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# A narrative review exploring the attitudes of nursing and complementary medicine students and practitioners toward biosciences curricula

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## ABSTRACT

A foundational understanding of the biosciences underpins most undergraduate programmes of study that lead to a career in the healthcare professions. The study of bioscience subjects including anatomy, physiology, microbiology and biochemistry has been reported to be challenging for a subset of these students with many students reporting negative attitudes. Identifying the factors that drive attitudes of students and practitioners towards the study of biosciences could inform curriculum modifications to reduce the challenges experienced by students. A review of the literature was undertaken using the search terms ‘student attitudes’, ‘biosciences’, ‘nursing’, ‘complementary medicine’, and ‘student success’. The review includes peer-reviewed primary data articles published from 1996 to 2023. The search identified 26 articles that met the inclusion criteria with the majority of published research in the nursing field. The literature review identified three major themes underpinning the attitudes towards biosciences reported by nursing and complementary medicine students and practitioners: actual or perceived intellectual difficulty of the bioscience content, a perceived lack of relevance of the bioscience subjects to their programme of study, and previous experiences studying the sciences. Negative attitudes towards the study of the biosciences can reduce engagement, create anxiety, decrease motivation to learn, and ultimately affect academic performance of students. Through identifying, acknowledging and responding to perceived challenges with bioscience subjects, educators may be able to improve engagement, performance and ultimately student success and enhanced practitioner knowledge and skills.

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Student attitudes;  
biosciences; nursing;  
complementary medicine;  
student success

## 1. Introduction

The study of one or more bioscience subjects is included in the first year of nursing and complementary medicine degree programmes; however, many aspects of bioscience content can be challenging for students, often leading to undergraduate attrition and non-progression (Cox and Crane 2014; Scott and Graal 2007). This has been identified as an issue for students studying

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undergraduate nursing and less researched in complementary medicine courses. Despite these challenges, the bioscience subjects are necessary in nursing and complementary medicine as they lay the foundation for the study of these professions, are fundamental to health assessment and are an integral part of the preparation of graduates pursuing clinical practice (Craft et al. 2016; Friedel and Treagust 2005; Jordan and Reid 1997; McColl, Bilszta, and Harrap 2012; Moxham et al. 2017). Poor understanding of the biosciences that underpin clinical care has implications for the safe delivery of care by nurses (Taylor et al. 2015), and an appropriate level of scientific understanding is required to develop the reasoning skills that are necessary for clinical practice (Logan and Angel 2014).

Students' attitudes towards a subject influence their motivation to learn and self-efficacy and can significantly influence their academic performance (Kpolovie, Joe, and Okoto 2014; Lopatto et al. 2022). Attitude to a particular subject is multifaceted, and the lens used to measure attitude can offer very different perspectives. For example, scientific attitude is how an individual thinks like a scientist, while attitudes towards science include an individuals' interest in science concepts (Gardener 1975). Additionally, attitudes can be formed based on either cognition (what an individual thinks about a subject), affect (how a person feels about a subject) or both (Edwards 1990) along with a perceived lack of relevance of the subject material. A sound connection between motivation and attitude to the learning of science has been observed (Osborne, Simon, and Collins 2003), along with a recognised link between attitude, motivation and academic achievement (Andrew 1998). Additionally, Kyte et al. (2023) reported that the participants in their study preferred learning activities that encouraged active learning, varied student activities during lectures and activities that encouraged group learning. Several participants stated that a good student–teacher relationship has a considerable impact on student motivation to learn. In an earlier study by Al-Modhefer and Roe (2009), students reported that learning would be enhanced when teachers enabled student interaction, introduced humour into the lectures, were sensitive to student workloads, and illustrated the theory with appropriate examples. Furthermore, Satoh, Fujimura, and Miyagawa (2023) reported that collaborating with multiple disciplines to provide education in anatomy and physiology and relating this to actual nursing care and clinical cases, along with self-directed and flexible learning, can lead to nursing students acquiring a deeper understanding of the significance of anatomy and physiology in clinical practice.

Previous studies have explored general attitudes towards the study of bioscience in nursing programmes along with its perceived relevance to clinical practice (Barton et al. 2021; Jordan, Davies, and Green 1999). Others have investigated how the mode of delivering the bioscience material may influence student attitudes (; Cox and Crane 2014). More recently, D. Barrett (2022) noted how COVID-19, and the rapid transition to online education, increased the anxiety of many nursing students who were concerned that the perceived loss of face-to-face academic and peer support mechanisms could impact their ability to succeed academically. Predictors of assessment performance in the bioscience subjects have also been reviewed to identify any links between previous science study experience and students' attitudes towards their current study of bioscience subjects (Al-Alawi, Oliver, and Donaldson 2020; Andrew 1998).

This narrative review will collate the current literature on nursing and complementary medicine students' and practitioners' attitudes towards the study of bioscience subjects within the nursing and complementary medicine fields. Identifying the factors that drive attitudes could inform curriculum modifications to reduce the challenges, perceived and real, experienced by students and ultimately improve practice.

## 2. Methods

A search of the literature related to the attitudes of students and practitioners to the study of biosciences in nursing and complementary medicine was conducted through the databases PubMed, CINAHL, ProQuest Central, WileyOnline, ClinicalKey and Google Scholar using the terms

'student attitudes', 'biosciences', 'nursing', 'complementary medicine' and 'student success'. The search included peer-reviewed, primary data published articles in English from years 1996 to 2023.

### 3. Results

Twenty-six articles met the inclusion criteria (Figure 1) and were analysed for participants' area of study or practice, study methodology, key findings and the major themes identified to contribute towards attitudes. Twenty-one of the studies were focussed on nursing students and/or practitioners and/or nurse teachers and only four studies were focused on the complementary medicine field. A summary of the findings under the themes of 'intellectual aspect of the biosciences', 'relevance of the biosciences to clinical practice' and 'previous experiences studying sciences at school' (Table 1).

The most common theme pertaining to nursing students and post-registration nurses was the 'intellectual aspect of the biosciences' whereas 'relevance of the biosciences to clinical practice' was

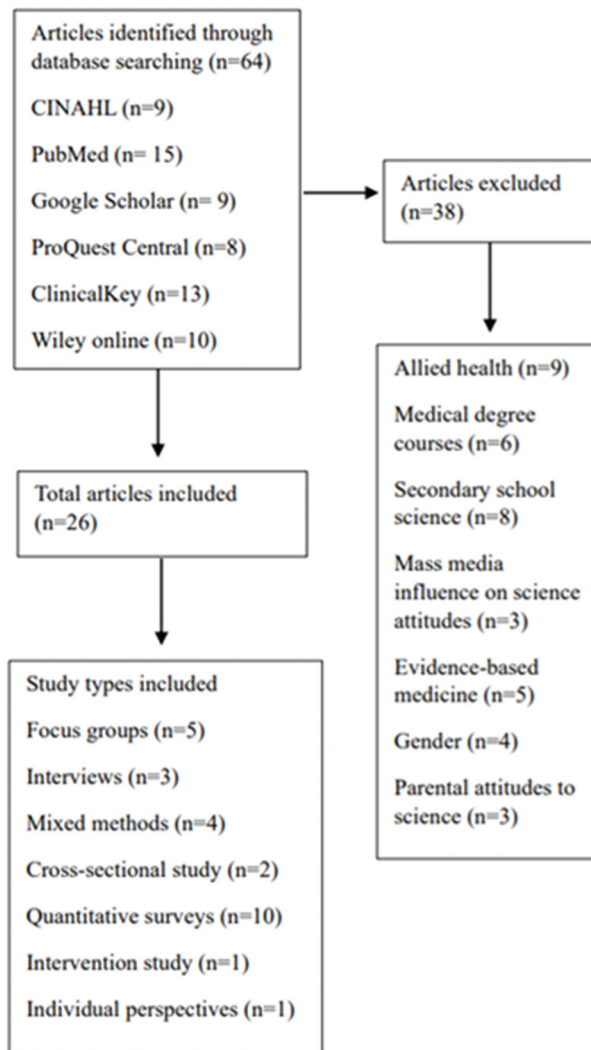


Figure 1. PRISMA flowchart summary of literature search results.



**Table 1.** Published studies of students and practitioners (past students) attitudes towards biosciences in nursing and complementary medicine courses.

Field	Reference	Participants	Methodology	Key findings	Major themes
Nursing	Jordan, Davies, and Green (1999)	155 nursing students and 29 nurse educators	Questionnaire and focus groups.	45% of nursing students agreed or strongly agreed that the language of bioscience is difficult to learn. 73% of nursing students disagreed or strongly disagreed that it was difficult to see how bioscience could be applied to their nursing practice.	Intellectual aspect of the biosciences.  Relevance of the biosciences to clinical practise.
	Corlett (2000)	23 nurse teacher, student nurses & preceptors	Interviews	Teachers stated that theory was learned in the classroom and the clinical setting, but nursing students stated that theory was only learned in the classroom.	Relevance of the biosciences to clinical practise.
	Friedel and Tregaug (2005)	339 nursing students and 73 nurse educators 10 nursing students	Researcher designed quantitative questionnaire and qualitative data from open-ended questions. Questionnaires & interviews	Percentage of students stating that bioscience is more difficult than ethics and law (72%); nursing concepts (68%); Nursing intervention (79%); sociology (75%). Only 53% stated that bioscience is more difficult than research. 40.5% of students stated that the bioscience content in their pre-registration courses linked to practise, 45.2% stated sometimes and 14.3% stated rarely.	Intellectual aspect of the biosciences.
	Davis (2010)	42 registered nurses in clinical practice	Questionnaires & interviews	40.5% of students stated that the bioscience content in their pre-registration courses linked to practise, 45.2% stated sometimes and 14.3% stated rarely.	Relevance of the biosciences to clinical practise.
	Whyte, Madigan, and Drinkwater (2011)	250 nursing students, 102 paramedic students, 74 in double degree	Cross-sectional study	Data revealed a low success rate in passing bioscience: 63.2% for nursing. 58.8 for paramedics. 67.6% for a double degree in Nursing/paramedics. Previous study of biology increased bioscience success.	Intellectual aspect of the biosciences. Previous experiences studying sciences at school.
	Durai et al. (2012)	30 nursing students	Exploratory Survey	28 nursing students stated that bioscience has a very heavy workload and 26 students stated that the timetable was too packed with the bioscience subjects.	Intellectual aspect of the biosciences.
	Craft et al. (2013).	273 first year nurses	Quantitative questionnaire	48% agreed & 41% strongly agreed that completing any science at school would be an advantage for bioscience subjects.	Previous experiences studying sciences at school.

(Continued)



Table 1. (Continued).

Field	Reference	Participants	Methodology	Key findings	Major themes
	Cox and Crane (2014)	118 nursing students	Questionnaire, 5-point Likert-scale. Pre-enrolment workshop.	95% of students were classified as science-anxious. >70% of students were anxious when studying for an exam. 100% of student who attended the workshop passed Human Bioscience 2 compared to 81.4% of non-attendees. Fijian students had a more positive attitude both cognitively and affectively towards chemistry.	Intellectual aspect of the biosciences.
	S. Brown et al. (2015)	160 first year nursing students from Fiji (Fiji National University) & 114 first year nursing students from Australia (Federation University)	Attitudes towards the Subject of Chemistry Inventory (ASCI)	The authors suggested that this could be due to more prominent role of chemistry in the Fijian school curriculum and/or lack of chemistry as a pre-requisite at Federation University whereas it is a pre-requisite and first year course at FNU.	Previous experiences at studying sciences at school.
	Molesworth and Lewitt (2015)	7 nursing students	Focus group/ interviews.	Bioscience is of key importance and found that practice experiences reinforced theoretical learning.	Intellectual aspect of the biosciences Relevance of the biosciences to clinical practise.
	Craft et al. (2016)	22 Registered nurses	Questionnaire, quantitative and qualitative	Registered nurses reflected on the undergraduate biosciences stating that they are relevant to clinical practice but they are difficult and are content heavy	Intellectual aspect of the biosciences.
	Craft, Christensen, et al. (2017)	Nine 1st year and 3rd year nursing	Workshop, evaluation survey & focus group, 5-point Likert- scale	Depth of bioscience content appropriate (mean=5.00, SD=0.00) I feel more confident after workshop (Mean=4.44, SD=0.527) Knowledge of pathophysiology increased (mean=4.20, SD=1.22) The rat dissection helped to visualise body systems (mean=4.40, SD=0.699)	Intellectual aspect of the biosciences.
	Craft, Hudson, et al. (2017)	49 enrolled nurses commencing registered nursing course.	Questionnaire with qualitative questions.	76% of students agreed or strongly agreed that studying science at school would be an advantage for bioscience subjects. 53% were anxious about studying bioscience subjects.	Previous experiences at studying sciences at school. Intellectual aspect of the biosciences.

(Continued)



Table 1. (Continued).

Field	Reference	Participants	Methodology	Key findings	Major themes
	Gordon et al. (2017)	Final year nursing students 126	Cross-sectional exploratory survey	65.9% of respondents considered bioscience subjects to require the most work; 73.8% would like a better understanding of bioscience but 76.2% understood the importance of bioscience in nursing practice.	Relevance of the biosciences to clinical practise. Intellectual aspect of the biosciences.
	Mortimer-Jones and Fetherston (2018)	196 pre-nursing students & 232 post-nursing students	Quantitative study comparing two groups of students, pre-nursification and post-nursification of a bioscience unit.	Pre-nursification group were less motivated to learn than the post-nursification group. Pre-nursification group reported less ability to learn bioscience content effectively than the post-nursification group.	Intellectual aspect of the biosciences.
	Montayre et al. (2019)	540 nursing students.	Descriptive cross-sectional survey, 5-point Likert-scale	Very important to have a good knowledge of bioscience subjects (Mean=4.44, SD=0.77). Less time allocated to the biosciences in class (Mean=2.64, SD=1.12). General positive perception of the biosciences (Mean=3.47, SD=1.02)	Intellectual aspect of the biosciences.
	Owens (2020)	51 pre-nursing study skills participants	Quantitative study	The intervention was shown to be an effective support strategy for student learning.	Intellectual aspect of the biosciences.
	Barton et al. (2021)	406 1 <sup>st</sup> , 2 <sup>nd</sup> & 3 <sup>rd</sup> Year nursing students	Questionnaire completed by all participants, 30 focus group interviews.	91.6% of undergraduate nursing students and indicated that every nurse must have a good understanding of bioscience and 50% of undergraduate nursing students indicated that bioscience content took up too much of their time.	Relevance of the biosciences to clinical practise.
	D. Barrett (2022)	50 nursing students	Quantitative study	80% of respondents were anxious about the impact of online learning on their ability to succeed. 62% concerned about being able to manage their workload during COVID.	Intellectual aspect of the biosciences.
	Tracy et al. (2022)	965 students	Quantitative/ Qualitative study	74% of respondents struggled with the science subject. 73% of those did overcome the struggle	Intellectual aspect of the biosciences.
	Kyte et al. (2023)	10 nursing students	Qualitative study. In-depth interviews with open-ended questions	Students are motivated to learn when bioscience theory is linked to clinical practice and lecturers incorporate innovative teaching methods.	Intellectual aspect of the biosciences. Relevance of the biosciences to clinical practise.

(Continued)

Table 1. (Continued).

Field	Reference	Participants	Methodology	Key findings	Major themes
Complementary Medicine	Satoh, Fujimura, and Miyagawa (2023)	37 nursing course faculty members teaching anatomy & physiology(A&P) from 37 universities.	Open-ended survey	Time allocated to A&P was limited. Large cohorts of students and small ratio of teachers to students are barriers to teaching effectively. Difficult to convey the connection between A&P with other relevant subjects.	Intellectual aspect of the biosciences. Relevance of the biosciences to clinical practise.
	Boon (1998)	187 licensed naturopaths & 16 students	Questionnaire & interviews	27 respondents were classified as having primarily scientific world views. 30 respondents were classified as having primarily holistic world views. Students with a holistic perception reported difficulty with the bioscience.	Relevance of the biosciences to clinical practice. Intellectual aspect of the biosciences.
	Jagtenberg et al. (2006)	Perspectives of a Naturopath, Herbalist, Homeopath, and a naturopathic educator to evidence-based medicine	Individual perspectives	<i>Naturopath</i> – “EBM marginalizes and corrupts traditional naturopathic knowledge.” <i>Homeopath</i> – “The logic of the RCT is alien to homeopathy as shown by the difference in their desired outcomes.” <i>Herbalist</i> – “EBM does not account for ecologic considerations.”	Relevance of the biosciences to clinical practice.
	Steele and Adams (2011)	12 naturopathic practitioners	Interviews	Some practitioners had polarizing viewpoints. Other practitioners attempted to link traditional and science.	Relevance of the biosciences to clinical practice.
	Steele et al. (2019)	29 students & 28 faculty and professional naturopaths	Focus group/Qualitative study	A perception widely voiced was the need for academic institutions to find the balance between traditional and scientific knowledge within naturopathic curriculum.	Relevance of the biosciences to clinical practice.



the most common theme for complementary medicine students and complementary medicine practitioners. 'Previous experiences studying the sciences' was identified as a factor influencing attitudes in four studies of nursing students.

None of the studies reported a predominance of positive attitudes towards biosciences even though there was general consensus that the biosciences are a necessary component of the curriculum.

## 4. Discussion

### 4.1. Intellectual challenge of bioscience content

The intellectual challenge of biosciences was a major theme identified in the literature review, however, this was mainly identified in the studies of nursing students and practitioners, with only one CM study reporting this theme. The Nicoll and Butler (1996) study revealed that in addition to being an intellectual challenge, nursing students found the biosciences to be content-heavy and difficult. This was later echoed by Durai et al. (2012) in their study of first-year nursing students in a Malaysian university where students did not expect medical sciences to be in their nursing course and found the medical science subjects to be content heavy. Jordan, Davies, and Green (1999) reported students' disproportionate difficulty with the biosciences was the cause of anxiety for many students. Additionally, the finding that 33% of the nursing educators surveyed thought the studies of the biosciences should be curtailed or abandoned is alarming to bioscience educators (Jordan, Davies, and Green 1999). In another study, recently graduated registered nurses also reported that the biosciences were content heavy and there was insufficient time to absorb the concepts especially if students lacked prior knowledge in science (Craft et al. 2016). The graduate registered nurses also stated that they lacked confidence in explaining the biology behind their nursing decisions (Craft et al. 2016).

The historical development of biosciences within the nursing curriculum exemplifies the dynamic and evolving nature of healthcare and healthcare education (Miao et al. 2022). Initially, nursing education focused on basic anatomical and physiological knowledge. Today, the focus has expanded to include advanced topics such as genomics and personalised medicine as a result of medical advances. This illustrates how the integration of biosciences in nursing education needs to adapt to meet the changing demands of the healthcare system, but also that bioscience concepts are becoming more complex. This evolution highlights the critical importance of a robust and adaptive curriculum designed to prepare nursing students to deliver high-quality, evidence-based care in a rapidly transforming medical landscape (Abu-Baker et al. 2021).

Several approaches have been undertaken to improve the delivery of biosciences to students. Knutstad, Smastuen, and Jensen (2021) compared the effects of delivering the biosciences by two teaching methods, traditional lectures and flipped classroom style. The results showed no effect on students' probability to pass in the flipped classroom when compared to the traditional lectures. To improve nursing education in the future, Evensen, Brataas, and Cui (2020) suggested that it is important for teachers to pay particular attention to the most difficult topics (identified as the nervous system, kidneys and the urinary tract and base-acid balance) and recommended that students spend more study time on those concepts and discuss any uncertainties with their teachers and fellow students. Owens (2020) designed and evaluated a pre-nursing bioscience intervention demonstrating improved self-efficacy of students following the intervention.

### 4.2. Perceived lack of relevance of bioscience

The perceived lack of relevance of bioscience to the field was the most common theme identified by the CM studies but was also very common amongst the nursing studies. The construct of attitude indicates that control of self-efficacy and external context factors both

contribute to the development of positive attitudes (van Aalderen-Smeets, Walma van der Molen, and Asma 2012). It is likely therefore that a perceived lack of control over their studies, including perception of lack of relevance, may contribute to the development of negative attitudes, and to poor performance (Davies, Murphy, and Jordan 2000). However, addressing this issue, Hatlevik (2011) observed that helping students to correlate theory to clinical practice is beneficial to nursing students' understanding of the relevance of the biosciences. Prowse and Lyne (2000) also observed benefit in correlating theory to clinical practice in their study of nursing practice. Bioscience studies are relevant to clinical practice despite the obstacles communicating the relevance to students and are required for the safe practice of any health field. The nursing profession is increasingly regarded as 'scientific in study and in practice' (Lumb and Strube 1993). Furthermore, a poor understanding of bioscience concepts makes it difficult for students to see the relevance of the biosciences to the clinical setting (van Aalderen-Smeets, Walma van der Molen, and Asma 2012). A study of by Davis (2010) of the views of registered nurses towards the biosciences in their under-graduate years showed that most of the participants in this study felt that the bioscience in their pre-registration programme was limited and the bioscience content had not been sufficient to prepare them for their roles on registration.

The theory-practice gap in nursing and CM refers to the disparity between the theoretical knowledge acquired through academic education and its practical application in clinical or therapeutic settings. The 'theory-practice gap' concept was introduced by Jordan (1994) and also researched by Corlett (2000) who proposed that the 'theory-practice gap' could be minimised through innovative curriculum, closer alignment of theory to practice, improving collaboration between nursing educators and clinical preceptors and evaluating whether there is sufficient time during clinical placements for students to relate theory to practice whilst acquiring new skills. In nursing, the theory-practice gap arises from several factors. First, the complexity of healthcare environments, including rapidly evolving technologies and diverse patient populations, can make it challenging for nurses to seamlessly translate theoretical concepts into effective clinical interventions. Additionally, students find it difficult to see the relevance of the biosciences when not applied to clinical practice in their curriculum (Davies, Murphy, and Jordan 2000). Similarly, in complementary medicine, the theory-practice gap can manifest due to differences in philosophical approaches, varying levels of evidence-based practice and integration challenges within conventional healthcare systems (Boon 1998). In the Corlett (2000) study, students in their foundational years regarded the bioscience subjects as irrelevant, yet they formed a large component of the curriculum; they were more interested in learning the practical skills that they could apply to the clinical setting. However, as students progressed in their programme of study, they realised the relevance of the theoretical component of their curriculum (Corlett 2000). Increasing technology in the health sector requires nurse education programmes to significantly increase the theoretical components required to meet the increasing demands of healthcare (Australian Government- Department of Health 2013). The Friedel and Treagust investigation of the 'theory-practice gap' reported that most nurse educators strongly agreed that bioscience is now vital in nurse education compared with some nurse educators in the 1990s (Friedel and Treagust 2005). This may be due to the earlier nurse training programmes being conducted in hospitals rather than universities.

A comprehensive grounding in bioscience also applies to the CM curriculum as clinical, scientific and regulatory standards are being applied to all areas of healthcare (Vickers 2000). However, there are sometimes competing perspectives and world views regarding the value of scientific knowledge when also gaining the traditional knowledge of complementary medicine (Steele et al. 2019). Similar perspectives were earlier identified in a Canadian study where some students were critical of components of the curriculum that 'embodied or emphasised a scientific world view which differed from their interpretation of the naturopathic philosophical world view' (Boon 1998). Some naturopathic practitioners expressed concern that scientific research was undermining traditional knowledge (Steele and Adams 2011) and some tradition-sensitive practitioners believe that traditional

naturopathy, herbalism and homoeopathy do not fit easily into the scientific method of research (Jagtenberg et al. 2006).

In nurse education, both the biomedical and social models of the body are presented as part of a holistic approach to health care but are rarely integrated. The overt message of holism encompasses many of the features of the social body. Therefore, the various models of healthcare need to be incorporated into nursing clinical practice. Students of complementary medicine regard their profession to be caring rather than scientific, where their vocation is holistic and person-centred that empowers the patient to take responsibility for their health (B. Barrett et al. 2004). Complementary medical practitioners describe themselves as holistic healers of the mind and body rather than managers of symptoms (B. Barrett et al. 2004). The different models can present nursing and complementary medicine students with a dilemma as they may present entirely different ways of responding to illness and disease and may be philosophically incompatible. Two examples to illustrate this conflict: consumption of alcohol increases when alcohol is cheapest, suggesting that alcoholism does not solely have biological determinants; economic and political factors also contribute (C. Brown and Seddon 1996). Under the biomedical model, the decline in tuberculosis and other infectious diseases during the twentieth century was due to the introduction of antibiotics. Sociologists attribute the decline to adequate sanitation, improved living and working conditions and better nutrition (C. Brown and Seddon 1996). Students of complementary medicine may aspire to the belief that nature is inherently healthful and the decline in infectious disease was due to a natural waning of disease as nature restores its health (Dubos 1968). Therefore, the presentation of the many different strands, although complementary to the biosciences, and the lack of integration between them can increase the level of anxiety in nursing and complementary medicine students. Additionally, the biosciences may not be adequately linked to clinical subjects. This may result in students' inability to make a sound connection between theory and clinical practice.

The introduction of E-learning and blended learning can be beneficial to students' ability to apply the biosciences to clinical practice (Smales 2010) and Cox and Crane (2014) observed that pre-enrolment face-to-face workshops helped to reduce the anxiety associated with learning the biosciences and attendees achieved significantly higher average marks for both online and on campus students. A possible solution to bridging the theory-practice gap would be to have co-operative teaching between the clinical nursing and bioscience lecturers, to more effectively blend the two disciplines (Friedel and Treagust 2005). Therefore, it will be in the best interest of educators to find ways of helping students perceive relevance and make connections between all aspects of their studies.

#### **4.3. Previous experience studying sciences at school**

Previous experience with science study was identified as contributing to attitude in several of the nursing studies. One study showed that students who had studied high-school chemistry had a much more positive attitude towards the study of chemistry in nursing, both cognitively and affectively (S. Brown et al. 2015), while participants from another study bemoaned their lack of exposure to science in school with approximately half of the respondents agreeing that completing a science subject at school would be an advantage to learning bioscience in nursing (Craft et al. 2013). An additional study asserted that a major factor impacting on student success in science subjects is a 'lack of prior engagement with, and interest in, science', leading to reduced self-efficacy and anxiety towards the study of science (Crane and Cox 2013). It has also been reported that experience with secondary school science has a positive relationship to results in nursing and could be used to predict if a student would pass or fail in 78.5% of the cases (Whyte, Madigan, and Drinkwater 2011). A study by Craft, Hudson, et al. (2017) found that enrolled nurses commencing undergraduate nursing education strongly agreed that completing science in school would be an advantage for bioscience subjects. The difficulties experienced by many undergraduate nursing students in the science subjects could be due to anxiety about science concepts, especially when

they have no background knowledge of science (Cox and Crane 2014). Cormick (2014) suggests that an unsatisfactory experience of science at school can lead to some individuals being very anti-science. Additionally, previous educational experiences and access to resources play a central role in shaping students' academic preparation for higher education and their overall success in undergraduate science subjects (Tracy et al. 2022). Furthermore, the choice of science textbooks by teachers could affect student attitudes towards the study of bioscience (Avelo and Uitto 2021).

In addition to prior positive experiences with science, parental attitudes can influence students' attitudes (Nasr and Soltani 2011, Osborne, Simon, and Collins 2003). Perera's study found that positive parental attitudes towards science can equate to more involvement in children's science studies, where parents take an active role in supervising homework along with encouraging children to visit science exhibits, expos or museums. Moreover, positive parental attitudes towards science have a statistically significant effect on science achievement by their children (Perera 2014). Mokoro, Wambiya, and Aloka (2014) in Kenya and Halim et al. (2018) in Malaysia found similarly significant correlations between parent and student attitudes.

## 5. Conclusions

Biosciences lay the foundation for the study of all healthcare professions and are an integral part of the preparation for graduates pursuing clinical practice. However, bioscience subjects can be challenging, with many students reporting that these subjects are the most difficult of all their subjects. Therefore, identifying the origins of attitudes and the barriers to engagement and success in the bioscience subjects, will enable those responsible for curriculum modifications to more effectively incorporate the biosciences with clinical subjects. Further studies of student attitudes towards the biosciences as well as strategies to change negative attitudes may help educators to present the bioscience subjects in a way that more effectively demonstrates the relevance of these subjects to clinical practice and may enhance the success of students studying nursing, complementary medicine and other health disciplines.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

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