The use of learning technologies in complementary medicine education: Results of a student technology survey

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ABSTRACT

Background: Learning technologies are becoming universal in health professional education. Despite the potential philosophical and ideological dissonance between CM and technology, the actual use of learning technologies by CM students is currently unknown. As such, there is a need to explore the prevalence and nature of use of educational technologies by CM students.
Methods: A cross-sectional survey examining students' behaviours and attitudes to learning technologies at the Endeavour College of Natural Health. Survey items focused on student demographic and educational background, and their use of technology. Chi-square tests were used to examine bivariate relationships and the characteristics of technology use based on respondents' age were determined using a backward stepwise logistic regression.
Results: There were 576 responses to the survey. The majority of respondents reported having a mobile phone (96.2%) or a laptop (85.9%), rather than a desktop computer (24.7%). Of those with phones, 92% had a smart phone. Almost all students access their emails every day (84%). Older students (>35 years old) were found to be more likely to have a desktop computer (OR 1.9) and access LinkedIn (OR 2.95), but were less likely to use an eBook reader (OR 2.63) or Facebook (OR 0.21).
Discussion: CM educational institutions need to adapt in relation to teaching and learning due to the changing use of and impact of technologies by more non- traditional students. This study points to the need for further research to explore the values, attitudes and use of technology by faculty in complementary medicine institutions.

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1. Introduction

1.1. Contemporary education trends and the rising use of learning technologies

Research has explored the changes to primary, secondary and tertiary education as a consequence of learning technologies, flipped classrooms, constructivist education theories, problem-based learning, and Massive Open Online Courses (MOOCs) [1–4]. Learning technologies include the new applications to teach and assess content, the delivery of content from learning management systems, eReaders and eBooks, the storage and collation of data in content management systems. Learning technologies also include tools for synchronous and asynchronous delivery such as webinar tutorials, pre-recorded lectures delivered any time, any device, anywhere, and the use of direct face to camera video [5]. While significant research and scholarship has been published on the theory, pedagogy and andragogy of online learning [6–8], questions continue to arise for education leaders about the use of technologies and the consequences of those changes for students, educators and institutions [9–12]. In particular, research has emerged focussing on faculty resistance to change, the digital divide between subsets of students and between students and faculty, student readiness for online study, and the influence of demographics such as age [13–17].

There is very little known about how Complementary Medicine (CM) practitioners are trained and educated, given the size of the billion-dollar (CM) industry [18]. The sparse existing research examining educational standards and competencies in CM has mostly focussed on naturopathy [19–24]. To date, the emphasis has been on maintaining quality [25–27], understanding the process of clinical decision making [28], practitioners perceptions of practice [29], the amount and pitch of the science needed in CM education

[19,30–33], the need for minimum education standards through the regulation of CM [32,34,35], and the possible loss of core CM values [36–39]. Further, there is debate about the interface between science and tradition in contemporary CM education and practice [31,40]. What is clear is that colleges of CM continue to see rising student numbers [32,41,42], as demand for courses increase. The professionalisation of education providers in CM continues, led by professional associations, users of CM, and educational institutions themselves [19]. While learning technologies are becoming ubiquitous in education [43,5,44], currently it is not known how the two worlds of technology and CM, changing learning technologies and student behaviours intersect in contemporary CM education. It is also unclear what the consequences of new technologies will be for CM students or the broader CM professions. Further, the impact of learning technologies for CM educators and individual institutions is unclear. From a compliance perspective, CM colleges are measured on many factors including the ability to create policy and process based on reliable data, and then the ability to report on, and respond to that data. From an operational perspective, Colleges are constantly responding to shifting needs of students and faculty to plan and upgrade facilities, design new curriculum, alter curriculum to deliver it to students in new and more relevant ways, and provide better and more tailored student services. None of this is currently known. The growing impact of electronic, online and mobile learning and educational technology in CM is under-researched [45]. Upon this background, this study reports findings from a survey of CM students regarding the use of educational technologies for educational and learning purposes and general use with a particular focus on the impact of student age on the use of educational technology within CM education.

2. Methods

2.1. Aim

The aim of this study is to describe the student use of learning technologies in a CM institution with particular focus on student age.

2.2. Study design and setting

Secondary analysis was conducted on data collected through an internal survey, administered online to all students (n = 3634) enrolled at Endeavour College of Natural Health in 2014 [46]. The cross-sectional survey examining the behaviours and attitudes to learning technologies at Endeavour was initiated for the compliance, regulatory and operational purposes of informing ECNH management about future infrastructure and student support requirements. No ethics approval was required as the anonymous data was released to the researchers for analysis following approval by the ECNH Research Management Committee (EOI 20150623) in accordance with ECNH policies.

2.3. Participants

The student population at ECNH spans full-time and part-time learners enrolled in higher education for three or four year degrees across naturopathy, nutrition, homeopathy, acupuncture, musculoskeletal therapy/myotherapy, and complementary medicine. ECNH has a growing number of non-traditional, part-time students, with an almost equal proportion of full time and part time students. The latter of these two groups are largely represented by older students (<35y years of age). At the time of the survey, ECNH was a dual sector institution servicing both higher education and vocational students. At this college, all information is delivered from a learning management system (at the time of the survey; Moodle 2.6).

2.4. Instrument

The survey examined respondents' demographics, including gender, age, area of residence, and income manageability. Participants were also asked to provide details of their highest qualification before starting their current course (certificate/trade qualification, advanced diploma, bachelor degree, postgraduate university degree), study load (e.g. full time, part time), year of study (e.g. 1st year, 2nd year, 3rd year), and course enrolled (e.g. naturopathy, nutritional medicine). Participants were asked to respond to a number of statements reflecting their use and attitudes or beliefs relating to learning technologies in CM education and their use of social media (eg, yes/no and select all that apply questions), as well as providing information about their use of devices (e.g. mobile phones, desktop computers, tablets) and apps. Information was gathered on student access to the internet, email behavior and patterns, the type of connection they used and age of the device they used.

2.5. Data analysis

Frequencies and percentages for reported characteristics were identified. Chi-square tests were used to examine bivariate relationships between key variables. To identify the relationship between respondents' age and use of learning/information technology; a separate backward stepwise logistic regression was generated to include all the demographic, attitudes and beliefs identified in the survey. This involved the identification of potential confounders informed by literature and experience in combination with statistical evidence via bivariate analyses between potential confounders and each outcome. We created age categories whereby younger students were considered >35 and older students < 35 [47,48]. Confounders included in the multivariate models were defined by any bivariate test which resulted in a *p*-value of <0.25 [49]. Each individual multivariate stepwise regression model included all identified variables that met this criterion for each outcome. The identification of the most parsimonious model, reflecting factors associated with an outcome, was determined by analyzing the multivariate models using backward stepwise regression [50]. Following this, the independent variable with the weakest association to the outcome was removed, and the model was analyzed again. A likelihood ratio test was conducted on each model to verify whether removal of the independent variable was appropriate [51]. Appropriate removal was defined as a likelihood ratio test resulting in a *p* value of <0.05. These steps were repeated for each independent variable until no variables could be removed without failing the likelihood ratio test. Only main effects were considered in the modeling as the literature did not suggest any inter-actions that should have been examined. All analyses were conducted using statistical program STATA 11.1.

3. Results

3.1. Demographic and educational background

The majority of survey respondents (n = 576, response rate 15.85%) were female (88.4%) (see Table 1). Participants were most commonly between 25 and 35 years (35.9%), with fewer under 25 years old (28.5%), between 35 and 45 (17.9%), 45 and over (17.7%). Students reported a range of previous qualifications including certificate (43.5%), year 12 equivalency (29.4%), undergraduate (19.7%), postgraduate (7.3%), trade apprenticeship (3%), up to year 10 (3%), and 1% reported no formal educational training at all prior to

Table 1

Profile of demographic factors associated with learners at Endeavour College [#].

Participant characteristics	All participants (n = 576)	
	n	*%*
Gender		
Male	67	11.6
Female	509	88.4
Age		
Under 25	164	28.5
25–35 years	207	35.9
35–45 years	103	17.9
45 and over	102	17.7
Highest level of qualification before enrolment		
Year 12 or less	169	29.4
Trade/apprenticeship/certificate/diploma	250	43.5
Bachelor degree	113	19.7
Postgraduate university degree	42	7.3
Financial status		
Always difficult to manage on available income	193	33.5
Sometimes difficult to manage on available income	232	40.2
Managing on available income is not too bad or easy	151	26.2
Area of residence		
NSW/ACT	105	18.2
QLD	206	35.8
SA	65	11.3
VIC	157	27.2
WA	36	6.3
Others (TAS, NT, Overseas)	7	1.2
Study load		
Full time	314	54.8
Part time	259	45.2
Year of study		
One	222	54.5
Two	103	25.3
Three	40	9.9
More than three years	42	10.3
Course enrolled		
Acupuncture	56	10.6
Naturopathy/Western herbal medicine	204	38.6
Nutritional medicine	230	43.5
Others[*]	39	7.4

[*] Complementary Medicine/Homeopathy/Musculoskeletal therapy.
[#] Participants were asked to select all relevant response options.

studying at Endeavour. Financially, 40.2% of respondents found it difficult some of the time to manage on their income while 30% answered that they found managing on the income they had difficult all the time, 21% reported feeling not too bad, 5% easy to manage and 3% of respondents found it impossible to manage on their current income. At the time of the survey 54.8% were enrolled full-time, while 45.2% had chosen part-time study. Over half (54.8%) of respondents were first year students, 25.3% in their second year and 9.9% in their third year. Another 10.3% indicated that they had been studying for more than three years. The majority of respondents (43.5%) were studying nutritional medicine, 35% naturopathy, 10.6% acupuncture, 3% beauty, 2% MST, massage, homoeopathy combined and 1% western herbal medicine.

3.2. Technologies and behaviours

As outlined in Table 2, the majority of respondents reported having a mobile phone (96.2%) or a laptop (85.9%), while a tablet (49%), MP3 player, desktop computer (24.7%) or e-book reader (7.1%) were less reported. Most students use 3 or more devices. Of those with phones, 92% had a smart phone; most commonly an iPhone (66.1%) although a substantial percentage also reported using an Android (25.9%). The smartphone functions and applications used by participants included: camera, YouTube, Facebook, maps, weather, internet, email, calendar, music, clock,

Table 2

Profile of learners' use of electronic devices.

Use of electronic devices	All participants (n = 576)	
	n	*%*
Devices [@]		
Mobile phone	554	96.2
Desktop computer	142	24.7
Laptop computer	495	85.9
iPod/Mp3 player	173	30.1
e book reader	41	7.1
Tablet	282	49.0
Number of devices used [#]		
0	2	0.4
1	16	2.8
2	190	33.1
3	219	38.2
4	109	19.0
5	35	6.1
6	3	0.5
Type of phone [#]		
Regular mobile phone	42	7.3
iPhone	377	66.1
Android	149	25.9
Functions used on smart phone [@]		
Text	529	92.0
Camera	502	87.2
Internet	490	85.2
Clock	490	85.2
Email	465	81.1
Calculator	460	80.0
Maps	452	79.3
Facebook	428	74.8
Calendar	418	72.7
Weather	407	70.7
Music	378	65.9
Youtube	309	53.9
QR code	68	11.9
Tablet Use [#]		
Yes	318	55.2
No	258	44.8
Android	47	8.2
Ipad	260	45.0
Use of electronic tablets for learning [@]		
Download Coursework	212	36.9
Write assignments	68	11.8
Take notes	137	23.8
Creating presentations	36	6.25
Communicate with lecturers	102	17.7
Communicate with fellow students	91	15.9
Use ebooks	148	25.7
Number of uses of electronic tablet [@]		
1	66	26.1
2	54	21.3
3	33	13.0
4	38	15.0
5	30	11.9
6	9	3.6
7	23	9.1
Frequency of electronic tablet use on campus [#]		
Everyday	135	49.1
Often	39	14.2
Sometimes	35	12.8
Rarely	24	8.7
Never	42	15.3

[@] Participants were asked to select one response option only.
[#] Participants were asked to select all relevant response options.

calculator and text. In relation to tablet use, 45% of those surveyed used an iPad with 8.2% using android.

3.3. Use of tablets

Tablets were being used by 36.9% of respondents to download coursework, 23.8% to take notes, 25.7% to read e-books, 17.7% to communicate with lecturers, 15.9% to communicate with

classmates, 11.8% write assignments and 6.25% to create presentations. Most students used their tablets for multiple purposes. Half of respondents with a tablet used it on campus every day.

3.4. The use of social media

Social media channels were regularly accessed by the respondents (see Table 3). In descending order, Facebook, Instagram, Skype and Google hangouts, Pinterest, LinkedIn, then Twitter were the most visited social media sites. Respondents reported they access social media whenever they have time (66.3%), in the evenings (16.8%), in the morning on waking (16.5%), mornings (8.16%) and afternoons (5.6%). Facebook was mainly used by respondents (81.5%) to connect with friends, while 40.52% use it to keep up with news and current events versus 16% for learning purposes.

3.5. Use of internet email and computers

The majority of students used ADSL internet access and half accessed 3 G or 4 G (see Table 4). A minimal number of students reported no internet access. Respondents use a desktop older than three years (55.6%), have a desktop between 1–3 years old (36.2%), respondents have a laptop between 1–3 years old (44.4%) or a new laptop under a year old (24.3%). Only 23.3% of respondents bought their laptop to campus every day. Students accessed their emails every day (84%).

3.6. Age and technology

In examining P value relating to age, older students were more likely to have a desktop computer (OR 1.90; p = .02, CI 1.11–3.22). Older students were less likely to use ipod's (OR 0.55, p = .03, CI 0.32–0.93), but were more likely to use an eBook reader (OR 2.63, p = .03, CI 0.32–0.93), compared to younger students. They were more likely to use LinkedIn (OR 2.95, p = .001, CI 1.55–5.61) than younger students, and less likely to use Facebook (OR 0.21, p < .001,

Table 3
Use of Social Media.

Use of Social Media	All participants (n = 576)	
	n	%
Use of Social Media [#]		
None	47	8.1
Facebook	476	83.0
Twitter	60	10.4
Flickr	3	.5
LinkedIn	85	14.8
Pinterest	135	23.5
Instagram	242	42.0
Skype	136	23.6
Google+	143	25.0
Other[*]	93	16.2
Time of day social media is accessed [@]		
On waking	95	16.5
Mainly in the morning	47	8.16
Mainly in the afternoon	32	5.56
Whenever time is available	382	66.3
Evenings	97	16.84
Main purpose for Facebook use [#]		
Do not use	74	12.85
Connecting with friends and family	468	81.53
Keeping up to date with interest areas	233	40.52
Accessing special offers and resources from businesses	49	8.51
Study-related connections	92	16.0

[*] MySpace, RSS, Own website, own blog, Blogger, WordPress, Wikia.
[#] Participants were asked to select all relevant response options.
[@] Participants were asked to select one response option only.

Table 4
Use of internet, email and computers.

Use of internet, email and computers	All participants (n = 576)	
	n	%
Internet access [@]		
None	10	1.7
ADSL	320	55.9
3 G/4 G	233	40.1
Dial up	1	0.2
Cable	49	8.5
Age of desktop computer [@]		
Less than one year old	16	8.2
Between one and three years	71	36.2
Older than three years	109	55.6
Age of laptop [**],[@]		
Less than one year old	125	24.3
Between one and three years	228	44.4
Older than three years	161	31.3
Frequency of laptop use on campus [***],[@]		
Everyday	105	23.3
Often	58	36.1
Sometimes	49	47.1
Rarely	85	18.9
Never	154	34.2
Access to email [@]		
Everyday	481	84
Often	79	13.1
Sometimes	11	1.9
Never	3	.5

[**] 514 individuals who identified as owning a laptop.
[***] 451 individuals who identified as bringing a laptop.
[@] Participants were asked to select one response option only.

CI 0.13–0.36). Of those that used FB they were less likely to access FB on waking (OR 0.16, p < 0.001, CI 0.07–0.41) (Table 5).

4. Discussion

This study reports the first examination of the use of educational technology amongst students within an educational institution with a sole CM focus and robust clinical program. A number of key findings from the analysis are of particular importance. It is not just in relation to teaching and learning that CM educational institutions might need to adapt due to the changing use of and impact of technologies by more non-traditional students [52]. This study points to important operational considerations in infrastructure and resource allocation which could include but are not limited to internet, computers, communication hubs, expectations of new equipment, updates to the latest technologies, the institution-wide IT spend, the amount and costs of bandwidth, campus design, recharging facilities, and occupational health and safety considerations [53].

This study points to a possible mismatch between student use of technology and the current methods of communication and curriculum delivery employed by CM institutions. The ubiquitous use of text messaging as a means of communication by students could impact on how CM education institutions communicate with their student body, particularly as email saturation is becoming a commonly reported occurrence in the general community [54]. This trend in students' 'text' communication preferences potentially impacts the overall operations of CM educational institutions; specifically their equity and disability policies, for institutions relying on email communication with their students [55,56].

The known costs involved in writing or redesigning curriculum [57,58], and the increased role of social media in formal [59,60], and informal [61] education institutions, CM educators need also be mindful of the use of social media. Reflecting global trends, students in our study confirmed Facebook is mainly used by

Table 5
Characteristics of older students.

Characteristics of older students (35 years and over) (n = 205)		
	Odds Ratio	p value, CI
Highest level of qualification before enrolment		
Year 12 or less	ref	ref
Trade/apprenticeship/certificate/diploma	1.9	0.04, 1.04–3.36
University degree	2.9	0.002, 0.48–5.79
Postgraduate university degree	8.7	<0.001, 3.2–23.6
Study load		
Full time	ref	ref
Part time	1.65	0.03, 1.04–2.60
Course enrolled		
Acupuncture	ref	ref
Naturopathy/Western herbal medicine	0.33	0.005, 0.15–0.72
Nutritional medicine	0.32	0.15, 0.67
Others*	0.80	0.67, 0.30–2.19
Use of electronic devices		
Desktop computer	1.9	0.02, 1.11–3.22
iPod/Mp3 player	0.55	0.03, 0.32–0.93
e book reader	2.63	0.03, 0.32–0.93
Use of social media		
Facebook (on smart phone)	0.21	<0.001, 0.13–0.36
Twitter	0.42	0.06, 0.17–1.03
LinkedIn	2.95	0.001, 1.55–5.61
Google+	2.82	<0.001, 1.66–4.78
Frequency of access to social media		
On waking	0.16	<0.001, 0.07–0.41
Mainly in the morning	0.36	0.03, 0.15–0.90

* Complementary Medicine/Homeopathy/Musculoskeletal therapy.

students for connection and learning, and much more than Twitter [62]. Informal study groups that use social media platforms to connect with peers are becoming an unexpected yet strong feature of the education landscape [63], and this should have a bearing how educational institutions proceed with curriculum design, assessment building, academic writing and student dishonesty [64,65]. Only a small number of respondents in this study brought their laptop to campus every day, yet the data confirmed that a large number of respondents access their emails every day [66]. This discrepancy between device portability and email access may indicate students are using other devices to access emails, especially with proliferate student mobile use and growing student tablet use [67–69]. The findings of this study also indicate tablets are now being used by more learners in CM educational institutions; reflecting trends worldwide in the tertiary sector and industry trends towards mobile learning (mLearning) [70]. The consequences of student-led behaviour change is currently unknown for educators of CM practitioners. Further research is needed to determine the extent to which CM education institutions are capable and ready for this change.

While current studies in education are inconclusive about the correlation between age and digital literacy in university settings [47], this study suggests an association between CM student age and the use of technology. Compared to their younger counterparts, older students in our study were also twice as likely to have a desktop computer. These age-associated trends have both academic and operational importance, as they indicate a priority to redistribute resources for better supporting the needs of the student population [71]. Non-traditional students tend to be older [72], part time, deal with stress differently [73], have higher attrition and lower retention rates and require more and varied types of student support [52]. The significance in the diversity of technology preferences among sub-groups of CM students may require expensive curriculum design and re-design. This requires implementation of educational technology resources that ensure learning materials are designed for smaller devices [74], yet also effective for computer-based learning. With age being a significant

variable in this research, and supported by other literature; emergent changes in learner behaviours will increasingly give rise to new challenges in education that requiring further research. Essentially, the fundamental nature of pedagogical/andragogical interactions and practices have to be re-constructed in a way that supports student access, classroom management and participation, learning outcomes and ultimately positive health user experiences [52].

This data tentatively suggests that the demographic, drivers and attitudes of students attending this natural medicine college are also changing [20] and in line with the sector in general. Colleges, universities and other education providers dealing with changing student demographics and attitudes, require a congruent educational andragogy and facilities that meet their needs and expectations. Because of their holistic working paradigms, the learning environment in CM colleges is possibly unique and there are specific requirements and attitudes that shape them.

4.1. Limitations

This survey was cross-sectional in nature and sampled from a single education institutions albeit one with 5 campuses spread nationally in Australia. As such, the examination of students' data provided a snapshot in time [75] of a single source regarding their behaviours and attitudes to learning technologies [76]. Survey items focused on student demographic and educational background, and their use of technology by gathering self-reported data, which did not establish causality but did give a broad overview of the prevalence and nature of use of educational technologies by CM students. Frequencies and percentages for reported characteristics were identified but cannot provide in-depth individual responses on meaning questions which would be more appropriately explored through qualitative design. Chi-square tests and backward stepwise logistic regression cannot provide adequate answers for all research questions, however were effective in suggesting areas of significance regarding educational technologies by CM students [75]. This study identified relationships between variables, but not their nature or direction. Further, it must be emphasised that paper was written as a secondary analysis of data collected through internal audit at the institution. The survey was initially written for an operational purpose and to meet regulatory compliance requirements and was not designed for best practice research. As such there was no pilot testing. It is to be noted that the subject participation in this yearly survey fluctuates, and that there exist large rates of participation in different years of study. As the survey was initiated for operational reasons and was not compulsory there are multiples possible reasons for the fluctuation including student survey fatigue but this statistical anomaly was taken into account in completing the backward step regression. The data provides an objective, repeatable design and structured tool/instrument (USC Libraries 2016) that can inform further research regarding the technological needs of CM learners at higher education institutions.

4.2. Research directions

This study provides insight into use of technology at one College of CM and is significant for the operational and academic discussions about educational technology, instructional design and IT infrastructure. Decision makers and education leaders need to make important choices about which software's to use, LMS design for mobile learners, tablet, laptop and desktop use, campus design and use of technology. It points to the need for further research to better inform these choices. Necessary are further studies to explore the values, attitudes and use of technology by faculty who tend not to be technological natives, the need to

develop comparative data on other health professional students on technology use. Particular attention needs to be given to choices and age to answer how CM educators strike the balance responding to the growing technology use in a unique college environment, such as one with CM students using technology and 'wellness' values around biophilia, life balance and digital detox. Comparisons with results in other health education settings are necessary to determine if these trends are mirrored, and if CM student behaviours and education environments are so unique after all or whether lessons here can improve health professional education more broadly. Further, the research agenda should include comparisons between CM institutions and other units in the educational sector.

5. Conclusion

This study reports findings important for CM educational institutions seeking to deliver education which is relevant to individuals practicing traditional medicine in a modern health system. The data presented is preliminary in nature, however the absence of any other substantive research in the topic of educational technology within CM practitioner training programs underscores the value of this study for professional leaders and educators. Additional research is urgently needed to clarify the trends and patterns emerging from this study to enhance learning outcomes and ultimately positive health user experiences.

Contributors

AG led the development of a study, conceptualization, conducted the investigation, data curation and drafted the manuscript.

HD provided expertise on methodology, software, all stages of the study and revised manuscript.

AS provided expertise on all stages of the study, supervision and the revised manuscript.

Ethical statement

This material has not been published in whole or in part elsewhere;

The manuscript is not currently being considered for publication in another journal;

All authors have been personally and actively involved in substantive work leading to the manuscript, and will hold themselves jointly and individually responsible for its content.

Conflict of interest

All authors declare no conflict of interest.

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