Evaluating and expanding usability and user satisfaction of an online research portal

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Whilst online learning has gained rapid momentum, the development of online technology and practices that support the delivery of online courses with a large research component has been slow. In 2017, the School of Psychological Sciences at Monash University, Australia, developed a potentially scalable and transferable online research portal. This is an all-in-one platform that is designed to facilitate and support online research and research supervision, for supervisors and students. The research portal has evolved to currently provide research and research supervision support to over 700 online psychology students at the university. This paper describes the development, implementation and impact of the research portal and presents data from a preliminary evaluation of its usability and user satisfaction. Both research students and supervisors from the fully online fourth-year Graduate Diploma of Psychology Advanced program at Monash University participated in a series of focus groups, individual usability testing sessions, and surveys, and reported favourably on the research portal's research supervisor and supervisee user satisfaction and usability. Qualitative and quantitative feedback provided useful information supporting research portal improvement and expansion possibilities, allowing an increasingly valuable contribution to online research supervision, research and research teaching.

Implications for practice or policy

- All research students will be able to complete their research-related professional training online.
- Research supervisors and students will be able to access a standardised best practice online research supervision and research tool across courses and topics.
- Course leaders will be able to expand online education with an online research supervision and research tool that supports all research programs.
- Universities will be able to provide a research learning pathway for all students.

Keywords: digital technologies, online research, online research platform, research portal, research supervision, virtual laboratory, web-based research platform

Online education has a long history. The arrival of the COVID-19 epidemic accelerated, rather than caused, the growth of popularity of online courses (McKenzie & Garivaldis, 2022). This growth has seen a shift of

online education to the mainstream and is expected to continue into the future (Archambault et al., 2022). The online learning industry is now projected to pass US $457.8 billion by 2026 (Globe Newswire, 2021). A primary reason for this demand is the greater flexibility that online education offers (Stöter & Bullen, 2014), which is needed for students who now lead more complex lives and often manage demanding jobs as well as family commitments (Latchem, 2018). For institutions, key drivers to help explain this growth of online education are the economic benefits of being able to respond to education demands that exceed on-campus teaching capacities, reduced costs (Lehmann, 2018) and the growing value of lifelong learning (Thwe & Kálmán, 2013).

There is often an assumption that the transition to an online environment can be effectively applied to all courses, and there is little consideration given for the types of courses that are most suited to online learning Abuhassna et al., 2020). In reality, this transition presents a number of complex and difficult challenges (Ndibalema, 2022; Zhao & Xue, 2022), including best utilising the full potential of the evolving online education modality whilst preserving ongoing pedagogical best practice principles (Garivaldis et al., 2022). For good reason, there is evidence of the paucity of online courses in architecture, science, engineering and creative arts (Latchem, 2018). Fortunately, actual and perceived barriers to the expansion of online education are increasingly being challenged and overcome. There is an increasingly wide range of courses, including practice-focused and research-focused courses and course components, which are being successfully developed and implemented in online environments (McKenzie et al., 2022).

Psychology is a discipline which has been very suitable for online delivery and online psychology courses are now very broadly offered, particularly in the undergraduate space (Fox. 2018). In the postgraduate space, there are fewer fully online psychology courses, presumably because of the persisting barriers to delivering fully online research courses and research supervision support. In Australia, fourth-year psychology programmes are the first in a series of studies that form a necessary pathway to registration as a psychologist, and these programmes require their students to conduct original research. With a growing demand for mental health professionals in recent times, there is an increasing need to offer online courses which include a substantial online research component, and which fully support online research including with flexible and optimal research supervision as well as research capacities. These capacities are increasingly necessary in an increasing number of courses that need to include a research component, to enable students to qualify to practise in a broadening range of professional areas, including by achieving the research skills that students of these practice-related professional areas are increasingly expected to attain.

A significant challenge for courses offering a large research component, typically accounting for up to 50% of the course and requiring intensive one-on-one student-supervisor interactions, is the need to provide high quality and face-to-face equivalent research supervision for a large and diverse student body, made possible by the online education mode (McKenzie et al., 2022). As technology advances, web-based platforms can increasingly meet this need by optimally facilitating online research and research supervision. There is a lack, however, of specifically developed online systems that allow high level and broad digital support of online research, research courses and research supervision, including in psychology. Moreover, of the systems that have been developed, there is a lack of documented usability and feasibility testing, which is vitally needed to provide evidence of their utility and usability.

There are barriers to achieving best possible online research supervision practice just as there are barriers to achieving best possible online education in courses with research components, and for achieving best possible online education in general. These barriers include the challenge of achieving online equivalence with traditional research supervision where the research student is in close physical proximity to the research student (Aziz et al., 2022). An optimal online research supervision and research supporting system therefore needs to support an optimal online coming together of research supervisor and research student, which is as fully equivalent as possible to face-face contact. This will allow an expanding of the potential value of online research supervision which is equivalent to the expanding potential value of online education in general.

As well as allowing an expansion of courses and course types that can be offered online, the development of optimally effective online research supervision capacities and practices allows an expansion of research student opportunities, including by giving them access to research supervisors who are not in close physical proximity to them (Kumar et al., 2020). To help research-related education transition to a paradigm shift in the way that research supervision and research are conducted (e.g., Palmer & Gillaspy, 2021), we developed and evaluated a comprehensive and integrated research supervision and research enabling system.

The Monash University research portal

From 2016 to 2017, the School of Psychological Sciences at Monash University developed an online research portal (https://www.monash.edu/research-portal). This is a fully online research and research supervision front end and an integrated total research environment. This is a one-stop shop that provides a comprehensive range of research capacities including research supervision which are needed to conduct, learn and supervise research online. Originally designed to cater for psychology students in their fourth year of study and their need to complete a large empirical research project (approx. 12,000 words), the research portal is potentially scalable and transferable to other courses with similar research and research supervision requirements, and to other tertiary institutions.

The research portal provides specific step-by-step guidance and support of the research process (i.e., supervision, planning, literature review, methodology, recruitment, analysis & write-up) and houses a complete suite of applications that allow research projects to be supervised and completed fully online. For the majority of students at fourth-year level, it will be the first time that they undertake a large-scale research project. Providing guidance and support at every stage throughout the research journey therefore facilitates timely project completion and reduces research supervision loads. Content and capacities which are common to all projects (e.g., attending supervision meetings, submitting an ethics application, recruiting participants) are centrally and efficiently provided in a dynamic and easy-to-use online environment for all students within the research portal. Its features are described in Table 1.

Table 1
Research portal features and descriptions

Feature	Description
Research supervision tools:	The research portal includes a total online research supervision capacity, which is systematically integrated with a research supporting capacity. This includes incorporation of the Zoom communication platform, to provide optimal capacities for students and their supervisors to schedule, conduct and record project meetings. This online conferencing system and its research supervision supporting features was included within a one-stop research environment, which also included the *LabArchives* electronic workbook. This feature of the research portal allows research students and their supervisors to store and share detailed research project notes and information including secure data and drafts. using the. Research data and documentation can be hierarchically shared between research supervisors, individual and groups of research students and internal and external collaborators in a single, intuitive framework. These research supervision capacities of the research portal support shared decision-making and shared use of all aspects of the research portal's comprehensive research support system.
Research participant recruitment resources:	Access to national and international participant databases (SONA, CloudResearch, & social media recruitment strategies)

Information and education resources:	A range of resources and information on research in general and on university-specific research projects is available in the research portal, which supports each of the components of a research project, including identifying a research topic, obtaining ethics approvals, selecting measures, selecting participants, collecting and managing data, analysing data and writing a report.
Virtual laboratory (vLab):	This unique and purpose-built feature of the research portal allows its users to select and/or create measurement tools and to acquire research data by conducting and contributing to the development of online experiments, surveys, and databases. The vLab provides an integrated environment for data collection, analysis and storage and includes a suite of research applications: • Quantitative analysis: SPSS, Matlab, SAS, R, RStudio • Qualitative analysis: NVivo • Survey administration: Qualtrics • Experiment administration: Inquisit Lab, Inquisit Web

Whilst the research portal has made possible the first fully online psychology course with a substantive research component – the Graduate Diploma Psychology Advanced (GDPA) – it has also been adopted by the on-campus equivalent of this course, the honours course. A vital step towards the expansion of any resource such as this involves conducting an evaluation of its utility and useability. An evaluation of the research portal was therefore conducted to comprehensively test its usability and user satisfaction.

Method

The evaluation of the research portal comprised an assessment of user satisfaction, usability and engagement. These components of the user experience meet the first two stages of the new world Kirkpatrick model of evaluation (Kirkpatrick & Kirkpatrick, 2016): user reaction and user learning. Over a period of 9 months, research students and supervisors from the GDPA – the portal's primary users – participated in structured focus groups and individual one-on-one usability testing sessions and completed online surveys administered at the end of each of the three research units (subjects) of their course, which the research portal was supporting. The specific study procedures, measures and participant characteristics are outlined below. Data was collected over a total data collection period of approximately 12 months between 2017 and 2018. This project received full ethical approval from the Monash University Human Research Ethics Committee (HREC project number: 10835).

Participants

Students enrolled in, and research supervisors employed by, the GDPA fully online psychology course were eligible to participate in the research portal evaluation. GDPA research students were recruited from each of its three research project units (subjects):

- PSY4402: Psychology Research Project: Literature Review
- PSY4403: Psychology Research Project: Methodology and data collection
- PSY4404: Psychology Research Project: Results and Discussion.

Recruitment for the evaluation (i.e., the focus groups, usability testing sessions and satisfaction and usability survey) occurred via email invitation. A sample of 23 participants (15 students & 8 research supervisors) was obtained for the focus groups and usability testing sessions, considered acceptable for generating reliable user perspectives (Nielsen, 2000). In addition, 63 participants (55 students & 8 research supervisors) were recruited for the usability and satisfaction survey.

To maintain anonymity, personal identifying information for the small sample of participants in the focus groups and usability testing were not recorded. The demographics of the participants of the satisfaction and usability survey, are presented in Table 2. As expected, there was a large proportion of female

students (89.1%) and a large age distribution (approx. 20–65 years), with the majority (76%) aged between 20 and 35 years. Psychology courses are known to have a higher proportion of females (Sander & Sanders, 2007) and also, as online courses offer greater flexibility than on-campus offerings, online student cohorts tend to have a wide age distribution (Patterson & McFadden, 2009). As such, the sample is typical and considered representative of an online psychology student cohort.

Of the eight recruited research supervisors, the majority (62.5%) were female (and their ages ranged from 25 to 50 years. Past and current usage of the research portal was high, with all supervisors using it at least sometimes or, usually, more frequently. A total of 20% of students rarely accessed it, with two students (3.6%) indicating that they had never used it; therefore, their data was excluded from the analyses.

Table 2
Characteristics of participants in the usability and satisfaction survey

	Supervisors (*n* = 8)	Students (*n* = 55)
Gender (%)		
Female	62.5%	89.1%
Male	37.5%	9.1%
Other	-	1.8%
Age (%)		
20–25	12.5%	27.3%
26–30	12.5%	27.3%
31–35	25%	20%
36–40	-	10.9%
41–45	25%	7.3%
46–50	25%	3.6%
51–55	-	1.8%
61-65	-	1.8%
Research portal use (%)		
Frequently	25%	36.4%
Sometimes	50%	21.8%
Every once in a while	25%	18.2%
Rarely	-	20%
Never	-	3.6%

Procedure

Focus groups and individual usability testing

After obtaining their informed consent, participants attended a 1.5-hour online focus group followed by a 45-minute individual usability testing session. During the focus groups, all participants were given a brief tour of the Monash Psychology research portal, including its vLab, and were then prompted to share their thoughts regarding features of the platform. Participants were also asked to provide feedback on the visual and organisational aspects of the platform and to suggest areas for improvement. Specifically, focus group participants were asked to consider questions such as the following: What is important for students to be able to conduct high-quality research online? Do you think the research portal improves the research learning experience?

Following the focus groups, participants completed a 45-minute one-on-one usability testing session where they were asked to perform a series of structured tasks within the research portal using the think aloud technique (Davison et al., 1997), which has proven effective in the study of human-computer interactions (Riper et al., 2010). Specific tasks included accessing the vLab, saving file, and accessing information on research procedures. At the end of the usability testing sessions, participants also completed the System Usability Scale (Brooke, 1996) to provide a quantitative measure of usability. Participants who completed the focus group and usability testing sessions were reimbursed with a $50 AUD gift card for their time. All focus groups and usability testing sessions were facilitated by trained staff

who utilised structured protocols. Sessions were conducted online via videoconferencing software, Zoom, and were audio-recorded and transcribed for subsequent analysis.

Usability and satisfaction cohort survey
Upon consenting to participate in the usability and satisfaction survey, participants were directed to the usability survey questions, which they completed in their own time.

Measures

Demographic data
Demographic data was collected for the satisfaction and usability cohort survey and included participants' age, gender,and frequency of research portal usage during the current teaching period.

System Usability Scale
The 10-item System Usability Scale (SUS) is a widely used (Sauro, 2011) and well-validated scale to measure perceived usability and learnability (Lewis, 2018). It utilises a 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*) and is suitable for testing online platforms (Bangor et al., 2008).

Satisfaction survey items and usability
An item from the Computer System Usability Questionnaire (Lewis, 1995) was adapted to measure student and supervisor satisfaction of the research portal (i.e., "Overall, I am satisfied with the Research Portal") and vLab (i.e., "Overall, I am satisfied with the vLab"). To assess usability, the Computer System Usability Questionnaire scale was used and adapted to better capture the specific features of the research portal and vLab. Modification of items included replacing the generic term *this system* in the stem of the items to a more specific reference (e.g., *research portal*). Additional items were also incorporated to capture the usability of specific features of the research portal and vLab (e.g., "It is easy and simple to access the research software via the vLab") and items deemed not relevant where excluded or replaced with more relevant items (e.g., "It was easy to learn to use this system" was replaced with "I can navigate through the content within the portal with ease"). The adapted scale comprised of 21 items and utilised a 7-point Likert scale (1 = *strongly disagree*, 7 = *strongly agree*). The obtained Cronbach alpha for this adapted scale was .97.

Results

Focus groups

Qualitative data from the focus groups (15 students & 8 research supervisors) were examined using an open coding strategy; whereby set items specifically discussed (e.g., support & technical issues) and suggestions by participants were used to identify common themes. Participant comments were categorised into themes until no new themes could be meaningfully formed. Throughout the coding, themes were modified (i.e., expanded, contrasted & changed) until data saturation was reached (i.e., the point at which there were no meaningful new insights). Coding was performed by researchers familiar with qualitative analysis, and the data was independently coded by two researchers and discrepancies found were discussed and agreed upon. A summary of common themes and respective comments are shown in Table 3. The frequency of each comment can be used to gauge the level of importance.

Table 3

Summary of themes, comments and comment frequency (students, N = 15; research supervisors, N = 8)

Theme	Comments	*N*
Support		
	Support page could be better labelled as a "Help" page as it provides more than just tech support.	3
	Video support is good but should also consider instructional step-by-step in a PDF form that students can follow.	2
	Support team helpful	1
	Suggested the inclusion of a community support forum	1
Technical issues		
	vLab apps (e.g., SPSS) run slow	3
	Accessing vLab via VPN is difficult	3
	Difficulty saving data	1
	VPN connection issues	1
Layout & presentation		
	Attractive	11
	Clear and intuitive	8
	Given the amount of information presented, students may find it difficult to access the information they want.	6
	Easy to use	5
	Student-friendly	5
	Appropriate/relevant images	4
	Good Monash Branding	3
	Didn't notice menu bar options	3
	Like the images	3
	Some images are not representative of an online environment but rather face-to-face	3
	Research process steps are not organised that well and could be better reordered to be more intuitive	3
	Monash website template makes it seem like it is part of the Monash website rather than a stand-alone tool	2
	Instead of large graphics/video, have shortcuts to regularly used sections	2
	Clean	2
	Impressive support page	1
	Apps well explained	1
	Apps could be better explained	1
	vLab should be more prominent	1
	Good amount of images	1
	Suggested more culturally diverse images	1
	News and Events could be more dynamic (e.g. blog, video)	1
	Not sure how useful the supervision and communication section is	1
Applications		
	Good range of applications	4
Videos and other multimedia		
	Helpful	4
	General video could be more specific	3
	Supervisors and students could upload videos of their research projects/interests	3
	Not always easy to find	2
	Suggest more instructional videos specific to applications in the vLab	2
	Suggest a video demonstration using the RP's research steps	2
	Good content coverage	1
	Suggest webinars to enhance greater student connection	1

Overall		
	Accessible anywhere from one centralised location	5
	Fantastic resource provided software/access issues are sorted	3
	Reliability will be important for its usage	3
	Comprehensive	2
	It is great that all the applications are provided and there is also guidance on how to use them	2
	Suggest a help function, FAQ	1
	It may help reduce supervision demands	1

Examples of comments obtained from both focus groups (students and supervisors) were quite positive:

- "Impressed by the number of applications"
- "Couldn't have done my research online without it [Monash Psychology research portal]"
- "Apps are well explained"
- "Attractive layout"
- "Great amount of information, that is clearly written"
- "Videos are helpful for first time users"
- "Support page is very impressive"
- "Impressed by the online recruitment options"
- "The best thing is that it is accessible anywhere"
- "I like it that all the apps are accessible from one centralised location".

In general, both research students and supervisors provided support for the research portal, in terms of its range of applications, information, layout and presentation. A concern was the possibility that given the amount of information that is presented, students may not be able to locate the specific information they need. Technical issues were also raised from past usage but this mostly stemmed from having to connect to a virtual private network (VPN) to access the vLab, which was a known issue that has been addressed.

Usability testing

Examining the SUS ratings (1 = *extremely negative* to 5 = *extremely positive*) across individual item responses, it can be seen that the percentage of usability testers provided positive reactions (seen as a rating of 4 or 5) ranging from 0.0% to 46.7% for items 1–10 (see Table 4). Combined, 13.4% of participants (12.7% had a positive rating of 4 & 0.7% had a positive rating of 5) had a positive reaction to the usability of the research portal, 31.3% had a neutral reaction and 55.3% had a negative reaction.

An obtained total average SUS score for both research students (N = 7) and supervisors (N = 8) combined was 72.33 (SD = 9.32, N = 15), out of possible maximum score of 100. According to the usability grade scale, this score meets grade scale C and using established adjective ratings, it is described as "good" (Bangor et al., 2009), indicating that overall the research portal is quite usable. Individual participant SUS total scores are presented in Figure 1 and show that 60% of the participants had usability scores that were considered "good" or above, and all but one participant (93% of the participants) had usability scores considered as "OK" or above. The one participant's score that did not meet an "OK" rating classification obtained a score that was less than 1 point below this criterion, which is a likely negligible drop below this rating.

Table 4
SUS item level

Item	Descriptor	Negative 1	2	3	Positive 4	5
1	I think that I would like to use this system frequently.		13.3%	40%	46.7%	
2	I found the system unnecessarily complex.*	13.3%	26.7%	26.7%	33.3%	
3	I thought the system was easy to use.	46.7%	46.7%	6.7%		
4	I think that I would need the support of a technical person to be able to use this system.*	20%	60%	20%		
5	I found that the various functions in this system were well integrated.		20%	60%	20%	
6	I thought there was too much inconsistency in this system.*	73.3%	13.3%	6.7%		6.7%
7	I would imagine that most people would learn to use this system very quickly.	20%	13.3%	46.7%	20%	
8	I found the system very cumbersome to use.*	33.3%	33.3%	26.7%	6.7%	
9	I felt very confined using the system.	6.7%	26.7%	66.7%		
10	I needed to learn a lot of things before I could get going with this system.*	26.7%	60%	13.3%		
	Total combined proportion	24.%	31.3%	31.3%	12.7%	0.7%

* Values of negatively valenced items were reversed.

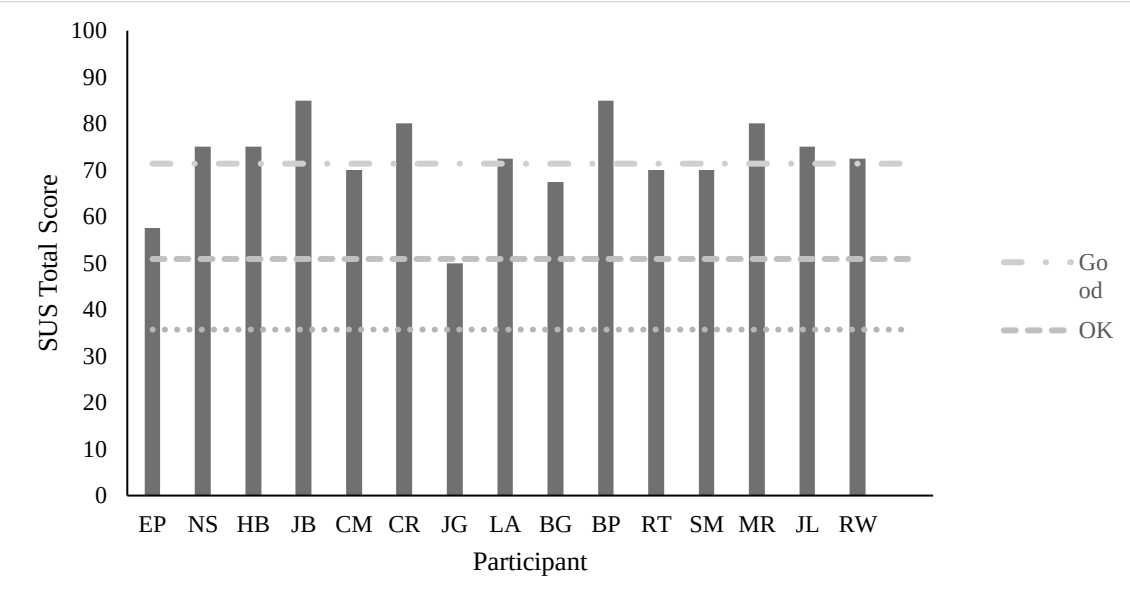

Figure 1. SUS total scores for supervisors (*N* = 8) and students (*N* = 7)

Examples of evaluative comments were positive and include:

- "What I appreciate about the research portal is that it is very professional, very clean design and it seems very easy to use … it is (user) friendly and is not overly complicated at all."
- "I think what the research platform and the vLab does (in) providing systematic tools is remarkable."
- "When I was doing my PhD I didn't have access to anything like this, it was just having conversations with my supervisor … I feel like with this research portal, it is not prescriptive… it's

got a range of resources and students can actually choose (the tools) and that's for me is really important."

- "With this research portal, there are various options that students can really and individually choose what they want to instead of just doing what they are told to do."
- "I think the research portal is a great resource with a lot of valuable information."
- "I didn't have anything like this when I was doing my PhD … I would like to have something like the portal, where I can just navigate and find my way."
- "Participants and research process sections are extremely helpful for students, to get the overview, at least. Besides, the access to many programmes, of course."

Cohort satisfaction and usability

Of the valid responses to the satisfaction items (8 research supervisors & 53 students), out of a possible maximum score of 7, average ratings for the research portal were 4.57/4.87 (supervisor/student) and more specifically for the vLab were 5.00/5.06 (supervisor/student), which were quite positive. Overall, this indicates that both research supervisors and students were satisfied with the research portal and vLab.

Satisfaction ratings across the three research units (subjects) were similar for research supervisors who had just completed PSY4402 and PSY4044 (vLab *M* = 6.00 & 5.50 respectively; portal *M* = 6.00 & 4.67 respectively); however, supervisors who had just completed PSY4403 provided a noticeably lower rating (*M* = 4.00; neutral anchor) for both the portal and vLab. For students, satisfaction ratings were similar across all three research units (subjects) (vLab; PSY4402, *M* = 5.19; PSY4403, *M* = 4.88; & PSY4404, *M* = 5.10 & portal; PSY4402, *M* = 5.07; PSY4403, *M* = 4.88; & PSY4404, *M* = 4.70; see Table 5).

Of those who completed the usability survey (rating; 1 = *strongly disagree* – 7 = *strongly agree*), supervisors (*N* = 8) and students (*N* = 51), reported an average usability score of 4.70 (*SD* = 1.29) and 4.82 (*SD* = 1.37), respectively, which is just above the neutral midpoint, indicating that both, on average, had a small but positive reaction towards the usability of the portal. Comparing usability ratings across research units (subjects) revealed similar scores for supervisors who had just completed PSY4402 and PSY4404 (*M* = 5.57 & *M* = 5.27 respectively). Supervisors who had just completed PSY4403 reported an average lower usability rating (*M* = 3.65). For students, usability ratings were relatively similar across all three research units (subjects) (PSY4402, *M* = 4.93; PSY4403, *M* = 4.88; & PSY4404, *M* = 4.69; see Table 5).

Table 5
Satisfaction and usability ratings across the three research units (subjects)

Research portal aspect	PSY4402 (*n* = 1; *n* = 14)	PSY4403 (*n* = 3; *n* = 17)	PSY4404 (*n* = 4; *n* = 20)
vLab satisfaction			
Supervisor(s)	6	4 (1.73)	5.5 (1.73)
Students	5.19 (1.97)	4.88 (1.76)	5.1 (1.52)
Portal patisfaction			
Supervisor(s)	6	4 (1.73)	4.67 (1.16)
Students	5.07 (1.71)	4.88 (1.8)	4.7 (1.53)
Usability			
Supervisor(s)	5.57	3.65 (1.1)	5.27 (1.15)
Students	4.93 (1.66)	4.88 (1.45)	4.69 (1.11)

Note. (*n* = supervisor(s); *n* = students)

Discussion

Despite the rapid growth in online education, the transition of some course types to a fully online environment is being inhibited by a number of factors. In the field of psychology, for example, many courses with a large research component have not yet made this digital transition, which may be due to a lack of resources available to support online research supervision and online research. However, as technology and Internet capabilities improve, web-based systems can increasingly provide these capacities. These expanding digital capacities can also create new efficiencies that support the advantages of online education as it rapidly evolves and grows (e.g., adaptability & scalability; Nguyen & Hoang, 2007). The research portal that was developed at Monash University, Australia, is a highly innovative all-in-one web-based digital capacity that supports and facilitates online research supervision and research, including by giving research supervisors as well as their research students access to a one-stop research support shop that supports all stages of the research sequence. This environment provides an interrelated optimal research supervision and research platform, including by providing research education as well as research capacities within the same environment and by allowing research supervisors and their students to share the same environment. This potentially scalable and transferable integrated research supervision and research supporting environment can expand the range of online courses that are successfully being offered to include courses with a substantial research component, including psychology courses. This simultaneously meets a growing need for advances in digital education, research and research supervision capacities that respond to the increasing need for and opportunity to change the way that we supervise as well as teach students online.

The aim of the project described in this paper was to evaluate the satisfaction and usability of a potentially scalable and transferable research portal directly from its end users (both research supervisors and students). Quantitative and qualitative data obtained from the focus groups and usability testing sessions indicate that reactions to the major features of the research portal were mainly positive and that the features of the programme performed well, indicating an acceptable level of usability. More specifically, results supported the research portal's layout and presentation, applications and instructional videos. Cohort satisfaction and usability ratings across the three research units (subjects) were acceptable to high. Of the three research units (subjects) in the GDPA, there was a lower satisfaction and usability rating among supervisors for PSY4403; however, this pattern was not observed for students who rated this unit (subject) comparably to the other two research units (subjects). In PSY4403, students are in the data collection and analysis planning stage of their project and are more reliant on a number of applications. Given this increased usage, particularly for students, one would have assumed that issues would have been reflected in student ratings more so than supervisor ratings. We acknowledge that research supervisors recruited into this project were users of an earlier version of the research portal, which did have a number known technical issues, and it is likely that their responses may have been influenced by past negative experiences. It also plausible that supervisor responses may have been an artefact of the small sample size (PSY4403; $N = 3$) and that the larger sample of students ($N = 17$) is more representative of usability and user satisfaction.

Feedback obtained from the focus groups and usability testing sessions have led to a number of improvements to the research portal. Firstly, the introductory video on the homepage was redeveloped to better explain what the research portal is and how it can help students through each step in the research process. In addition, a video was added which briefly and engagingly outlines what applications are available and informs the user of their purpose. This improved introductory video aims to help address concerns raised about users being unable to find relevant and specific information, as it provides a good overview of the research portal and how to access relevant content and applications. The video improvements help address the concerns identified in the layout and presentation and videos and other multimedia themes. This video redevelopment is particularly important for first-time users and also for those who have not conducted research online, as it informs the end user of how the research portal and its applications can help facilitate online research at every step. Another useful addition addresses reported concerns about the excessive number of clicks required to access applications in the research portal, found in the layout and presentation theme, with a quick links section being added to the

homepage. From here, users can quickly access frequently used applications and key research portal content with minimal click-through. In summary, the changes that were implemented based on surveys and focus group data focused on the layout and presentation of the research portal. More specifically, this included improved introductory videos to help introduce the user to the research portal and its various suite of applications and their utility and the addition of a quick links navigation section to the landing page to help improve user navigation.

Technical issues were a known problem for an earlier iteration of the research portal. Previously, users were required to log into a VPN to access the vLab which houses the research portal's key applications. For example, users experienced connection and speed issues, particularly during high usage periods, and reported issues with saving work. In the focus groups, although participants were presented with the improved version that addresses this connection issue, participants often commented on these past issues and experiences. Migrating applications onto the Citrix platform, which the university purchased to support the research portal, resulted in a more stable connection with fewer dropouts and speed issues. Also, as Citrix does not rely on a VPN, users save and seamlessly edit their work without the need to upload and download files from a VPN.

A limitation of the research portal evaluation is that demographic data for the focus group and usability sample was not collected and it was therefore not possible to look at how representative the sample was of the larger student cohort and research supervisory team. Although small sample sizes are considered acceptable for programme evaluation (Nielsen, 2000), this could have also contributed to a lack of representativeness. Online student cohorts typically represent a rather heterogenous demographic (Bates et al., 2008), and it is likely that certain subpopulations (e.g., mature students) exist and may have different experiences with using an online research platform. Additionally, information on past usage and experience of a previous version of the research portal was not collected, and these experiences may have negatively influenced responses. We suggest that future research explore the usability and satisfaction of the research portal for known online subpopulations. Another limitation of the research portal evaluation is the lack of direct evaluation of accessibility and inclusivity, which needs to be specifically examined in future research. Further evaluation of the research portal is planned to determine whether changes have improved usability and user satisfaction.

The research portal has incrementally evolved since its initial development with ongoing refinements based on user feedback including that obtained via the evaluation reported in this study. The results of this evaluation of the research portal, and associated conclusions relating to its efficacy, usefulness and user satisfaction, relate to the ongoing total development and evolution of the research portal and are not limited to particular iterations of it.

In its current form, the research portal is specifically designed to cater to psychology students in their fourth year of study; however, the underlying structure, design and template can easily be used as a transferable host structure, to enable many other research portal variants. The current version of the research portal could be specifically tailored to suit different disciplines (e.g., nursing, medicine) and also higher qualifications, including those with a clinically applied component (e.g., clinical masters in psychology). There are many expansion possibilities for the research portal, and the platform could also benefit traditional on-campus courses with a research component, whereby students could conduct their research entirely off campus, affording greater flexibility and reducing the burden on on-campus resources, including research supervision resources. The findings from this evaluation have been mainly positive and will help inform future iterations and improvements of the research portal, which will benefit and expand online higher education.

A second generation research portal incorporating artificial intelligence (AI) features such as a chatbot is currently being developed, which has the potential to better engage the student (a fundamental prerequisite for learning) and create a more personalised learning experience (Timms, 2016). As technology improves, more advanced AI features such as voice recognition and a virtual assistant will be integrated into the research portal to provide individually tailored research advice. It is anticipated that

these AI features will support further advances and efficiencies in the teaching and supervision of research-related courses and improvements in research students' learning experience. The research portal and its potential scalable and transferable next generations have the potential to provide an optimal online research supervision and research supporting online system which can valuably bridge what we would like online education to fully support and what it can fully support.

Author contributions

Author 1: Conceptualisation, Investigation, Data gathering, Data analysis, Writing – original draft, Writing – review and editing; **Author 2**: Conceptualisation, Investigation, Data gathering, Data analysis, Data curation, Writing – review and editing; **Author 3**: Conceptualisation, Investigation, Writing – original draft, review and editing; Corresponding author; **Author 4**: Conceptualisation, Writing – review and editing; **Author 5**: Investigation, Data gathering, Data analysis, Data curation; **Author 6**: Investigation, Writing – review and editing; **Author 7**: Project lead, Conceptualisation.

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