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Structured Empirical Evaluation of "Campbell's Physiology Notes" and "Campbell's Pathophysiology Notes": A Cross-Cultural Evaluation of Two Nursing-Related Biosciences Textbooks

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Abstract

A three-country study was undertaken to assess the educational efficacy of two textbooks authored by the researcher. The same texts were distributed to groups of student nurses in the United Kingdom, Cambodia, and Kenya. A data collection tool was developed to obtain quantitative data and to ask open-ended questions on how useful readers found the texts to be. Quantitative data indicated that the books were useful in areas such as aiding understanding of scientific and medical terminology and helping nurses to assess their patients and understand nursing care. It was also found that simplified diagrams were a useful modality for communicating bioscientific concepts. Answers to open-ended questions indicated areas where the texts could be improved. Evidence for how useful bioscientific concepts can be to improving patient assessment and management was also identified. Significant agreement between quantitative data and answers to open-ended questions was noted. It was concluded that the same texts could have a significant degree of educational acceptance and efficacy in wildly differing cultural and national situations. This approach to resource production and distribution also forms a model other educationalists may choose to adopt.

Keywords

nurse education, bioscience in nursing, textbook evaluation, flexible distance learning, international and transcultural education

Introduction to the Study

To investigate the efficacy of two bioscience-based textbooks written by John L. Campbell, a study was undertaken with the aim of assessing the educational effectiveness of the books in a variety of national and cultural settings.

Campbell currently has two textbooks in print: Campbell's Physiology Notes (Campbell, 2009) and Campbell's Pathophysiology Notes (Campbell, 2011). They were written as learning aids, rather than comprehensive texts. The philosophy was the generation of "teaching" books, as opposed to "text" books. Clinical implications of the underpinning scientific concepts in the books were included in the context of patient assessment and management. This approach seeks to explain concepts, rather than provide encyclopedic masses of information.

It is hoped that these books can be distributed to many groups of student nurses in both developed and less developed countries. As these books are self-published, they are available at very low cost. In addition, sales from more developed countries provide funds for free distribution to students in poorer regions of the world. However, there is no point distributing texts with low levels of educational efficacy which do not aid student learning and consequently will not improve the clinical care nurses are able to offer. It is also hoped that some determination can be made as to how appropriate a single text can be in three completely different national settings on three continents.

Lack of Bioscientific Knowledge and the Need for Teaching Resources

The initial impetus to develop the two texts came from Campbell's own work on nurse's knowledge of biological

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and related science (Campbell & Leathard, 2000). This study highlighted that nurses lacked scientific knowledge as well as a lack of application of their knowledge to clinical practice. More recently Davis (2010) highlighted a lack of biological science knowledge in registered nurses (RNs). The majority of the RNs interviewed by Davis (57.1%) felt that they had received limited input of bioscience in their preregistration education, while many (40.5%) stated that the bioscience content had not prepared them for their roles on registration. Combining the importance of bioscience to nurse education, and evidence for lack of such knowledge, it can therefore reasonably be suggested that teaching texts in this area are needed.

Precedents for Textbook Evaluation

While virtually every published journal contains book reviews, these are usually written by an individual, who makes personal judgments related to their individualized reading of the text. It could therefore be suggested that these ubiquitous book reviews are little more than subjective impressions.

Despite being an essential resource for the education of all health care professionals and the universal use of textbooks by students and academics, surprisingly little literature was found on the objective evaluation of texts. Indeed, no specific literature relating to the evaluation of nursing textbooks was discovered. However, an attempt to formally evaluate a World Health Organization (WHO) text on epidemiology was made by Beaglehole, Bonita, Robinson, and Kjellstroms (1992). Beaglehole sent a copy of the text to a very small sample size of 14 teachers and lecturers of epidemiology. While this allowed for a limited consultation of potential users of the text in terms of educators, it did not evaluate the reception of the text by students. Likewise, Promila and Ranjana (2010) commented that textbooks are the main instruments which enable a teacher to impart knowledge to the students. While this contention could be debated, Promila and Ranjana claimed to have undertaken "systematic evaluation and research" in relation to the use of English teaching books in India. However, they only collected the impressions of a convenience sample of teachers (n = 200), again failing to collect any information directly from the students themselves. Raseks, Esmaeli, Ghavamnia, and Rajabi (2010) evaluated a range of English teaching books for use in Iran. To promote objectivity, they generated a range of criteria by which to assess the quality of each of the texts. However, they then went on to adjudicate each textbook themselves, using the criteria they had generated. This study therefore failed to consult teachers or the student end users. Yilmaz (2010), however, did collect data directly from students. Yilmaz conducted a readability survey on high school geography textbooks in Turkey and was able to make some specific educational recommendations for future publications as a result.

The somewhat obscure nature of the above review serves to point out the deficiency of objective empirical work into students' views of textbooks. Given the ubiquitous nature of the textbook, this could be considered surprising. As it seems reasonable to argue that it is the learners themselves who constitute the most important assessors of text efficacy, it is surprising that their views have not been studied more often.

Method

The data collection tool was a questionnaire designed to obtain objective quantitative data, which would be amenable to descriptive and inferential statistical analysis. However, the tool also allowed scope for the respondents to give open-ended examples of clinical applications of the biosciences presented in the texts. These responses were designed to provide additional information which could be considered independently and also be related to the quantitative results. It was also hoped that inclusion of open-ended questions would afford opportunities for respondents to suggest text improvements for future editions. Respondents were not asked to complete the questionnaire until they had owned a personal copy of a book for at least 1 month. The majority of the data were collected during 2012. All quantitative data were subsequently analyzed using SPSS version 19.

Pilot Study

To test the competence of the data collection tool, it was piloted on a group of seven academics and 30 students. Importantly, the tool was piloted on native and nonnative English speakers. As a result, some modifications were made to the data collection tool. These modifications were mostly related to minor alterations in the wording of some questions, to improve the clarity of meaning.

Data Collection Tool

It was decided that the same data collection tool should be used for separate evaluations of the physiology and pathophysiology texts to generate two sets of data. Lecturers were asked to give the separate questionnaires out to groups of students who were asked if they would like to participate. Questions 1 to 4 were related to country of residence, job title, area of clinical practice, and first spoken language. Questions 5 and 6 inquired about the nature of an individual's bioscientific education, and how this knowledge informs their clinical practice. Questions 7 to 13 sought information more specifically about the text under consideration, and how the content could be related to practice. For Questions 5, 6, and 8 to 13, Likert-type scales with a range of five possible responses were used to collect quantitative data at ordinal level. Question 7 collected data relating to number of hours spent reading a text and was therefore at nominal level. The final two questions (14 and 15) sought open-ended responses

relating to possible improvements for future editions and application to readers' clinical practice.

Sample Selection

Four convenience samples were used for the data collection. These were based on institutions with which Campbell has educational links. Data were collected from a university in the United Kingdom; a university in Cambodia; from a large school of nursing in Nairobi, Kenya; and from a group of Hong Kong students visiting a U.K.-based university. In addition to collecting a large data set, the study was designed to allow cross-cultural comparisons of the views of the four national groups.

Ethical Considerations of the Study

Prior to commencement of the study, written consent was gained from the University ethics committee. All of the student groups were asked whether they would like to take part. It was stressed that participation was voluntary with no negative or positive consequences for nonparticipation. Information relating to the study and the possible use of findings was explained to the potential participants, so that they could give informed consent. Participants were asked not to write their names on the questionnaires, so that there could be no possible identification of individuals.

All of the U.K. students had paid for their textbooks, and as Campbell had taught many of them, he could have been seen as occupying a position of power. This could have led to individuals feeling obliged to participate and indeed all students present chose to take part. It was noted, however, that when colleagues distributed the questionnaires to other groups of U.K.-based students, the response rates were equally good. All of the students in the Kenyan and Cambodian samples had been given their personal copies of the books free of charge by Campbell. This may have meant that students in these samples felt some obligation to take part; however, it was stressed that they could opt in or out, with no record of names being kept. For the overseas students whom Campbell collected data from personally, there were no problems relating to student reluctance to take part. In fact, all of the students were enthusiastic about their participation. Likewise, questionnaires distributed overseas by local colleagues attracted similar 100% response rates.

Results of Questions 1 to 4 for Both Books Giving Background Information

There were a total of 303 respondents for the Physiology Notes book: 76 were from the United Kingdom, 106 from Cambodia, 116 from Kenya, and five from Hong Kong. Of these 303 respondents, there were 270 student nurses, five qualified nurses, one medical student, two doctors, 24 student midwives, and one nurse lecturer. English was reported to be the first language for 138 respondents. Khmer was spoken by 106 respondents, Cantonese by five, Nepalese by six, and Gujarati by one. Various African languages were spoken as a first language by 47 respondents.

For the Pathophysiology Notes book, there were a total of 340 responses: 112 were from the United Kingdom, 98 from Cambodia, 122 from Kenya, and eight from Hong Kong. There were 307 student nurses, four qualified nurses, one doctor, 22 student midwives, and six nurse lecturers. English was reported to be the first language for 171 respondents. Khmer was spoken by 98, Cantonese by eight, Nepalese by six, and Gujarati by one. A range of African languages were spoken as a first language by 52 respondents.

Results and Discussion Relating to the Teaching and Clinical Importance of Physiology and Pathophysiology

Full results for the Physiology Notes are provided in Table 1, whereas the results for the Pathophysiology Notes are recorded in Table 2.

Question 5

Responding to Question 5 on how well physiology and pathophysiology were taught in basic training, the median response was 2 (well taught), and the mode was 2 for both subjects. This was despite anecdotal reports from the United Kingdom that there was not sufficient time allocated to these subjects. However, the quality of the educational content they did receive was highly rated.

Question 6

In response to Question 6 on the importance of physiology and pathophysiology to clinical practice, the median and modal responses were both 1 (very important) to both subjects. From this, it is clear that the consensus view of the respondents considers physiology and pathophysiology to be essential fields of knowledge to inform their daily clinical practice. When these data were broken down and analyzed by individual country, it was still found that the vast majority of respondents from all countries believe physiology and pathophysiology to be "very important" or "important." This indicates that belief in the importance of these bioscientific subjects is an internationally held position.

Results and Discussion Relating to the Reception of the Two Textbooks

Question 7

This question asked how many hours participants had spent reading the books during the first month of book ownership. The range of hours spent reading the Physiology Notes in the

Table 1. Quantitative Results for Campbell's Physiology Notes.

Question 5: How well do you feel physiology was/is taught in your basic training? (n = 300)

Very well	*Well*	*Neither well nor badly*	*Just adequately*	*Badly*
116 (38.7%)	154 (51.3%)	11 (3.7%)	14 (4.7%)	5 (1.7%)

Question 6: How important do you think knowledge of physiology is to your daily clinical practice? (n = 302)

Very important	*Important*	*Neither important nor unimportant*	*Not very important*	*Irrelevant*
219	81	2	0	0

Question 7: During the first month of owning your copy of Campbell's Physiology Notes, approximately how many hours did you spend reading the book? (n = 300; result given in average number of hours per respondent in each country category)

The United Kingdom	Cambodia	Kenya	Hong Kong
8.3	21	38.4	13.6

Question 8: How easy did you find it to understand the use of scientific and medical terminology used in the book?

	Very easy	*Easy*	*Neither difficult nor easy*	*Difficult*	*Very difficult*
All responses (n = 300)	78	161	41	19	1
"English" group (n = 138)	57	73	7	1	0
"Not English" group (n = 162)	21	88	34	18	1

Question 9: The book provides explanations of physiology; how helpful did you find these explanations?

	Very helpful	*Helpful*	*Neither helpful nor unhelpful*	*Unhelpful*	*Very unhelpful*
All responses (n = 302)	148	146	7	1	0
"English" group (n = 138)	90	47	1	0	0
"Not English" group (n = 164)	58	99	6	1	0

Question 10: How useful did you find the diagrams in aiding your understanding of the physiology in the book?

	Very useful	*Useful*	*Neither useful nor useless*	*Not very useful*	*Not useful at all*
All responses (n = 302)	143	144	14	1	0
"English" group (n = 138)	88	46	4	0	0
"Not English" group (n = 164)	55	98	10	1	0

Question 11: Overall how helpful do you feel Campbell's Physiology Notes is to your studies and overall levels of knowledge?

	Very helpful	*Helpful*	*Neither helpful nor unhelpful*	*Unhelpful*	*Very unhelpful*
All responses (n = 302)	157	138	6	1	0
"English" group (n = 138)	93	43	1	1	0
"Not English" group (n = 164)	64	95	5	0	0

Question 12: Overall how useful do you feel Campbell's Physiology Notes is in aiding your understanding and skills in assessing patients in your clinical work?

	Very useful	*Useful*	*Neither useful nor useless*	*Not very useful*	*Not useful at all*
All responses (n = 302)	145	149	7	1	0
"English" group (n = 138)	82	54	2	0	0
"Not English" group (n = 164)	63	95	5	1	0

Question 13: Overall how useful do you feel Campbell's Physiology Notes is in aiding your understanding and practice of patient care?

	Very useful	*Useful*	*Neither useful nor useless*	*Not very useful*	*Not useful at all*
All responses (n = 302)	131	162	8	1	0
"English" group (n = 138)	80	56	2	0	0
"Not English" group (n = 164)	51	106	6	1	0

Table 2. Quantitative Results for Campbell's Pathophysiology Notes.

Question 5: How well do you feel pathophysiology was/is taught in your basic training? (n = 340)

Very well	*Well*	*Neither well nor badly*	*Just adequately*	*Badly*
153 (45%)	164 (48.2%)	12 (3.5%)	7 (2.1%)	4 (1.2%)

Question 6: How important do you think knowledge of pathophysiology is to your daily clinical practice? (n = 340)

Very important	*Important*	*Neither important nor unimportant*	*Not very important*	*Irrelevant*
246	92	2	0	0

Question 7: During the first month of owning your copy of Campbell's Pathophysiology Notes, approximately how many hours did you spend reading the book? (n = 340; result given in average number of hours per respondent in each country category).

The United Kingdom	Cambodia	Kenya	Hong Kong
9.3	21.5	49.8	11.2

Question 8: How easy did you find it to understand the use of scientific and medical terminology used in the book?

	Very easy	*Easy*	*Neither difficult nor easy*	*Difficult*	*Very difficult*
All responses (n = 336)	92	183	50	11	0
"English" group (n = 171)	70	87	11	3	0
"Not English" group (n = 165)	22	96	39	8	0

Question 9: The book provides explanations of pathophysiology; how helpful did you find these explanations?

	Very helpful	*Helpful*	*Neither helpful nor unhelpful*	*Unhelpful*	*Very unhelpful*
All responses (n = 336)	168	164	4	0	0
"English" group (n = 171)	104	66	1	0	0
"Not English" group (n = 165)	64	98	3	0	0

Question 10: How useful did you find the diagrams in aiding your understanding of the pathophysiology in the book?

	Very useful	*Useful*	*Neither useful nor useless*	*Not very useful*	*Not useful at all*
All responses (n = 336)	167	155	12	2	0
"English" group (n = 171)	111	57	3	0	0
"Not English" group (n = 165)	56	98	9	2	0

Question 11: Overall how helpful do you feel Campbell's Pathophysiology Notes is to your studies and overall levels of knowledge?

	Very helpful	*Helpful*	*Neither helpful nor unhelpful*	*Unhelpful*	*Very unhelpful*
All responses (n = 335)	189	142	4	0	0
"English" group (n = 171)	120	51	0	0	0
"Not English" group (n = 164)	69	91	4	0	0

Question 12: Overall how useful do you feel Campbell's Pathophysiology Notes is in aiding your understanding and skills in assessing patients in your clinical work?

	Very useful	*Useful*	*Neither useful nor useless*	*Not very useful*	*Not useful at all*
All responses (n = 334)	172	156	4	2	0
"English" group (n = 171)	110	59	2	0	0
"Not English" group (n = 163)	62	97	2	2	0

Question 13: Overall how useful do you feel Campbell's Pathophysiology Notes is in aiding your understanding and practice of patient care?

	Very useful	*Useful*	*Neither useful nor useless*	*Not very useful*	*Not useful at all*
All responses (n = 335)	182	146	6	1	0
"English" group (n = 171)	119	51	0	1	0
"Not English" group (n = 164)	63	95	6	0	0

first month of ownership ranged from 1 up to 170 hr, with a mean of 23.4 hr with a large standard deviation of 32.8.

Average times spent reading the Physiology Notes during the first month of ownership were then broken down by country (Table 1). Kenyan respondents indicated the greatest mean hours of reading; Cambodia was clearly second, with the U.K. respondents reading the least. There was found to be no significant difference between the number of hours read by the Kenyan and Cambodian respondents ($p = .751$). However, when the Kenyan and U.K. respondents were compared, there was a highly significant difference ($p \leq .0001$) with the Kenyans reading more than the U.K. respondents. Likewise, the Cambodian students also read for significantly more hours than the U.K. students ($p \leq .0001$).

These results could partly be accounted for by the pleasure in owning their own copy of the book, as anecdotally many Kenyan students reported that they had not previously owned any new books. Kenyan students also had less personal access to the Internet for reading educational materials, and printing cost for Internet-based content was significant in terms of a percentage of their income.

While Cambodian students rarely owned new textbooks, they did have more access to the Internet, which might partly account for the somewhat reduced reading hours in comparison with the Kenyans (although the apparent difference was not significant). Clearly, U.K.-based students have access to large numbers of alternative texts and essentially open access to Internet-based resources, possibly indicating why they read for fewer hours in the first month of ownership. It is also possible that students based in the different countries had different mean levels of motivation. These findings indicate that in terms of dollars per educational hour, the Physiology Notes books represent very good value for money in the Kenyan situation and good value in the Cambodian context.

The results for the Pathophysiology Notes were similar (Table 2). It was also found that the difference between the hours of reading in the Kenyan respondents was significantly greater than the U.K. cohort ($p < .0001$). However (unlike the result for the Physiology Notes), with the Pathophysiology Notes, it was found that Kenyan respondents read for significantly more hours than the Cambodian respondents ($p = .009$). The reasons for these differences were probably similar to those already identified for the Physiology Notes. It could be argued that a period of 1 month was not enough time for participants to read and utilize the content of the texts. In future work, it would be interesting to collect further data after a longer period of ownership, possibly at 6 months.

Question 8

This question asked how easy participants found it to understand the use of scientific and medical terminology used in the books. Results for the Physiology and the Pathophysiology Notes were again similar, both resulting in a median and modal response of 2 (easy to understand).

Given that the same texts were being surveyed in different national and linguistic situations, it was decided to further analyze the data in terms of a respondent's first language. As the books were written in English, the respondents who had English as a first language were included in one "English" group, whereas all respondents who used English as a second language were grouped together in a "not English" group. It was found that more respondents with English as a first language found the scientific and medical terminology in both books very easy to understand. However, the modal response for the "not English" group was 2 (easy to understand). This difference between the "English" and "not English" groups was confirmed by carrying out a Mann–Whitney U test on the data. This revealed that those respondents who had English as a first language found the scientific and medical terminology significantly easier to understand than the "Not English" as a first language group ($p < .0001$).

This is not surprising as people who have English as a second language might be expected to have more difficulty with scientific and medical terms in English. It is also unsurprising that some respondents who do not speak English as a first language had more difficulty understanding the terminology, placing themselves in the "neither difficult nor easy to understand" or "difficult to understand categories." However, overall most respondents confirmed that they were able to understand the terminology, indicating mostly successful communication of technical terminology.

Another possibility is that the degree to which the scientific and medical terminology was understood was related to the number of hours a respondent has spent reading the books in the first month of ownership. If the variables of understanding and hours of study were positively correlated, this would indicate that it was the amount of study, rather than the first language, which was the main determining factor. To test this possibility, a Spearman rank correlation coefficient for nonparametric data was used. This analysis indicated a Spearman's rho correlation of .142 ($p = .015$). This rho value indicated that although the correlation was minimally positive, there was in fact very little correlation between the two variables. From this, it is not possible to say that hours of reading and levels of understanding the scientific and medical terminology are correlated, much less that the two variables have a causal relationship.

Question 9

This question pointed out that the books provided explanations of physiology (or pathophysiology for the second questionnaire) then asked how helpful the participants found these explanations. Again the data on the two books were analyzed separately, and again it was found that both median results were 2 (helpful) and the mode was 1 (very helpful). This indicates that the average responder found the helpfulness of the explanations of bioscience in the books to be between "very helpful" and "helpful." It can therefore be

inferred that the way physiological and pathophysiological concepts were explained in the text and diagrams was found to be efficacious by the majority of respondents.

Again the data were further analyzed using the "English" and "not English" groupings. This analysis indicated that "English" readers were more likely to find the explanations "very helpful," as opposed to "helpful." Conversely, the "not English" group were more likely to find the explanations "helpful" as opposed to "very helpful." However, this is not surprising given the not English group were reading in a less familiar language. Again, the fact that the vast majority of responses were in the "very helpful" or "helpful" categories indicates successful communication of physiological concepts to native and nonnative English speakers, indicating at least a degree of multilingual efficacy. It was encouraging to note that no responders placed themselves in the "very unhelpful" category.

Question 10

This question asked how useful respondents found the diagrams used in the books were in aiding their understanding of physiology (or pathophysiology for the second questionnaire). For the Physiology Notes, the median and modal responses were both found to be 2 (useful). Results for the Pathophysiology Notes revealed that the median value was 2 (helpful), and the mode was 1 (very helpful). When the data from Question 10 were analyzed using the "English" and "not English" language groups, it revealed that the diagrams in both books were found to be more helpful to respondents who spoke English as a first language. This result is surprising, as it might be expected that diagrams represent a nonlinguistic, egalitarian modality of communication. However, all the diagrams were annotated in English, which could have affected the "not English" group. Alternatively, there could be a previously unrecognized confounding variable affecting these data. For example, as the creator of the diagrams was from a U.K.-based culture, it could be that there are unidentified cultural factors operating in diagram generation and comprehension.

Question 11

This question asked how helpful overall participants felt Campbell's Physiology Notes (or Pathophysiology Notes for the second questionnaire) were to their studies and overall levels of knowledge. For both books, the median and modal responses were both 1 (very helpful). When the results were analyzed using the English as a first or second language groupings, it was the English as a first language group who gave more positive responses in regard to overall contributions to levels of knowledge. However, the modal response for the not English group was still in the "helpful" category.

Question 12

This asked how useful participants felt Campbell's Physiology Notes (or Pathophysiology Notes for the second questionnaire) were in aiding their overall understanding and skills in assessing patients. For the Physiology Notes, the median and modal responses were both 2 (useful), whereas for the Pathophysiology Notes, the median was 1 (very useful) and the mode was 1. When the results were broken down according to the respondent's first language, the English as a first language group reported higher levels of efficacy in regard to the application into patient assessment for both books. However, the results remain positive, indicating some efficacy in both linguistic groups.

Question 13

This asked how useful participants felt Campbell's Physiology Notes (or Pathophysiology Notes for the second questionnaire) were in aiding their overall understanding and practice of patient care. For the Physiology Notes, the median and modal responses were both 2, whereas for the Pathophysiology Notes, the median and mode were both 1 (very useful). The results were again broken down according to the respondent's first language which demonstrated a similar distribution to the previous results with more respondents in the English as a first language group choosing "very useful" (1) as opposed to "useful" (2). Conversely, in the English as a second language group, more respondents chose "useful" (2) as opposed to "very useful" (1). Again, it was encouraging that very few respondents chose the less favorable responses of "neither useful or useless," "not very useful," or "not useful at all."

Results of Question 14 for Both Books, "Are There Any Topics Not in the Book Which You Would Like to Have Been Included?"

As Question 14 asked for an open response, it afforded the respondents latitude to express their own opinions. This also allowed for the comments made by participants to be grouped together to provide a range of suggestions. These suggestions provided valuable insight into student perceptions and useful material to consider for the next editions.

> **Suggestion 1 for both books:** Adequacy of the books in terms of included material.

Many respondents did not record any comments relating to this suggestion, possibly indicating that they did not feel additions or modifications were necessary. Indeed, many indicated that the content covered was sufficient for their needs.

A good variety is already provided. (U.K. student nurse)

Suggestion 2 for both books: Inadequacy of the books in terms of included material.

A minority of respondents indicated that they would like more detailed content on some or several topics. Others indicated that the spread of topics was adequate, but that they would like more detailed information within chapters and sections. Several responses from the Cambodian cohort indicated that they would like a dedicated section on valvular heart disease. This reflects the high prevalence of mitral stenosis, after rheumatic fever in Cambodia. Several of the responses from Kenya suggested more on eye diseases, dermatology, cerebral palsy, and tetanus, again reflecting local morbidities. Several responses indicated that they would like more developmental and pediatric content.

Would like to have learned more about neonates. (Cambodian student nurse)

Need more information in pediatrics. (Kenyan student nurse)

Suggestion 3 for both books: Lack of discussion related to how bioscientific knowledge is generated and confirmed.

Some respondents indicated that they would like to have more information on how physiological knowledge has been developed through a process of research. The thinking behind these responses seems to be that some students are unhappy that information is sometimes simply presented as fact, without explanations of how the knowledge was initially obtained, and indeed how the information presented in the book might be empirically substantiated.

How physiological is researched and how we know about physiology. (Cambodian student nurse)

Suggestion 4 for the Physiology Notes: Lack of material in relation to midwifery.

While a chapter is included on the anatomy and physiology of the female reproductive system and the breasts, some respondents would have liked more details. This arose because some respondents were student midwives, and so it is not surprising they suggested increasing the amount of content relating to pregnancy and the process of delivery, which is of course a physiological process, so should be considered for more detailed future inclusion.

Physiological changes in women during pregnancy. (Cambodian student midwife)

Suggestion 4 for the Pathophysiology Notes: The book could be improved by inclusion of a glossary of terms.

As indicated by the quantitative results from Question 8, several respondents indicated that they had difficulty with some of the terminologies. This was despite the best efforts of Campbell to discuss the meaning of terms as a chapter progressed. However, the desire for a glossary indicates that the tactic of introducing terms progressively in the text was not adequate for the educational needs of some readers. The next edition could benefit from a glossary, possibly at the end of each chapter. Another possibility under consideration by Campbell is the inclusion of a chapter on how medical terminology can be understood by an exploration of prefixes and suffixes.

Glossary of terms would be useful as a quick reference guide. (U.K. student nurse)

Suggestion 5 for both books: Lack of ongoing formative assessment material in the books.

Some respondents suggested that the books could contain some formative assessments, such as mini-tests, multiple choice questions, or crosswords. If included these could make the books a more complete learning package, in addition to explaining essential concepts, they could help students consolidate a subject and aid their personal assessment of educational progress.

Could have included mini-tests, quizzes, crosswords, etc. At the end of a chapter to check on learning. (U.K. student nurse)

Suggestion 6 for the Physiology Notes: Learning experience could be improved by greater integration of the book content with other educational resources.

Some respondents suggested that the text should contain directions to other educational resources. For example, after a chapter on a particular topic the reader could be directed to other, possibly web-based learning resources, such as video clips or podcasts. Alternatively, video clips and podcasts could be included on a DVD, supplied with the book. These materials could be designed to complement and interact with the written and diagrammatic material in the book. This would promote the book as part of a multimedia, flexible distance learning suite of materials.

Results for Question 15 From the Physiology Notes Questionnaire: "Please Give One Example of How You Have Applied Your Knowledge of Physiology Gained From the Textbook in Your Recent Clinical Practice"

The responses for this question fell into two outcome groups, the first group related to the physiological content of the text and how this was relevant to nursing (Outcomes 1-5). The second group of outcomes (6-9) were related to the book specifically.

Outcome 1: Student nurses report physiology is useful for their clinical practice.

Consistent with the quantitative data from Questions 12 and 13, there was a broad consensus among the respondents that physiology was essential knowledge for nurses:

> I have a patient, he has diarrhoea. When I am nursing I have to tell him that he has risk of dehydration, so you should take medicine and give I.V. fluid. (Cambodian student nurse)

> Etiology of fever has abled me to manage a patient with fever caused by infection. (Kenyan student nurse)

Outcome 2: Student nurses report physiology aids their understanding of disease processes.

Many respondents reported that physiology had aided their understanding of pathophysiology and disease. This is completely consistent with the common contention that an understanding of the normal processes of the body is essential if the abnormal situation is to be understood.

> When working on a stroke ward, I wanted to understand the basic brain function and different areas of functioning to allow me to therefore understand when a stroke occurs which area is affected and to have an understanding why. (U.K. student nurse)

Outcome 3: Physiology aids nurse's ability to provide health education, patient education, and advice.

Physiological knowledge was useful in equipping nurses with essential skills required to explain health-related matters and disease states to patients and fellow professionals. This assisted nurses to be better health educators and to give accurate predischarge advice.

> In the nutrient and diet chapter I learn about glycaemic index, which tells about glucose testing from food in the blood, thus low GI food will help teach patients to reduce time of hunger and help in DM and obesity. (Cambodian student nurse)

Outcome 4: Physiology aids nurse's abilities to assess their patients.

Several respondents reported that knowledge of anatomy and physiology was important to facilitate accurate patient assessment. Again, this is consistent with the quantitative results already reported for Question 12. Physiological knowledge was found to improve respondents' understanding of normal function. It is only when nurses have an understanding of a normal parameter that they are able to recognize observations above or below the normal range. Knowledge of the normal can also apply to qualitative observation, for example, skin and mucous membrane color may be pink and well perfused, or demonstrate pallor as in shock, yellowing as in jaundice or cyanosis as in hypoxemia. Several respondents reported that physiological knowledge was useful in assessing how severe a particular patient's condition was. The reasoning here was the further away from normal a particular physiological observation was, the more likely the situation was to be severely pathological. This allowed respondents to determine whether a patient needed immediate emergency attention or whether they could wait until more routine further assistance was available.

> The patient have abdominal pain and we assess the patient which side that pain, when the patient tells us we can know the patient pain about something in abdominal. E.g., the patient pain in the right side, may be they have a appendix pain. (Cambodian student nurse)

Outcome 5: Physiology can contextualize clinical experience to aid overall learning and comprehension.

Consistent with quantitative data from Questions 11, 12, and 13, several respondents indicated that they could use their previous learning of anatomy and physiology to facilitate their understanding of clinical experiences. This indicates that physiological knowledge is necessary to make sense of many clinical situations. If students are able to understand procedures they watch or take part in, learning and clinical skills are likely to be enhanced as cognitive links are forged:

> After understanding the renal and the urinary systems, when I am observing an operation about embolisation of a renal artery. I find it easier to follow and understand the whole procedure. (Student nurse from Hong Kong)

Outcome 6: The Physiology Notes helped students to learn principles of physiology.

While it may be considered obvious that reading a physiology book increases the readers understanding of physiology, it would be presumptuous to assume this. Participants' responses did report that reading the text had improved their understanding of physiology, demonstrating consistency with quantitative results from Question 11:

> After reading the textbook I know about function and structure of all system and all body. When I to the clinical practice, I can know about normal and abnormal condition. (Cambodian student nurse)

Outcome 7: Simplified diagrams are very useful for learning anatomy and physiology.

Consistent with the quantitative data from Question 10, some respondents reported that they found the diagrams aided their understanding of physiological processes. Indeed, despite there being 215 diagrams already included in the Physiology

Notes, some respondents indicated that they would like to have seen more:

> Use of diagrams simplifies topics and makes them easier to understand. When working in practice they help to understand how the human body works and what it needs in order to function normally. (U.K. student nurse)

> **Outcome 8:** The Physiology Notes were useful for knowledge consolidation and revision.

Several respondents found the text useful for review and consolidation of material covered in class, demonstrating consistency with results from Question 11. It was also commonly used as a revision guide, prior to examinations.

> In revising for exam was able to review and consolidate my knowledge easily. (U.K. student nurse)

> **Outcome 9:** The Physiology Notes were well integrated with other course materials and other sources of information.

It was reported by several respondents that the text was useful as their course went along to connect different areas of learning. Some students found it useful in class, to help understanding of the current lecture. Some respondents indicated that using the Physiology Notes helped to gain a basic understanding, which was subsequently useful to aid comprehension of more detailed texts.

> I compared it with other textbooks and it gave me more understanding. (Kenyan student nurse)

> **Outcome 10:** The Physiology Notes improved respondents' ability to communicate physiological concepts with colleagues and learners.

Discussion between students was facilitated and students were able to start their development as teachers in their own right.

> The diagrams are so simple, I like to give it to the beginning student nurses at the start of their course. The simplified diagrams and book allows the students to grasp the knowledge and concepts. (Kenyan nurse lecturer)

Results for Question 15 From the Pathophysiology Notes Questionnaire: "Please Give One Example of How You Have Applied Your Knowledge of Pathophysiology Gained From the Textbook in Your Recent Clinical Practice"

As with the Physiology Notes book, the emergent outcomes fell into two sections: the first group related to the pathophysiology content of the text and how this was relevant to nursing (Outcomes 1-7), and the second group of outcomes (8-11) was related to the book specifically.

> **Outcome 1:** Pathophysiological knowledge gives an understanding of disease etiology, which enhances the nurse's role as a health educator.

Many responses indicated the importance of knowledge relating to the etiology of diseases. Clearly, if the cause of a condition is known, advice can then be given on how to avoid these causative factors:

> In asthmatic patients, one has to make sure the patient is not exposed to the predisposing allergens. (Kenyan student nurse)

> I learn about HIV and how this causes AIDS, and how the infection goes between people and the baby if HIV mother. I now teach the people how to not get AIDS and the pregnant woman, so the baby does not get HIV. (Cambodian student nurse)

> **Outcome 2:** Pathophysiological knowledge aids understanding of clinical features aiding disease recognition.

Many respondents indicated that their knowledge of pathophysiology aided them in their process of patient assessment, consistent with results from Question 12. It allowed them to recognize and contextualize disease processes as they assessed clinical features.

> In A and E there were many patients that came in with MIs. I used this book to understand the pathophysiology of this and what clinical signs needed to be observed. (U.K. student nurse)

> **Outcome 3:** Knowledge of pathophysiology informs patient management.

Consistent with results from Question 13, numerous examples were given relating to how knowledge of pathophysiology informs patient care. As well as indicating that a particular course of action is appropriate, this understanding provides rationales for interventions. This in turn increases the likelihood that the intervention will be appropriate in a particular patient's situation, and also improves professional accountability:

> The patient come to hospital and complain about signs and symptoms for a few weeks, such as fatigue, frequent urination, thirst, hunger. When I assess the patient I think that he have signs of diabetes, and so I check blood sugar level, the result is 7.8 mmol/L. So I explain to the patient about this problem, and manage with diet and actively monitor blood glucose, medication and education also. (Cambodian student nurse)

> **Outcome 4:** Pathophysiological knowledge aids early detection of patient deterioration.

Several responses related to the early detection of patient deterioration. This is clearly a vital aspect of nursing observations, as early treatment invariably improves prognosis. Some responses indicated that deterioration in a patient's condition can only be understood against a background of knowledge of the disease process involved. This qualitative outcome is consistent with results from Question 12.

> Caring for a patient with sepsis—being able to recognise the signs of sepsis early and treating the patient appropriately. (U.K. student nurse)

> **Outcome 5:** Pathophysiology helps students understand a variety of practice situations and clinical procedures.

Numerous responses indicated that pathophysiology was useful in a range of clinical practice situations relating to a number of specialisms. As reported for the applied physiology, many responses indicated that they were able to use pathophysiological knowledge to contextualize patient care, aiding their understanding of the patient journey. This outcome is also consistent with results for Question 13:

> I had a patient who has ulcerative colitis and required the surgical resection of colon with permanent stoma. After I read the book I found that surgical measure is the last resort and I know he had previous actually tried steroids, etc. (Student nurse from Hong Kong)

> **Outcome 6:** Pathophysiology helps students forge links between theory and practice.

Frequently, comments were made which demonstrated students had been able to form cognitive connections between the pathophysiological content in the book and their own clinical experiences. Examples were given from diverse areas of experience. Specific conditions mentioned included myocardial infarction, chronic obstructive pulmonary disease, cancer, pancreatic and hepatic disorders, diabetes mellitus, and understanding pain and fevers. This understanding strengthens the links between theory and practice.

> Whilst spending time with the COPD specialist nurses, I was fully able to understand about the effects of the disease and the reasons for the common clinical features. (U.K. student nurse)

> **Outcome 7:** Knowledge of disease processes aids multidisciplinary team working and communication.

Clear lines of communication between nurses and other members of the multidisciplinary team (MDT) are vital to ensure patient safety. This involves having the knowledge and vocabulary to be able to clearly exchange and receive contextualized observations and instructions within the MDT. This means that nursing and other MDT members have the facts on which to base fully informed decisions:

> It helped me understand when doctors are talking to me. (U.K. student nurse)

> After admission of a patient after a road traffic accident a patient later developed tachycardia, tachypnoea and pallor. I was able to SBAR the doctor using all of the correct terminology, so the doctor immediately realised how serious the condition of the patient was. The doctor then came to the ward immediately. (U.K. student nurse)

> **Outcome 8:** The Pathophysiology Notes provides clear explanations of many concepts.

Consistent with results from Question 11, several respondents commented on the clarity of explanations given in the book. For example, readers were able to understand the two forms of diabetes mellitus and how this understanding implies appropriate medications. Another example related to understanding ischemic heart disease, and how this informed appropriate investigations.

> Helped me to understand better the pathophysiology of the heart when an MI occurs. I did not fully grasp it when on a cardiology ward and this book helped me to understand why certain investigations were carried out and how to apply the right patient care. (U.K. student nurse)

> **Outcome 9:** Use of the Pathophysiology Notes aided respondents in their role as teachers and health educators.

All nurses have a teaching role, often teaching patients and carers and also other nurses and MDT members. Several respondents felt that the book had aided their ability to communicate relevant information to others.

> If the patient got a diabetes mellitus, I can explain about the nutrient to patient and how to protect from complications. (Cambodian student nurse)

> **Outcome 10:** The Pathophysiology Notes are useful for academic assignments.

It was often reported that the Pathophysiology Notes were helpful when completing assignments, assessments, and other aspects of academic work.

> It has helped me to understand my essays and to make theory to practice links. (U.K. student nurse)

> **Outcome 11:** Diagrams are a useful tool for understanding pathophysiology.

Consistent with the results from Question 10, several respondents indicated that the use of diagrams aided their understanding of the concepts involved.

> The Pathophysiology book has made learning about diseases easier and fun to understand. The use of diagrams is a fantastic learning aid and allows me to refer to them in practice. (U.K. student nurse)

Discussion Related to the Study

Possible Influence of the Hawthorn Effect

It is important to consider the possibility of the Hawthorn effect, as this could significantly influence the generalizability of the study outcomes. Subjects that provided the data in this study may have been positively or negatively affected by the knowledge they were providing data. This could have been a tendency to give more positive responses which tended to infer that the books were better than they were. Conversely, the Hawthorn effect could have increased the tendency to give more negative responses, indicating that the books were not as good as they were in reality.

Possible Influence of the Psychology of Suggestion

Although every effort was made to write the questionnaire using neutral terminology (i.e., not as leading questions), it remains that a possible influence on the data could relate to the psychology of suggestion. Because specific questions are asked about physiology and pathophysiology, there is already a suggestion that they are relevant and important, prompting a positive response. Likewise, because the books are specifically highlighted, and questions asked about them, the suggestion could be implanted in the mind of the respondent that they are good books, and so a positive response prompted. However, the role of a significant influence of suggestion is argued against by the fact that numerous respondents put forward their own novel examples of the application of physiology and pathophysiology in their personal clinical practice. This indicates that the respondents were able to think about the questions in an open way. At the very least, these qualitative responses indicate that respondents were able to form cognitive links between taught material and their clinical work.

Possible Influence of "Loss of Face" Mentality

In Asia, the concept of loss of "face" is potentially significant. This means that there is reluctance for individuals to "lose face," and this reluctance is extended to other people, with individuals not wanting significant others around them to "lose face," as a result of their actions. However, the concept of face is not well developed in Kenya, so this problem is less likely to be a confounding effect for the African respondents. Face is also not a well-developed concept in the United Kingdom, so again this factor would not be expected to be significant in these respondents. The fact that the responses were not consistently more positive in the Asian participants argues that this may not have been a significant factor.

Possible Influence of Being Given Free Books in Africa and Asia

The Kenyan and Cambodian students were very grateful to receive free books, it may be that this generated excessively positive attitudes to Campbell, and the students therefore responded in a way that they believed Campbell would like. If this was a significant factor, it would skew the results in a positive direction. This is argued against by the lack of significant differences in the positive nature of responses between overseas participants compared with those from the U.K. participants who bought their copies.

Possible Influence of the Low Cost of Books to U.K. Students

Most of the U.K. students paid £15 for the two books. This is about a quarter of a full commercial price. This means the U.K. students felt that they had a "good deal." This raises the possibility of the U.K. respondents answering the questions in terms of "value for money." The positive responses from the U.K. students may indicate that the books were good value for what they paid for then, rather than being good in absolute terms of efficacy. Had the books been much more expensive, the responses could have been less positive, as they might have felt that the content was not worth the larger sums paid.

Possible Influence of Some Respondents Knowing John L. Campbell

Given that many of the students in all countries had been taught by Campbell, it may be that the relationship built up during taught sessions was influencing the respondents. If the students had developed a positive attitude to Campbell as a teacher, then this could have positively influenced their responses. However, many respondents in Kenya, Cambodia, and the United Kingdom had not been directly taught by Campbell. As the results from students who had not been directly taught by Campbell were equally positive, the effect of knowing Campbell as a teacher is unlikely to be significant.

Limitations of the Study

Geographical Generalizability of the Study Outcomes

While it is clear that the two books have evaluated well, both in terms of internal content validity and application to clinical practice, the majority of the data were only collected in three national situations. It may be that the positive results

would not be duplicated if the study were to be expanded into other countries. However, given that the countries chosen represent three continents, this seems unlikely.

Data Are Largely Restricted to Student Opinions

Results from the study clearly indicate that students felt the books were helpful in numerous aspects of their clinical practice. However, it could be argued that this was only the students' opinions, it could be that their impressions about the application of the books were inaccurate, and the books in fact had no, or very limited, positive impact on their clinical work. An extreme view might be that the study merely records student's subjective feelings, which are disconnected from reality.

An argument against this possibility of pure subjectivity is provided by the open answers data. As the students were able to give numerous specific examples of how they were able to interrelate the content of the books with their clinical practice, this indicates that they were able to apply the content to the real world. These clinical effects are open to objective evaluation. For example, if a patient recovers from an illness and walks out of hospital, this is an objective outcome. Ideally, a future study would collect data which demonstrated a direct causal relationship between the students' study of the books and actual clinical outcomes. If this could be done, it would improve the objectivity and validity of the study.

As students are not the only people involved in the educational process, the lack of data collected from other relevant professionals could be considered a limitation. A future study could also collect data from academic faculty and clinical mentors. These data could then be compared with those collected from students.

Possible Future Work

Study Comparing Reader's Responses to a Variety of Textbooks

It would be possible to compare the Physiology and Pathophysiology Notes with alternative texts on the same topics. This would allow comparison of responses between two texts rather than an analysis focused on a single text. To date, no such comparative study has appeared in the literature.

Need for Low-Cost Textbooks to Be Written in a Student's First Language

There was a consistent trend in the quantitative data for English as first language respondents to rate both the Physiology Notes and Pathophysiology Notes higher than the English as a second language group. Typically, the modal response for the "not English" group was in the "useful" category, as opposed to the "very useful" category. From this, it could be suggested that educational processes could be optimized if books were written or translated into local languages. This possibility of producing versions with English and a local language combined is currently being investigated.

Conclusion

The overall impression is that the books have been favorably received in several national situations and that they have good levels of educational and clinical efficacy. They aid in the professional and clinical development of students, equipping them to provide improved patient care. Evidence has been provided to support the extension of the project as soon as funding becomes available. It has also demonstrated a novel method of textbook production and distribution, which can act as a model for other academics and authors. This study also constitutes a model for assessment of textbooks and, by extension, other educational materials.

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Supplementary Materials

All of the original materials from this research process have been retained. This includes the original completed questionnaires and all of the databases used with SPSS. Blank questionnaires are also available. I am happy to forward the anonymized data on any reasonable request from other academics.

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