 4 (19%) |
| | Prefer not to say | 1 (4.8%) |
| First or primary language | English | 18 (87.5%) |
| Current degree | Bachelor | 13 (61.9%) |
| | Master's | 4 (19%) |
| | Other | 4 (19%) |

### Measures

Participants completed questions about their demographic information, their reasons for studying online, disclosure of diagnosis and support received when studying online, their interactions with course staff and other students when studying online, their experience with the online learning materials, and their reflections on the skills which helped or hindered them in their online learning experience. They were also provided with screenshots of mock Blackboard course sites which differed in terms of the amount of information provided on the page (low, medium, high), the range of colours used on the page (low, medium,

high), and the number of non-content items (e.g., pictures) on the page (low, medium, high). The content of the questionnaire was informed by the combination of the results of the systematic review and the research team's experience of teaching online to students on the autism spectrum. The questionnaire was initially drafted by the research team and then reviewed by two postgraduate students who have a diagnosis on the autism spectrum. Their feedback, particularly around question clarity and response options, was incorporated to increase the accessibility of the questionnaire and the accuracy of the data being requested. Answer formats across the survey were free text, yes/no, multiple choice, or rated on a 5-point Likert scale. All questions were optional, so some participants did not provide responses to all of the questions. A copy of the survey is available in the Appendix.

Five participants opted into the open-ended questions stage of the study, all of whom chose to answer the questions using written responses (via an online survey tool). Questions for this section asked participants to share any barriers to and facilitators or enablers of their online learning that they experienced, their experience of the support provided by the university to online students, their reflections on differences between online and face-to-face learning, and the impact that their interactions with course staff, fellow students, and the learning tools had on their online learning experience.

## Study 2: The experiences of university students on the spectrum studying courses online – Results

### Online learning

The number of courses that participants had studied online in the past 3 years varied, with seven (33.3%) studying 1 or 2 courses, three (14.3%) studying 3 or 4 courses, five (23.8%) studying 5 or 6 courses, and three (14.3%) studying 7 or more. Eight (38.1%) participants noted that they had had to withdraw from at least one online course before completion. The reasons selected for studying their course online varied – the most common reasons selected were flexibility of time (71.4%), course availability (57.1%), flexibility of location (52.4%), less face-to-face interaction (38.1%), and learning more effectively online (19%).

Only four (19%) participants stated that they had disclosed their diagnosis of autism to the university. Three of these participants noted that they did not disclose their diagnosis immediately upon enrolling but disclosed after attempting their online study. Reasons given for not disclosing were that they did not want or need any support ($n$ = 4), they did not think it would help ($n$ = 3), or they did not know how to disclose a diagnosis when studying online ($n$ = 2).

### Interactions with course staff and instructors

Most participants ($n$ = 14; 66.6%) reported that interactions with their instructor were important to their online learning. Students tended to interact with their instructors via email ($n$ = 16; 76.3%) or discussion boards ($n$ = 11; 52.4%) rather than on the phone ($n$ = 2; 9.5%). Not all participants felt that they were able to contact their instructor when needed, with participants reporting a particular difficulty with informing the instructor if problems arose ($n$ = 5; 23.8% only being able to do this *some of the time* to *rarely*/*never*) or expressing opinions ($n$ = 5; 23.8% only being able to do this *some of the time* to *rarely*/*never*).

### Interactions with students on the course

Approximately half ($n$ = 10; 47.6%) reported that interactions with other students were important to their own online learning. The most common way to interact with other students was via discussion boards ($n$ = 12; 66.1%) and email ($n$ = 7; 38.9%). Some participants reported that they were only able to interact with students *some of the time* to *rarely*/*never* to provide help ($n$ = 7; 33.3%), ask for help ($n$ = 5; 23.8%), and to express opinions *some of the time* to *rarely*/*never* ($n$ = 6; 28.6%).

### Interactions with learning materials and course site

A notable proportion of students reported having difficulties with the amount of information presented on the page ($n$ = 6; 37.5%), navigating their Blackboard course site ($n$ = 6; 37.5%), and working out the weekly

content of the course ($n$ = 5; 31.3%). Most participants ($n$ = 10; 66.6%) reported that they preferred to have information presented in small chunks of content.

In addition to the survey and additional open-ended questions, students were asked to provide feedback on screenshots of three mock course sites provided to them, each of which had the same learning activities but, as noted in the Method section, were low, medium, or high in the amount of additional text, colours, and images on the page. Students were most positive about the sites which had the least visual or text distractions, with comments such as "This is the best image. It's not cluttered. I can clearly see the tasks that need to be completed". Two participants did not like the red colour of the icons, with one noting that they associated it with stop or danger. They found the page with the highest quantity of additional text and images more difficult to navigate, with comments such as "This is the worst image. Too much text, too many colours, too busy"; "This is too busy/crowded"; and "This page is way too busy with words." A number of participants commented that they were not entirely clear in what order they had to do the tasks, a comment that was made across all three images, regardless of the quantity of text or images provided.

### Barriers to and facilitators or enablers of online learning

When asked about barriers to online learning, participants listed tutors not being visible in discussion boards, the inability to get immediate answers to questions when studying, and the disconnect between the description that online learning is "flexible" and the high amounts of work and specific deadlines for assessments. When asked about what aspects of online learning worked well for them, multiple participants noted the ability to pause videos and rewatch videos whilst taking notes, the ability to work at times convenient to them, and the incorporation of discussion boards.

### Skills used in learning online

Of the 14 participants who provided responses to the questions about the skills required for online learning, only four (28.5%) *agreed* or *strongly agreed* that they learnt better online than face-to-face. Five participants (35.7%) *agreed* or *strongly agreed* that they managed their time well each week and across the trimester when learning online, and seven (50%) *agreed* or *strongly agreed* that they were able to keep up with the course schedule for the online learning. In contrast, seven (50%) *agreed* or *strongly agreed* that they had difficulties in monitoring their own learning.

### Additional information from participants in responses to free text questions

Students noted some aspects which aided their online learning, including quick responses from their lecturers for questions and queries and active tutors in the discussion boards, the use of online tests to reduce anxiety and sensory stimulation, provision of clear rubrics to help align the assessments to the marking criteria, short videos with the slides available to download and annotate, and the provision of a timetable for the trimester which highlights progress required and when certain activities are due. Several participants noted that whilst they did not contribute to the discussion boards (with one specifically stating that this was due to their anxiety), they gained benefit from observing the discussions of other participants with the instructor.

## Discussion

This study sought to investigate the experiences of students on the autism spectrum studying online at university to gather evidence upon which some key principles of online learning design could be developed and shared with colleagues to maximise successful outcomes for students on the spectrum. By conducting a systematic review and using this to inform the results of the questionnaire study, we were able to synthesise the current available peer-reviewed literature, use this to inform the design of the questionnaire study, and explore the common themes reported in the results of the questionnaire with the previous reported studies. This comprehensive method has generated additional evidence from which to suggest recommendations for online course design and delivery for students on the autism spectrum.

The systematic review (Study 1) identified that the experience of online learning for university students with a diagnosis on the autism spectrum is an under-researched area, with the majority of studies to date reporting on single cases and on undergraduate samples. The questionnaire study (Study 2) examined the

issues above and added to the limited literature by recruiting a cohort of students on the spectrum who have experienced studying online across both undergraduate and postgraduate settings. The findings from the questionnaire study reveal the importance of not making assumptions regarding online learning for students based simply upon the stereotypes of a diagnosis. For example, despite the characteristic differences or difficulties in social communication and the finding that many individuals have strengths in using technology (Odom et al., 2015), fewer than 40% of the students chose to study online due to the reduced social interactions, and fewer than 20% chose online learning because they believed they learn more effectively online. Although there was no control group within this study to compare between those with and without a diagnosis on the spectrum, the most highly endorsed reasons for choosing to study online (flexibility of time and/or location and course availability) are similar to those reported by neurotypical university students (Bailey, Gosper, Ifenthaler, Ware, & Kretzschema, 2017; Henry, Pooley, & Omari, 2014).

Analysis of the questionnaire results supported the findings of the case studies in the systematic review and suggested some common outcomes. The students on the spectrum in both Study 1 and Study 2 reported that they felt disoriented in the online learning environment in relation to navigation, context, and procedures; they struggled with too many options; and they wanted more clarity about both order of tasks and the tasks themselves. While the broader research literature has identified many of these elements as critical design factors when constructing a successful online learning environment for all learners, the elements exert a different magnitude of importance (and therefore level of influence) on the experience of students on the spectrum because of the effect the combined social communication difficulties and possible mental health conditions (such as anxiety) have on their capacity to respond to them. Therefore, when working towards digital equity, instructors should consider not only the presence but also the impact of each aspect of their course design.

Clearly, good practices and principles of online learning environments are applicable to both students on the spectrum and neurotypical students; however, the following three design factors were identified in this study as essential components of effective course design for students on the autism spectrum: (a) curriculum alignment; (b) interaction plans, opportunities, processes, and supports; and (c) course site design. The following discussion should of course be interpreted with knowledge of the limitations of both this study and the four previous studies undertaken in this area: small sample sizes ($n$ = 1 up to $n$ = 48), a lack of control or comparison group, and the lack of statistical comparisons when exploring the data.

### Curriculum alignment

Surveyed students' need for improved clarity suggests that the principles of constructive alignment (Biggs & Tang, 2011) have to be made visible down to the learning activity level so that students with different learning profiles (which of course encompasses all students, not only those on the spectrum) can "connect the dots" between the learning outcomes and assessment tasks, and how the learning activities are going to get them there.

Responses to questions related to the principles of constructive alignment showed that:

- over 35% of students surveyed reported they had problems identifying which parts of the online content were most important;
- more than 70% felt that clarification of content by instructors aids their online learning; and
- 80% found it helpful when the instructor communicated links between content across the weeks or modules.

Aligning the components of the course (course learning outcomes, learning activities, and assessment) and reinforcing how they work together to support students' construction of meaning will, therefore, assist students organise their work, prioritise tasks, and stay on track.

### Interaction plans, opportunities, processes, and supports

Results from both the systematic review and the questionnaire study showed that interactions with instructors and students are of significant importance to those surveyed and, dependent upon the form and frequency of these interactions, can be experienced as a barrier to or facilitator and/or enabler of successful

learning. It is useful, therefore, to consider these findings in concert with broader research on the impact that interaction patterns have on the learning experience.

Finch and Jacobs (2012) identified four types of interaction as the "basis for development of a collaborative learning community": student-to-online delivery system, student-to-content, student-to-student, and student-to-instructor (p. 548). The community of inquiry framework (Garrison, Anderson, & Archer, 2000) posits and explores the factors critical to a successful blended or online learning community. Interactions described by Finch and Jacobs make possible the combination of social, cognitive, and teacher presence that an online learning community of inquiry requires. The results of this study nevertheless showed that interaction with instructors and peers could either form a barrier to learning or become a facilitator and/or enabler. For example, participants listed an instructor's visible absence from communication and interaction forums such as discussion boards as a barrier to their learning, whereas receiving prompt responses to queries through that same communication channel was listed as an enabler. Student-to-student interaction could also be either a barrier to or an enabler of learning. An example was provided where the student on the spectrum became distracted from the purpose of the collaborative task by focusing instead on the behaviour of the other students (and trying to work out why they said what they did) rather than concentrating on the sharing of, and reflecting on, ideas. Results illustrated, therefore, that these interactions are of considerable importance to the success of their learning and that the interaction plan for a course will have important implications for student outcomes.

Knowing whether particular styles of interaction are going to support learners or create unintended barriers is a challenge to instructors, which can be significantly reduced if students feel able to disclose their needs. Responses to this study indicated, however, that difficulties with self-advocacy (which are frequently reported for individuals on the autism spectrum) may have impacted upon disclosure of diagnosis to the university, as some participants stated that they did not know how or where to disclose when studying in an online setting. Within university settings, students are expected to advocate for themselves. It has been suggested that some students on the spectrum would benefit from support or mentoring to develop their self-advocacy skills during their time at university (Adreon & Durocher, 2007). A systematic review of experiences and supports for students on the spectrum attending university in a face-to-face setting noted a range of support schemes, including peer mentorship programs, assigned counsellors, aides, or liaisons, and parental involvement (Gelbar et al., 2014). However, without disclosing their diagnosis or attending the physical campus of the university, students on the spectrum may not be able to access such support, resulting in a vicious cycle. It may be that non-formal methods of support may be easier for students to access, highlighting a need for more research into this area.

### Course site design

The online learning course site is the medium through which students engage with content, instructors, and peers. Within the learning design, therefore, an interplay between the structure of the curriculum, how content is presented to students, the opportunities for interaction, and the messaging to students in the learning design is necessary. In this study, factors that enabled learning or made learning more difficult were identified, indicating that common design practices across the sector may have unintended consequences for students on the spectrum by creating barriers to learning and embedding digital inequities. Students without autism may be able to overcome certain difficulties (which to them are minor), whereas for students on the spectrum those same design practices can have a large impact on how successfully they can engage and learn online. Results suggest, for example, that too much "stuff" on a page can become seriously overwhelming to the point where students cannot choose what to focus on. Punctuation and grammar (e.g., a misplaced colon) can distract and detract from learning. Conversely, students on the spectrum in this study reported that breaking large quantities of material into manageable chunks (such as recorded mini lectures) enabled them to more easily pause, review, and take notes at their own pace. Admittedly, this is a practice that could benefit all students.

The types of online tools deployed within a course site were found to have potentially unintended consequences for students on the spectrum. Even though they generally reported few problems using the common tool set, if an issue does arise, they may not feel able to approach the instructor or the university's technical support team to seek help due to the symptomology of their condition.

### Limitations

The small number of articles revealed by Study 1, the small sample sizes of previous research, and the focus of Study 2 being on only one university limits the generalisability of the findings. The information identified in this systematic review may be complemented by a broader scoping review which aims to identify additional research and findings from the grey literature.

While we have situated this research in the broader field of online learning enquiry, further research to extend the sample size of participating students on the spectrum would be a valid undertaking, as would conducting the survey and questionnaire with a student cohort who are not on the autism spectrum. This would enable us to directly compare responses to the same questions to determine similarities and differences and make strong recommendations for practice.

### Implications for practice

There are specific challenges to successful online learning for students on the spectrum, but there are teaching strategies and practices that can reduce the unintentional barriers to learning that occur. Designing successful online learning for students on the autism spectrum requires the consideration of both good design principles and an appreciation of how the implementation of the course design can impact students' capacity to respond to the academic demands due to factors such as communication difficulties or feelings of disorientation brought about by too many options from which to choose.

As discussed earlier, the quality of online learning is firmly linked to the connection between students, content, and instructors. It is through interactions and instruction that content becomes relevant (Hill & Lawton, 2018). Hence, the community of inquiry framework (Garrison et al., 2000) may be a useful design principle to consider due to the way in which it conceptualises the need to create balance between all components of a course design: through the convergence of social presence (environment of trust, open communication, and group interaction), cognitive presence (where students make meaning), and teaching presence (design, facilitation, and direction of the learning community in both synchronous and asynchronous modes).

As the meaning and implications of the evolving nature of digital inequity are considered, there has been a long-recognised need (Gorski, 2009) for professional learning to be provided to assist instructors in designing both progressive and pedagogically appropriate digital learning spaces. A key outcome of this study has been the creation of "actionable knowledge" that can be shared with colleagues to assist them in their design processes. Rather than relying on face-to-face workshops, the project team designed a suite of just-in-time resources (tip sheets) and a professional development video that can be used at any time during the design lifecycle of a course, focusing on the following themes: student-to-student interaction; instructor- or teacher-to-student interaction; learning approaches; using online tools; and visual presentation of information. These can be accessed for free via https://app.secure.griffith.edu.au/exlnt/entry/8008/view. An online professional learning video resource outlining the reasons for the project and the outcomes to date has also been developed.

## Conclusion

Within an online learning environment, there is a high risk of invisibility of students who may have differences or difficulties with the online learning experience. The heterogeneity of skills, abilities, and needs of students on the spectrum, combined with a low rate of disclosure for diagnosis, means that instructors need to be proactive in developing online learning environments which are considerate to (or ideally supportive of) these diverse profiles and which reduce the heightened risk of academic or personal failure for students on the spectrum. Study 2 has facilitated the identification of common design elements that can be either beneficial or problematic for all students, regardless of diagnosis. Importantly, it has also enabled us to identify the presence of challenges that are unique to students on the spectrum that will need to be addressed if we are to overcome a potential digital inequity. Focusing on this cohort of students has illuminated not only the broad good practices and principles required, but also the nuances needed in our response to the design imperative of good online course delivery.

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# Appendix – Online learning for university students on the autism spectrum: A systematic review and questionnaire study

**Questions administered through online survey**

**Background: This section asks questions about yourself, your personal background, and study status. Please answer the following as honestly as possible:**

1) What is your gender?
- Male
- Female
- Other

2) What is your age in years?
- under 24 years
- 25-34 years
- 35-44 years
- 45-54 years
- 55-64 years
- 65 years or older

3) Have you received a diagnosis of any of the following? Select all that apply.
- Autistic Disorder
- Autism Spectrum Disorder
- Asperger Syndrome
- Other (please specify)
- Self-diagnosis on the autism spectrum

4) Is English your main language?
- Yes
- No

5) What is the highest level of education you have **completed?**
- High school
- Bachelor's Degree
- Graduate Certificate
- Graduate Diploma
- Masters
- PhD
- Other

6) What degree are you **currently** studying?
- Bachelor's Degree
- Graduate Certificate
- Graduate Diploma
- Masters

7) How many online courses/subjects/units at university have you enrolled in during the past 3 years?
- 1 or 2
- 3 or 4
- 5 or 6
- 7 or more

8) Did you withdraw from any of these subjects before completion?
- Yes
- No

9) What was the name of the degree(s) that your online course(s) form part of? (please specify)
<Free text>

10) Why did you choose to study online rather than face-to-face? Select all that apply.
- Flexibility of time
- Flexibility of place
- Reduced travel time
- Learn more effectively
- Less face to face interaction
- Course availability
- Geographical location
- Other

11) Have you formally disclosed your diagnosis to the University?
- Yes
- No

12) If no, please indicate the reason for this decision.
- I did not think it would help
- I did not know I could
- I did not know how to do this
- I did not need any support
- I did not want any support
- I had a negative experience after previously disclosing
- Other (please specify)

13) If you disclosed your diagnosis, did you receive any support/adjustments in relation to your diagnosis for your online study?
- In all units
- In most units
- In some units
- In no units of study (Please list reason(s) why you did not receive any support/adjustments in relation to your autism for your online study <Free text>)

14) If you have received supports/adjustments were these adequate and appropriate?
- Yes always
- Yes mostly
- Yes sometimes
- No rarely
- Not at all

**This next section asks questions about your interactions with your university course instructor while studying online. The term 'instructor' refers to the person you had the most contact with. Please select one instructor from your most recent course. This may have been the instructor or the tutor. Please answer the following as honestly as possible:**

15) Interactions with my instructor were important to my online learning

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly agree | | | | Strongly disagree |

16) How did you communicate with your instructor? (Tick all options that you use)
- Email
- Phone
- Discussion thread
- Chat board (e.g. Yammer)
- Video call
- Other (please specify)

17) I was able to contact my instructor when needed/required

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Always | | Some of the time | | Rarely/never |

18) What factors supported the interactions between you and your instructor to aid your online learning? Select all that apply.
- Instructor availability (e.g. email, phone)
- Instructor clarification of content (e.g. response to questions, comments on discussion board)
- Instructor feedback on assessment tasks
- Instructor flexibility in course delivery
- Instructor support when requested
- No nothing
- Other (free text)

19) Is there anything else the instructor could have done to support interactions to aid your online learning? Select all that apply.
- Instructor availability (e.g. email, phone)
- Instructor clarification of content (e.g. response to questions, comments on discussion board)
- Instructor feedback on assessment tasks
- Instructor flexibility in course delivery
- Instructor support when requested
- No nothing
- Other (free text)

**While studying online, if needed/required I was able to**

20) Ask my instructor questions

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Always | | Some of the time | | Rarely/never |

21) Inform the instructor when unexpected problems arise

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Always | | Some of the time | | Rarely/never |

22) Initiate discussions with the instructor

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Always | | Some of the time | | Rarely/never |

23) Express my opinions to the instructor

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Always | | Some of the time | | Rarely/never |

24) Seek help from the instructor when required

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Always | | Some of the time | | Rarely/never |

25) Share any concerns I might have regarding my progress with the instructor

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Always | | Some of the time | | Rarely/never |

26) Ask the instructor to clarify information or learning materials if they are not clear to me

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Always | | Some of the time | | Rarely/never |

**Interactions with other students during online learning: This next section asks questions about your interactions with other students while studying online. Please answer the following as honestly as possible:**

27) Interactions with other students in my course were important to my online learning

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly agree | | | | Strongly disagree |

28) I was able to interact with other students as part of my online learning when needed/required

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Always | | Some of the time | | Rarely/never |

29) What was your preferred method of interacting with other students? Select all that apply.
- Email
- Phone
- Discussion thread
- Chat board (e.g. Yammer)
- Video call
- Other (please specify)

**If needed/required for my online learning, I was able to**

30) Participate in online discussion (e.g. collaborate sessions)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Always | | Some of the time | | Rarely/never |

31) Express my opinions to other students about the course content (e.g. yammer, discussion boards, blogs)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Always | | Some of the time | | Rarely/never |

32) Respond to students' comments about course content (e.g. yammer, discussion boards, blogs)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Always | | Some of the time | | Rarely/never |

33) Provide help to other students about course content

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Always | | Some of the time | | Rarely/never |

34) Request help from others about course content

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Always | | Some of the time | | Rarely/never |

**Your experience with the content and course site in online learning: This section asks questions about how you experienced the content and course site while studying online.**

**Please read through this list and let us know which of these systems you have used, and if you have encountered problems with these systems:**

| | Not used | Don't know if I have used this | Used with no problems | Used with minor problems | Used with major problems | Unusable due to problems |
|---|---|---|---|---|---|---|
| 35) Learning @ Griffith? | | | | | | |
| 36) Facebook? | | | | | | |
| 37) Twitter? | | | | | | |
| 38) Echo 360/Echo Centre? | | | | | | |
| 39) PDFs? | | | | | | |
| 40) Zoom? | | | | | | |
| 41) Pebble Pad? | | | | | | |
| 42) Referencing Tool? | | | | | | |
| 43) Griffith Collaborate? | | | | | | |
| 44) You Tube? | | | | | | |
| 45) Griffith library website and database | | | | | | |

46) If you had problems using these systems, what caused those problems? (select all that apply)
- No problems
- Course site e.g., Learning @ Griffith difficult to navigate
- Lack of ease finding the weekly/module content
- Amount of material presented on the page is too much e.g., text, video, readings
- Technical skills required
- Other (please specify)

**Your own skills used for online learning: This section asks questions about your own skills that you used while studying online. Please answer the following as honestly as possible using the scale from 1 (Strongly agree) to 5 (Strongly disagree).**

47) I learn better through online learning than face-to-face learning

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly agree | | Neutral | | Strongly disagree |

48) I manage my time well each week for studying online

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly agree | | Neutral | | Strongly disagree |

49) I plan my time efficiently across a trimester/semester when studying online

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly agree | | Neutral | | Strongly disagree |

50) I identify what parts of the online content are the most important for each week or module

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly agree | | Neutral | | Strongly disagree |

51) I find it helpful when the instructor makes clear links between the content across the weeks or modules

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly agree | | Neutral | | Strongly disagree |

52) I independently keep up with the course schedule for my online learning

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|

Strongly agree Neutral Strongly disagree

53) I independently keep track of my progress toward assessment completion

1 2 3 4 5

Strongly agree Neutral Strongly disagree

54) I structure my assignments according to the instructions and criteria provided by the instructor

1 2 3 4 5

Strongly agree Neutral Strongly disagree

55) I find it important to have information presented in small chunks of content

1 2 3 4 5

Strongly agree Neutral Strongly disagree

56) Taking responsibility for monitoring my own learning is difficult

1 2 3 4 5

Strongly agree Neutral Strongly disagree

**<PAGE WITH IMAGES OF EXAMPLE COURSE SITES ETC>**

For each of the images below, please describe what is good about the course site and what you do not like. Please feel free to comment on the layout, amount of information presented, use of images and colour.

**Your own personal experiences: This section asks you to provide us with some information regarding your own personal experiences of studying online and the strategies, supports, and/or approaches you used. Please provide a written answer to the following questions:**

57) What aspects of online learning work well for you? If nothing about online learning works well for you, write "nothing".
<Free text>

58) What were barriers to your online learning? If you didn't find anything about online learning difficult, write "nothing".
<Free text>

59) Are there strategies, supports, or approaches have a negative impact on your learning when studying online? If so, please describe them. If nothing, write "nothing".
<Free text>

60) Are there strategies, supports, or approaches have a positive impact on your learning when studying online? If so, please describe them. If nothing, write "nothing".
<Free text>

Thank you very much for completing this survey. If you wish to make any additional comments, please do so in the box below.
<open answer>