



An examination of technologies in complementary medicine education and practice: The perceptions and experiences of naturopathy students, faculty and educational leaders

Alastair C. Gray^{*}, Amie Steel, Jon Adams¹

Australian Research Centre in Complementary and Integrative Medicine (ARCCIM), School of Public Health, Faculty of Health, University of Technology Ultimo Sydney, NSW, Australia

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ABSTRACT

Objectives: Little is known about the education of future CM practitioners. The objective is to explore the perceptions and experiences of students, faculty and professional leaders toward technologies in complementary medicine education and practice.

Design and setting: Qualitative focus groups and one-on-one semi-structured interviews were conducted in CM educational organizations and institutions in North America (United States / Canada) and Australia involving seven focus groups (29 naturopathic students), and 30 one-on-one interviews (faculty, educational and professional leaders of the naturopathic profession).

Results: Data analysis identified five issues reported. These related to perceptions of; *the shortfalls of CM classroom technology, the value of technology within CM clinical practice, learning technologies in the classroom, addressing equity concerns as a consequence of learning technology use, and the need to develop technology literacy skills amongst students and faculty.*

Conclusion: This is the first study to examine the perceptions of students, faculty and professional leaders toward technologies in CM education and practice within an education setting. CM students exhibited complex attitudes and adoption patterns to technology. CM students were critical of faculty who have perceived low levels of digital literacy. The technology issue that students in our study found most challenging was PowerPoint use in the classroom. There is an urgent need to establish a strategic research agenda and modelling around this important area of health care education in order to ensure a well-educated, effective workforce able to deliver the best outcomes for the patients and communities they serve.

1. Introduction

Complementary medicine (CM) - commonly defined as healthcare not traditionally associated with the conventional medical profession or medical curriculum [1] - houses a diverse field of mind-body practices (e.g. yoga, meditation) natural products (e.g. vitamins, herbal medicines), whole healing systems and therapies (e.g. naturopathy, traditional Chinese medicine) and treatments (e.g. aromatherapy, reflexology) [2]. There is an increasing uptake of CM worldwide [3] and CM accounts for around half the Australian healthcare sector, in terms of practitioner visits [4] and over the counter sales [5–7], while in the US the latest available research shows a 12-month CM use estimate of

33.2% [8]. The CM education sector appears to also be experiencing growth and professionalisation. Yet, despite the substantial footprint of CM industry and provision within the Australian and US healthcare landscape and clinical settings [9–11], CM practitioner education has received little empirical attention to date.

A recent review of CM education research [12] shows the quantity and quality of research regarding learning technologies in education more broadly [13–16] (and medical and allied health education research more specifically) is notably absent within the field of CM educational research with little research investigating CM academic perspectives to learning and technologies [17–19] and there is infrequent and dated empirical research conducted on CM students and their

^{*} Correspondence to: 6190 Ardleigh Street Philadelphia, PA 19138, USA.

E-mail addresses: AlastairCharles.Gray@student.uts.edu.au (A.C. Gray), Amie.Steel@uts.edu.au (A. Steel), Jon.Adams@uts.edu.au (J. Adams).

¹ ORCID ID is 0000 0002 9901 5717

perspectives to learning [20–23]. Much of the existing educational research within CM has focused on naturopathy [12,24] as it is one of the largest and most dynamic of the CM professions in Australia and the US [25–27]. Research has yet to explore the identified gaps including faculty resistance to change, student readiness for online study as well as the digital divide between subsets of students and between students and faculty [28–32].

Meanwhile, the internet has placed unprecedented information at patient's fingertips and personal health devices, technologies and applications are changing how individuals perceive, engage with, manage and communicate their health [33]. Medical organisations, individual clinics, hospitals, and broader healthcare systems have acknowledged the significance of these issues in planning high-quality care [34] and technologies (especially robotics, nanotechnology, health informatics) are increasingly dominating medical and healthcare provision [35–37] alongside the use of telehealth and practice enhancing software in clinical practice. Patients and practitioners exhibit increasing willingness to adopt applications of telehealth - 'a collection of means or methods for enhancing health care, public health, and health education delivery and support using telecommunications technologies' such as Zoom, Skype and Google hangouts' as part of managing care [38–51]. Practice enhancing software – here defined as a technology used to enable efficient, novel application in a clinical setting – are also commonplace and widespread in medicine and complementary medicine, see Table 1. Significant research has recently focused on the implementation and impact of learning technologies [52–55] - the study and application of technologies to support and/or enhance teaching, learning and assessment - for students, educators and educational outcomes [14,16,56–58].

These telehealth technologies are now being widely employed in conventional health care [59,60], and also appear to be employed in some areas of CM clinical practice [61]. Little is known about the use of digital technologies in CM clinical practice. Similarly, only a small amount is currently known about telehealth and CM and is limited to only particular practices such as mindfulness [62], yoga [48,63], and music therapy [64]. In direct response to the circumstances outlined above, the study reported here provides the first examination of the perceptions and experiences of students, faculty and professional leaders toward technologies in complementary medicine education and practice.

2. Methods and materials

The study reported in this paper aims to explore the perceptions and

Table 1

One: Examples of Practice Enhancing Software Currently Used in Clinical CM practice.

General medical apps and resources	(e.g. MIMs online, Natural standard, NICE Guidelines),
Practice enhancing technologies include (but are not limited) to applications and software specifically orientated to the technical disciplines of	
Acupuncture - point location software	eg Points PC
Naturopathy and Nutritional Medicine - prescription of supplements and nutritional advice	e.g. Nookal, Foodzone, EPIC, FoodWorks
Homeopathic Medicine - Repertory software, and databases	eg RadarOpus, Synergy
Iridology	eg EyeRonec
Numerous other software in the CM marketplace	e.g. CorePlus, Health Quest, Ginko, nPod
Practice management software available in CM clinical settings - management of their practices, bookings, report writing as well as patient and information management	eg Clinic Essentials, Clinko, Birdsong, Unified Practice, Compass, Practice Fusion
Generic applications such as information and financial management tools	eg Dropbox, Xero, Email, Excel, Outlook, Word

experiences among students, faculty and professional leaders (such as representatives of regulators and associations) of the naturopathic profession in Australia, Canada and the US toward technologies in complementary medicine education and practice drawing upon focus group and semi-structured interview data.

2.1. Setting

The study fieldwork was conducted in 2015 in Australia, the US and Canada - three countries chosen due to their naturopathic training delivery being relatively aligned in terms of curriculum content and graduate skills, knowledge and attributes. The focus upon naturopathy programs was due to naturopathy being one of the largest CM professions in Australia and US and the substantial numbers of naturopathy students, faculty and leaders within US and Australian CM educational institutions.

2.2. Sample and recruitment

Student participants were recruited from [Redacted for Blinded Review] in Australia and [Redacted for Blinded Review] in the US. Faculty and professional leaders were recruited from Canadian, US and Australian academic organisations and institutions that met the requirements for membership with the World Naturopathic Federation [65] ensuring the organisations satisfied international recognised standards for professional representation. Students were recruited for focus group participation via email invitation sent via their faculty administration. In the case of two students - where distance was a major barrier to focus group participation – one on one interviews were conducted. Relevant faculty and professional leaders (leaders of an academic department or professional organisation) were identified by senior management from their organisation or institution, and invited by the research team to participate in one-on-one interviews. All study participants received a participant information sheet (PIS) prior to fieldwork before providing informed consent. Consent was gained verbally and in writing from all participants. All interested practitioners were interviewed to ensure any differences in perspectives across organisations and regions were captured.

2.3. Data collection

Focus Groups. A total of seven focus groups, three in Australia and four in North America, were conducted on site at each institution involving a total of 29 naturopathy students. The focus groups provided a forum for students to discuss their perceptions and experiences regarding technologies in education and practice through both individual insights and via sharing and reflecting upon the experiences and perceptions of others.

Interviews. Semi-structured interviews were conducted with 30 CM faculty and professional leaders in North America (n = 19) and Australia (n = 10). Interviews were selected as the data collection method for academic and professional leaders to allow open, confidential discussion of personal opinions and experiences. The time and location of the interview was chosen to suit the participant.

Guide. Focus groups and semi-structured interviews were conducted by [redacted for blinded review] using a validated semi-structured question/topic facilitation guide (see Appendix One). The same guide was used for both sample groups as the study sought the perceptions and experiences from all parties on similar themes, domains and topics and allowed for exploring related and/or different issues that were introduced by the participants in the fieldwork process.

Domains. The domains to guide the interview and focus groups (as outlined in the guides) were: perceptions and experiences of educational delivery methods in the education of CM practitioners; learning technologies in the education of CM practitioners; and practice enhancing technologies and software used in clinical practice.

Recording and transcribing. Interviews and focus groups were recorded via a digital recorder and then transcribed. Each interview was between 45 and 60 min in duration and focus groups were approximately 90 min in duration.

Thematic saturation. Thematic saturation – the point at which repeated investment in further data collection appears to not reap significantly new data - was attained after 15 interviews and 4 focus groups.

2.4. Data analysis

Prior to transcript analysis, all interviewees were allocated pseudonyms while focus group participants were only identified by the country where they were located (North America or Australia). Using a Framework approach [66], we followed the established process of *familiarisation, identifying a thematic framework, indexing, charting, and mapping and interpretation* [67]. Congruent with the Framework approach we chose to adopt an implicit theoretical approach (in which the theory is not made explicit), as utilised in applied health care research in many fields including general practice [68–70], nursing [71] and health promotion [72].

3. Results

Data analysis identified five explicit issues reported amongst the participants. These related to *perceptions and experiences of the shortfalls of CM classroom technology, perceptions of the value of technology within CM clinical practice, perceptions of learning technologies in the CM classroom, addressing access and equity concerns for students as a consequence of the use of learning technologies, and addressing the need to develop literacy and technology skills amongst students and faculty.*

When asked about the learning technology employed within the classroom, all participants first commented on the use (and perceived misuse) of slide presentation software such as Powerpoint™. The vast majority of students were critical of the value of delivering content using slide presentations, as seen by the following quotes from two US students (See Table 2: Quote 1.1, Quote 1.2). The lecturers agreed that students tended not to enjoy the Powerpoint presentations, but also felt that many students required and expected them. This dissonance in perspectives was described succinctly by a faculty member from the US (Quote 1.3). The reason that students gave for their dissatisfaction with slide presentations was due to past and in most cases ongoing experience of lecturer(s) simply reading through slides with no embellishment. Students in both the US and Australia describe this linear, restrictive use of the software as impacting on the student's ability to engage fully with the class content (Quote 1.4, Quote 1.5, Quote 1.6). Some faculty also acknowledged the negative impact on student engagement of some lecturers reading through distracting information-dense slide presentations (Quote 1.7). However, it was acknowledged by many participants that slide presentations are not necessarily inherently problematic, emphasising their potential alongside discussion-based classroom delivery (as opposed to didactic reading). As one academic emphasised, this relates to the importance of the lecturer's professional experience and personality to ensure content and delivery is engaging (Quote 1.8). Other teaching technologies were discussed by both students and faculty but mostly with regards to their absence - frustrations reported by students that academics were not using the breadth of learning technologies available, and with regards to faculty, the challenges resulting from the institutional leaderships' expectations around accessing and using newer technologies (Quote 1.9, Quote 1.10).

Another topic raised by academic participants was what they perceived to be the relationship between introducing technology within clinical practice – in most cases enthusiastically supported, in some cases with reluctance and in other instances supported as a necessary evil - and technology in naturopathic education. For example, one lecturer outlined how a contemporary clinician should make use of the resources

Table 2

Exemplar quotes for identified themes - from CM Students, Faculty and Professional Leaders.

Quote #	Quotes relating to <i>Perceptions and experiences of the shortfalls of classroom technology</i>
1.1	"I am the anti PowerPoint" - student (FGD), United States
1.2	"I really hate most of the Powerpoints that I get" - student (FGD), United States
1.3	"Students tend to want them but hate them" - academic I, United States
1.4	"You can put up a PowerPoint of a 150 slides through 100 slides and a teacher can just flip through them very quickly and you won't be able to engage on that slide for very long and you already past it, and if they don't finish you're still responsible for all the material that just wasn't gone over." - student FGA United States
1.5	"So if someone stands up and their reading basically a PowerPoint... my mind's going to wander" - student FGA, United States
1.6	"You show up and sit down and somebody will read your PowerPoint for three hours. And every 15 min you get up and walk around for 10 min. But it's like crazy, I don't know how anyone learns this way. You know... no one learns" - student FGD, Australia
1.7	"But I know a lot of instructors just plough a bunch of information out there that they would just read out loud...and I think that students can kind of zone out on them. It makes learning kind of passive and when there's notes in front of the students and the very same stuff is on the slide and then the person is reading them." - Academic Leader I, United States
1.8	"I think that there's value in there but it's also data, there's no soul so I think it's kind of contextualized. You can have somebody that has a great PowerPoint but does not have a good personality to deliver it versus a person who has a great personality and a passion to deliver the material and I think people respond more to that rather than respond to other." - Academic/Professional Leader M, Australia
1.9	"I think we have a lot of expectation on us to have things readily available and happen on systems that are working, technology that's unique and power points that are put together in their learning style and things like that" - Academic E, United States
1.10	"I think those are teaching technologies that I have been requesting in every one of my classes since I started here and it's not used and I don't have any idea why. I don't know if it's that, teachers have been teaching the same way about PowerPoint for so many years that they have refused to switch over but there's so much out there that they can utilize and they're not using it. Yeah they're just not." - Student (FGD), United States
	Quotes relating to The value of technology within clinical practice
2.1	"If I'm going to be a primary care physician in any industrialized society in the world, it would be negligent and unethical for me not to use. not necessarily every single piece of technology because I think you can get a technology overload. It would be negligent of me not to use technology on a regular basis." - Academic Leader B, United States
2.2	"For telemedicine, for example, you know to be able to train practitioners in school how to make effective use of telemedicine safely and in a way that is super compliant and effective is an enormous advantage that you can give to a student who is graduating today. Seeing with this use of electronic medical records systems and you know how to maximize their potential and use them to really make their life easier and not more difficult." - Professional Leader F, US
2.3	"And if we're training naturopathic physicians in the US to be primary care doctors and that's where they intend their careers to go, we've got to encourage them to embrace just to govern pop-cultural landscape, embrace the technology that's available." - Academic Leader B, US
2.4	"You can't know what it is like to have that physical contact to know what a real human being sounds like or looks like or smells like. All of those things are part of understanding what is going on with someone" - Academic Leader A, US
2.5	"From what I noticed in the clinic is that we're so engrossed in the technology... most people are looking in the screen and are clicking 'do you experience?' versus like being able to have a conversation with them [the patient] and then taking a few seconds to draw things out..." FG C"
2.6	"We can borrow studies... that say the computer in the room does not necessarily have to affect the care that's given and patients usually don't notice the computer in the way which is comforting for me" - FG C, US
	Quotes relating to Complex approaches of classroom learning technologies
3.1	"I think it's really good. I think it gives people the chance to experience a lot of things. They might watch a YouTube Video about how to make something or how to do something and it might inspire ideas. They can go back to that video later on" - FG Bris, AUS
3.2	"I think it's great that it exists but I wish it wasn't necessary. Like it's good it's there for people who can't come to the lectures in person, but there are some subjects that you have to do online, and a whole lot of stuff that you have to do online." - FG Bris, AUS
3.3	"I do worry about how much technology, however necessary it might be, makes the course inaccessible to a lot of people, particularly older people, or people

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Table 2 (continued)

	who might for whatever reason can't do all of this stuff online. That makes it difficult that it becomes necessary but yeah, you can't do it with just the library. You can't access." – FG Bris, AUS
3.4	"I know personally I don't like the idea of online learning because it's so individualized, I think that people learn so much by being together and talking to each other and debating and discussing, but you need to provide these opportunities within class." – FG D, US
3.5	"Online is really hard to do with active learning activities as well although again I've done it, I can make it work. I find that there's a lot less discussion that happens and I don't feel like the richness of the education is the same" – Academic H
3.6	"That's another thing about the qualms of doing online is that part of the maturation process of the student is having interaction. Literal human interaction with their classmates, their instructors. The younger generation, how will they feel comfortable interacting with someone and sitting down with someone not just asking questions because you have to but getting to the level of treating the whole person, you get into some pretty deep things. And how someone going to feel comfortable doing that if they don't have any conversations?" – Professional Leader I
3.7	"I think that probably most of...the didactic information of the science of medicine could easily be delivered online. Where I would maybe think twice about is any kind of physical, clinical education...things like that which are really, I think, better with a hands-on component." – Academic F, US
3.8	"I'll have to say I think they are turning to online education for most didactic courses as the benefit of actually leading to greater standardization of education...When it comes to clinical education I think that has to be done in the trenches, I think our students need exposure to more real people." – Academic G, US
	Quotes Relating to Addressing access and equity concerns
4.1	"You have to pretty much have an internet connection in order to do the course at all. And even in class not having a laptop is sometimes a problem." – FG Bris, AUS
4.2	"So making the course inaccessible to a lot of people, particularly older people, or people who might for whatever reason can't do all of this stuff online. That makes it difficult that it becomes necessary but yeah, you can't do it with just the library." – FG Bris, AUS
4.3	"Yes, I think we have a lot of expectation on us to have things readily available and happen on systems that are working, technology that's unique and power points that are put together in their learning style and things like that" – Academic E, US
4.4	"I don't embrace it [technology]. I'm dragged kicking and screaming because I have to but I also recognize that it is where it is going so I have to." – Academic M, US
4.5	"So they [academics] are part of it and they're helping to steer but students are driving some of that and I think some of the research on the millennial generation is that they want to drive their own education, their own knowledge acquisition but they do need someone to help them along that path otherwise they do end up way off or are using things that aren't necessarily the best resources." – Professional Leader R, US
4.6	"Then we've had students tell us that the whole reason that they came to naturopathic medicine was that they are not interested in technology, I don't buy it, I mean I don't - that doesn't mean that I don't believe it, I mean like I had a student this fall who told me that he was going to struggle reading any other papers I recommended because I posted them on moodle and he doesn't have a computer at home and I said you're in medical school buy yourself a computer or go to the library and use the computer and I have no problem with you downloading the papers, making a paper copy and reading them on paper but you got to figure out how to use a computer well enough to use the educational technology that we're using for the course, if you're smart enough to go to medical school, you're smart enough to figure that out." – Academic H, US
4.7	"I don't embrace it. I'm dragged kicking and screaming because I have to but I also recognize that it is where it is going so I have to. Here's my recent technology. a diary. That's my day planner. My schedule is in there. I have a telephone, I have a fax machine. I have a digital clock. I don't have a computer in my office. I have it somewhere else. One of these things? [points to tablet on table] A tablet. I don't know how to use it." – Academic M, US
	Quotes relating to Addressing the need to develop literacy and technology skills of students and faculty
5.1	"I found that with the internet, there's just so much information to sift through. A lot of it is irrelevant. It felt like I was wasting a lot of time looking for resources and then I can just walk into the library and look in an index and find exactly what I want." – FG Bris, AUS
5.2	"Because these computers...hold so much and then it's just, it's a file and...the big thing is being able to search. And so when I'm going to see a patient... I can type in a condition, and it will give me my documents of what has this condition so I can bring out my herbal formulas very quickly that I want to use in this particular case or interactions." – FG A, US

Table 2 (continued)

5.3	"a lot of professors spend...upward of 10 min of class time trying to get the microphones working or trying to turn the fire points on and...it's fiddling with things in the microphone and...it's just like come on and it's very frustrating for us because we know it's taking our class time and so I think maybe some kind of training at the start of the term or something to get them familiar with the technology will be helpful." FG C, US
5.4	"I think we need to be more conscious of how we provide information to students, critical information to students that we need them to have and at the same time I think providing them with the skills of where to go looking for quality information and the ability to evaluate that." – Academic ZC, Australia
5.5	"And so I do think that there are opportunities that students take to create their own work life balance through their creative use of that technology and that's I think a really empowered stands in a really alliance stands and I think it is important to recognize that the balance between paternalism and cultivating empowerment in students as well." – Academic W, US

available and how not employing technology in clinical practice was, in some instances, negligent through denying patients' best practice. In doing so however, academics also acknowledged that complete reliance on every technology available could be problematic (Quote 2.1). Similarly, two professional leaders presented the view that effective use of electronic medical records (EMR) and telemedicine were important skills necessary for contemporary naturopathic practice (Quote 2.2, Quote 2.3). In keeping with this perception of the value of technologies, some students also expressed interest in apps and other technological resources for possible future use in practice, but in doing so also clearly indicated concern that their knowledge or training about these technologies were not currently being provided by their lecturers or formal education. Concerns regarding technology use in clinic were also raised by students, faculty and professional leaders, particularly as relating to the potentially negative impact on patient experiences of clinical consultations and quality of care delivered. One academic expressed concern that technology may lead to clinical care without direct patient contact resulting in sub-standard care (Quote 2.4). One student similarly described their concern (Quote 2.5). However, this view was not held by all participating students, with others drawing on awareness of research findings suggesting technology has minimal impact and the use of it may not concern patients (Quote 2.6).

The use of online technology to help facilitate practitioner training was viewed differently between students, academics and professional leaders. There was also a lack of consistency and some complexity within the responses of members of these groups. For example, online technology was seen by some students as facilitating flexibility in learning (Quote 3.1). Yet, other students were less supportive of technology (Quote 3.2, Quote 3.3). Some participants – students, faculty and professional leaders - also perceived online platforms, particularly if used as a sole delivery method, as creating student isolation and limiting the development of students' communication skills with impact on their wider learning experience and outcome (Quote 3.4, Quote 3.5, Quote 3.6). Academics acknowledged the potential or realised value of online technology for education delivery. They also expressed a view that it should be implemented with discernment whereby some content, such as sciences, could be delivered online but others, such as naturopathic clinical skills, required face-to-face delivery (Quote 3.7, Quote 3.8).

Concerns regarding the impact of technology to facilitate or hinder access and equity among students were raised by student and academic study participants. Student participants also described a need, stemming from the technology used in course delivery, to purchase expensive equipment such as a laptop making the course, to their mind, inaccessible to them (Quote 4.1, Quote 4.2). Academics expressed awareness of the importance of supporting their student's ability to use the additional technology required to access their course content. However, this was also experienced by academics as a pressure on faculty to provide additional infrastructure (Quote 4.3 Quote 4.4, Quote 4.5). Some academics also observed students resisting the technology on philosophical grounds that affected both access to learning materials student learning

(Quote 4.6). Another US academic described their own philosophical resistance to technology driving an active choice to avoid much technology in their daily life (beyond computer use) (Quote 4.7).

Interlinked with the issue of equity, participants described the need to develop literacy and technology skills. These skills included the ability to operate technology as well as the ability to manage the format and quantity of information available. Some students experienced the gap as too great between the required digital literary skills and their current skill set to access digital information (Quote 5.1). Highlighting the variety of perceptions and experiences of student participants some described using technology, such as new software, to help manage electronic files, with the goal of improving their curation of information (Quote 5.2). However, some students were also critical of the technological skill level of faculty, (not reflected in faculty accounts) and suggested a need for further technology training of academics (Quote 5.3). Academics recognised the challenges students face in managing and evaluating the quality of the information available (Quote 5.4). Academics also described the ability for technology to help facilitate work-life balance among students through the creative use of technology and emphasised the empowering value for students to cultivate skills to use technology to their advantage (Quote 5.5).

4. Discussion

Our study resulted in a number of key findings. The technology issue that students in our study found most challenging was PowerPoint use in the classroom. While previous educational research suggests there can be both positives [73–75] and negatives [76,77] regarding PowerPoint use, our finding appears to move beyond this highlighting a relatively strong negative perception where CM students found it to be linear, restrictive and critical of the way in which it is being used. It is important that we further examine the use of classroom technologies and decipher the extent to which possible challenges are the result of technology design and/or human application. This student dissatisfaction could be possibly related to either teaching skills or methods (as it appears that the lecturers still use traditional/teacher-centered approaches) and/or socio-demographical characteristics of students (and lecturers) that may influence perceptions to digital teaching tools. Furthermore, there is a need for further research to also help understand the detailed needs of both CM academics and students regarding this classroom technology and related technologies.

The CM students spoken to exhibit complex attitudes and adoption patterns to technology (*'hate it' but then 'demand it'*) [78,79]. This finding is congruent with broader educational literature. Discerning the acceptance of technology in an educational setting is rarely straightforward and necessitates understanding the complex moving parts that make up digital literacy – often including but not limited to gender, race, social class, identity, power, inequality, age and generation [80–82]. Similar to other research into institution's or fields where low digital literacy exists within the student and faculty body [83,84] our study highlights a complex learning environment where it is possible that some digital natives have not developed the digital literacy or critical thinking skills needed for higher education. There is surprisingly little research into institution's or fields where there is evidence, as is the case here in our study, of students being critical of faculty who have perceived low levels of digital literacy or where possibly a subset of the students body is well in advance of other student subsets or their teachers - a digital divide between students and academics [29,31,32,85,86]. Moreover, research has shown that where academics have been found to be critical of basic academic writing skills as is the case here in our study, further training and resources to develop preparedness for study [30] and tertiary level academic literacy skills has been needed for students [28], as well as a need for adaption of teaching practices, assessment design and feedback to students by academics, in order to assist improvement of those academic literacy skills [87].

Another important finding from our study is the perception that the

requirements of providing some or all of a course (didactic and/or clinical) online potentially discriminates against older, digitally-challenged, less digitally literate students as is the case in these CM institutions [19]. In addition, the range of opinion expressed indicates a wide variety of seemingly conflicting attitudes to technologies which ranged from positive, (*flexibility, adds value, good – when done well*) to ambivalent (*this is a necessary evil, it would be negligent not to use*) to negative (*I don't embrace it. I'm dragged kicking and screaming because I have to*). The main concern expressed was about the negative impact of technologies (*when used in a one-dimensional way that creates isolation and poor clinical outcomes*). This is almost the opposite to findings from previous research and commentary that has predominantly seen learning technologies (such as MOOCs - Massive Open Online Courses) as vehicles with which to democratise learning [88], underpin a more equal global distribution of knowledge [89–92] and having the capacity to right significant social inequities and power dynamics and bring inexpensive, quality education to students in places remote to bricks and mortar institutions [93–96]. In subsequent studies this finding of 'inequality' requires clarification. Furthermore, as one of the fundamental principles of naturopathy involves an appreciation of nature, the healing power of nature, and natural approaches to life that may include work / life balance and life / technology balance (digital detox and device vacation) further research into philosophical and ideological perceptions (*there are whole lot of things you cannot do online, physical, clinical education cannot be taught online*) and experiences of CM stakeholders regarding the use of technologies in both practice and education require expansion.

5. Limitations and future research

In this study, data collection was conducted before the outbreak of the Covid-19 pandemic which has led to an inevitable surge in the use of digital technology tools (e.g., Voice over PowerPoint or video conferencing tools) in educational settings. For CM educational leadership, critical questions emerge as to how these circumstances may have changed students' perception (and/or attitude) towards the use of digital technologies in their classroom since the analysis of this data. This important limitation notwithstanding, and while many learning technology-related issues may be shared across CM and non-CM educational settings, the findings from our study do suggest a further research examination of CM specific use and experience may well be justified and provide benefit in addressing possible challenges and tensions regarding learning technologies. From the broadest perspective, part of a future research agenda could involve the development of a fit-for-purpose theoretical model with which to approach and understand adoption, perceptions and experiences, behaviours and potential change strategies regarding technologies in CM educational environments. More specific future research needs could examine the limitations of what can and cannot be taught online in CM and if and how a more nuanced deployment of technologies may be preferable to relevant stakeholders. Our findings also point to the need to know more about the wider use of clinical and practice enhancing software and technologies available, as well as perceptions and experiences of telehealth by the CM faculty and student body.

Research is needed to explore the perception and experience of faculty and students of CM education institutions as well as professional leaders within CM towards the challenges, opportunities and use of a variety of educational delivery methods and technologies within the specific needs of CM practitioner training and what culture change might be necessary and what skills need to be taught to faculty. Areas requiring further enquiry include the effectiveness of educating CM practitioners as a result of learning technology utilisation and the priorities of educational providers to keep pace with modern educational technology developments. Future research in CM health education settings could involve tools such as asset mapping or infrastructure and technology audits in order to identify the learning technologies used,

and the student services, faculty and IT support infrastructure that is currently in place. Possessing broader knowledge on the topic could have an impact in overall institutional strategy, curriculum design, employment status, resource allocation, infrastructure and operational imperatives for CM leaders in these private equity education environments [12]. The findings highlighted in this study and the results of further research are important for education leaders, especially if clear trends in education towards the uptake of learning technologies are not being adopted within CM educational institutions.

6. Conclusions

This is the first study examining the interface between technologies in learning and clinical practice within CM education settings. Some students, faculty, and professional leaders of the CM professions in the US and Australia appear conflicted about the use of these widely available educational and clinical tools. More research is necessary to determine CM faculty and student perceptions, experiences and adoption patterns regarding technology, their digital literacy, the divisions and subdivisions within the faculty and student body, the way in which these groups adopt innovations and their identifiable attitudes to technologies and learning. The impact of Covid-19 on CM educational institutions has highlighted the critical nature of these questions. There is an urgent need to establish a strategic research agenda for this important aspect of health care education in order to help ensure a well-educated, effective CM healthcare workforce.

Ethics approval and consent to participate

Ethics approval was granted prior to data collection from the Endeavour College of Natural Health's Human Research Ethics Committee (EC00358). Consent was gained verbally and in writing from all participants.

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Authors contribution

AG led the development of a study, conceptualization, methodology, conducted the study, formal analysis, investigation, project administration, data curation and drafted the manuscript AS provided expertise on all stages of the study, supervision, review & editing of the revised the manuscript JA provided expertise on all stages of the study, supervision, review & editing of the revised the manuscript.

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Author disclosure statement

AG led the development of a study, assisted in FG and IV data collection and drafted the manuscript.

AS led the FG and IV data collection, provided expertise on all stages of the study and revised manuscript.

JA provided expertise on all stages of the study and revised manuscript.

Declaration of Competing Interest

All authors declare no competing or conflicts of interest.

Availability of data and material

The dataset supporting the conclusions of this article is included within the article (and its additional file).

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Appendix

Focus groups and semi-structured interview question/topic guide (see Appendix 1).

Focus Groups.

1. Background and beliefs about complementary medicine and its role
 1. Tell me what attracted you to study complementary medicine?
 2. What is your academic background?
 3. How has your involvement in complementary medicine impacted on your life outside of study?
 4. The influence of their biography of their experience (age, ethnicity)?
2. Traditional knowledge and scientific research
 5. What do you understand the term 'traditional knowledge' to mean?
 6. How important is traditional knowledge to your personal experience of complementary medicine? To your future role as a practitioner?
 7. What about scientific research? What role do you expect science to play in your study and your future practice?
 8. How would you describe the balance between science and tradition in your studies at the moment?
 9. How does this balance compare to what you expected when you started studying?
 10. Would you like to see a change to this balance?
 11. What are the strengths and weaknesses of both science and tradition in complementary medicine?
3. Education delivery methods in the training of complementary medicine practitioners
 1. What types of learning environments have you experienced at this institution and elsewhere? What are your thoughts on these different environments?
 2. Tell me about your personal use of technology
 3. What are your views about the use of technology in society?
 4. How would you describe your personal relationship with technology?
 5. What is your experience of using technology for learning?
 1. How do you feel about technology being used as part of complementary medicine practitioner education?
 2. Are there any areas of practitioner education that you feel technology is better or worse suited?
 3. What has been your personal experience of using technology as part of your learning?

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