# Computer-based learning for the enhancement of breastfeeding training

[a] **Du Plessis LM,** M Nutrition, RD (SA) [b] **Labadarios D,** MBChB, PhD, FACN [c] **Singh T,** MD, MA (Distance Education) [a] **Marais D,** PhD, RD (SA)
[a] Division of Human Nutrition, Faculty of Health Sciences, Stellenbosch University, South Africa
[b] Knowledge Systems, Human Sciences Research Council, Cape Town, South Africa and Tygerberg Academic Hospital, Tygerberg [c] Christian Medical College, Ludhiana, India
**Correspondance to:** Lisanne du Plessis, email: lmdup@sun.ac.za
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## Abstract

A great need exists for ongoing breastfeeding training. Students of today relate well to computers in the learning environment. In this study, computer-based learning (CBL) was explored in the context of breastfeeding training for undergraduate Dietetic students.

**Aim:** To adapt and validate an Indian computer-based undergraduate breastfeeding training module for use by South African undergraduate Dietetic students.

**Methods and materials:** The Indian module was adapted to suit the South African scenario and converted into low-bandwidth, interactive computer-based material. It was assessed for face and content validity by 19 peer reviewers and 17 third-year Stellenbosch University (SU) Dietetic student reviewers by means of self-administered questionnaires. Impact of the adapted module on knowledge was evaluated on second-year SU (n = 14) and University of the Western Cape (UWC) (n = 15) Dietetic students by means of pre- and post-knowledge tests.

**Results:** All reviewers rated their information technology (IT) skills as sufficient and enjoyed the presentation mode of the adapted module. Student reviewers indicated that CBL was a "nice way of learning", but requested that it should not be used as the sole source of instruction. Fifty three per cent (n = 19) of the reviewers rated CBL to be equally effective compared to conventional lectures, 36% (n = 13) rated it as being more effective and 11% (n = 4) as less effective. Pre- and post-knowledge test scores showed a significant increase (SU $p < 0.0001$ and UWC $p < 0.00115$).

**Conclusion:** It is recommended that validated computer-based breastfeeding training modules be integrated as part of multi-media methods to increase coverage and enhance breastfeeding learning for undergraduate Dietetic students. Other students of health care professions and health care workers may also benefit from such modules.

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## Introduction

Breastfeeding is an unequalled way of providing the ideal natural first food for babies.[1] Despite the short- and long-term benefits[2,3] of breastfeeding and all the programmes, treaties and policies that have been developed to protect, promote and support breastfeeding,[4] the prevalence of exclusive and continued breastfeeding in South Africa[5] and on a global scale[6] is low.

It is clear from the literature that there is a great need for ongoing breastfeeding training for students of health care professions and health care workers (HCWs) in order to redress the situation.[4,7–9] Many breastfeeding courses, materials and manuals are widely available, including on the internet.[10–12] However, there is a need for new approaches to ensure greater and more effective training of HCWs.[8] Most of the available courses rely heavily on the availability of trained peer counsellors and/or HCWs. The availability of these groups is often hampered in South Africa due to staff shortages in the health care sector.[13]

In order to optimise any learning experience, it is imperative to know which methods and mediums enhance learning. The available literature indicates that computer-based learning (CBL) can be integrated effectively as part of multimedia methods of teaching and has the potential to enhance learning.[14,15] It creates a flexible learning environment in which students can work at their own pace and in their own place as well as revise their work using available CBL facilities.[16,17] CBL further brings variety and interactivity to the learning process,[17] and creates new opportunities to increase knowledge and competencies.[16] However, caution has been raised regarding the indiscriminate use of this teaching method, since students might miss contact with their teachers and peers, and some students have been reported to struggle with concentration, time management and self-discipline.[17] CBL also requires a degree of computer literacy and support in different forms is needed to create an effective electronic-learning (e-learning) environment at teaching facilities.[18]

This study formed part of the Indo-South Africa Intergovernmental Science and Technology Co-operation Programme and focused on web-based undergraduate Nutrition training modules. The aim was to adapt and validate an Indian computer-based undergraduate breastfeeding training module for use by South African undergraduate

Dietetic students, in order to assess whether CBL in breastfeeding training could address the relevancy of the topic, assess how students view the learning experience and determine whether it could contribute to a gain in knowledge on the subject.

## Methods

The study was approved by the Committee for Human Research, Faculty of Health Sciences, Stellenbosch University (Project number: N06/06/114). It followed a cross-sectional descriptive design.

### Design of learning material

The Indian breastfeeding module was developed for undergraduate students of health professions in *Microsoft PowerPoint* format with animation and interaction. An independent peer review of this CD-ROM concluded that the program "will be most helpful for students of the health professions, including nursing, midwifery, medicine and medical support services". It was viewed as "an accurate, clear and welcome addition to the menu of options for learning how to provide effective encouragement and support for the nursing couple".[19]

The Indian module was reviewed by the authors regarding the relevancy of the content for the South African context by paying specific attention to policy, cultural and language issues. Policy issues that were reviewed were specifically related to the South African National Breastfeeding Guidelines for Health Workers and Infant and Young Child Feeding (IYCF) in the context of HIV/AIDS and the Prevention of Mother to Child Transmission (PMTCT) programme, to ensure that messages were consistent with current policy. The current curriculum for the second-year Stellenbosch University (SU) Bachelor of Sciences (BSc) in Dietetics course in the subject "Nutrition in the life cycle" was consulted to compare the contents with the present lecture content material. Since the Indian module was based on World Health Organization (WHO) guidelines and recommendations, the bulk of the content remained the same for the South African context and included nine learning sections (Figure 1).

Cultural issues that represent the South African context were incorporated through the inclusion of photographs taken by UNICEF specifically for the National Directorate Nutrition, Department of Health (DoH). Permission for the use of these photographs was obtained from the National Directorate Nutrition, DoH. Photographs from Jack Newman's training CD-ROM, which contain no copyright restrictions, were utilised, and free video material from the internet was further incorporated into the updated module. The latter visual material, although not of South African origin, was judged to be culturally acceptable for the South African context. Examples of indigenous South African foods were also included. All sources were duly acknowledged. The Indian module was presented in English, but vernacular adaptations were made to the text to represent South African English.

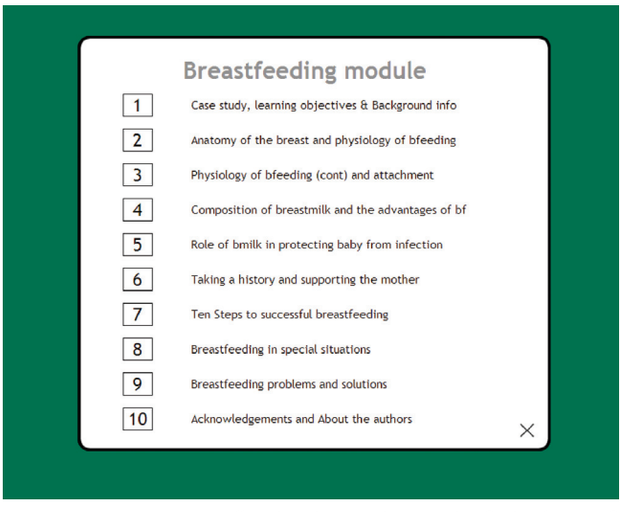


Figure 1: Window displaying different sections contained in the South African VTS breastfeeding training module

Acceptability of the presentation of the module was also investigated by the authors and it was decided to utilise a different mode of presentation other than *Microsoft PowerPoint.* A software tool for web-based learning, Virtual Training Studio (VTS), had been specifically designed for use in developing countries and it allowed for more interactivity to be incorporated into the teaching material. VTS is a free software tool for web-based learning. Key features of VTS are that it enables the creation of professional-looking, low-bandwidth interactive teaching material without extensive work or technical knowledge required by the lecturer. It enables material to be presented via the internet or CD-ROM, hard drive or Local Area Network (LAN).[20]

Each section started with an opening window with tabs at the top indicating the different topics included in the section (Figure 2). Guiding and interactivity tools available in VTS were included in the adapted module (Figure 3).

The adapted module was then exported to the read-only interface on a CD-ROM and subjected to the validation process.

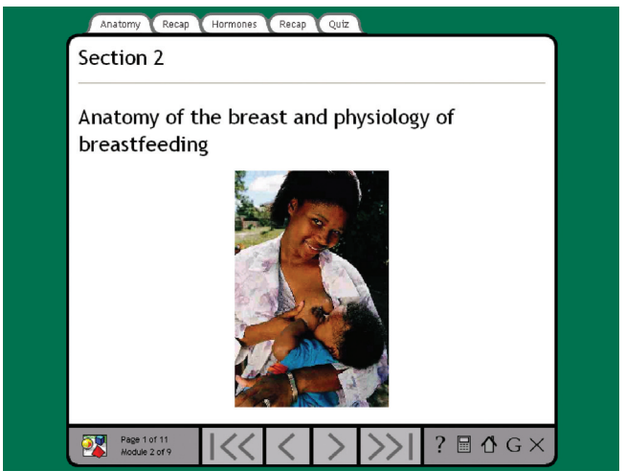


Figure 2: Example of an opening window of a section of the South African VTS breastfeeding training module

### Validation of the adapted module

The process of adaptation and validation followed some of the WHO "Key elements of successful large scale behaviour change programmes".[8] It stated that "the development of interventions for the promotion of improved IYCF should include attention to policy analysis, reform and advocacy and local adaptation of guidelines and approaches using formative research".

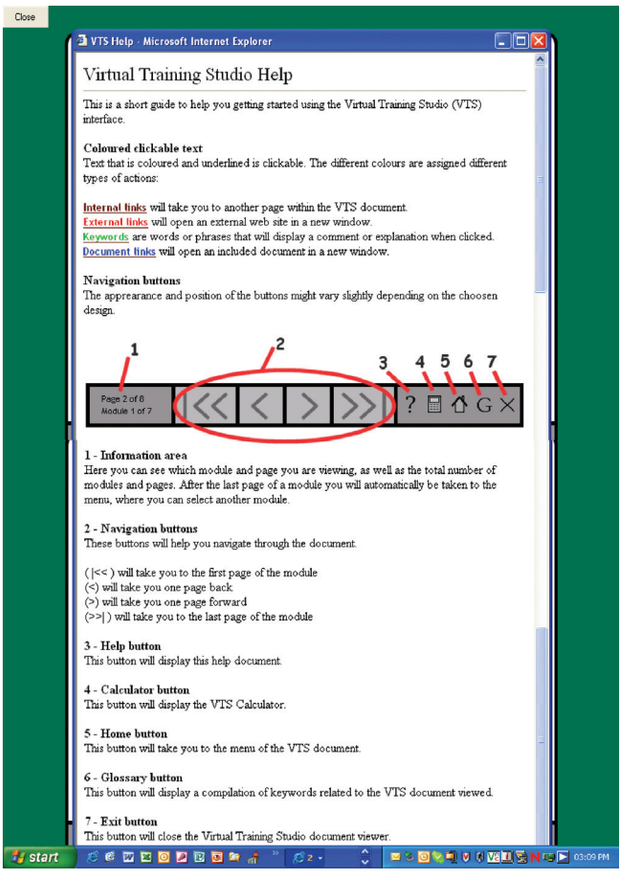

Figure 3: "Help" window indicating guiding and interactivity tools available in VTS

*Evaluation by peer reviewers*

Thirty-six peer reviewers were selected by means of judgement sampling, based on their broad involvement with breastfeeding in South Africa (Table I) to evaluate face and content validity of the adapted breastfeeding training module. They were mailed a letter outlining the research, a CD-ROM with instructions on how to work through the adapted module and a hardcopy peer reviewer questionnaire.

The peer reviewer questionnaire contained six questions on demographic information (including questions on age, gender, residing province, specific experience in breastfeeding training), seven administrative questions (including questions on place and situation of module completion, time taken to complete module, sufficiency of IT skills, facilities and support), eighteen questions on the mode of presentation (including questions on familiarity and usefulness of icons and menu, functionality and usefulness of links and other visuals and colour scheme), eleven questions on content (including questions on level, sufficiency, skills acquired, relevancy and applicability of interactive tools and cultural acceptability) and eleven questions on the perceived efficiency of the adapted breastfeeding module. Each section contained open and close-ended (yes/no, choose the most appropriate and Likert scale) questions.

*Evaluation by student reviewers*

Module editing was done after feedback from the peer reviewers, before evaluation of the adapted module by the third-year SU Dietetic student reviewers.

**Table 1: Total respondents from invited groups of peer reviewers**

| Groups | No invited | Total respondents |
|---|---|---|
| Directorate and Sub-directorate Nutrition, DoH, South Africa | | |
| • National Directorate Nutrition | 3 | 0 |
| • Western Cape Provincial Sub-directorate Nutrition | 1 | 0 |
| • Western Cape Integrated Nutrition Programme (INP) district dieticians | 2 | 0 |
| • Western Cape hospital-based INP dieticians | 3 | 3 |
| Selected for their extensive input in, among others, two of the key performance areas of the INP programme, namely "Maternal nutrition" and "Infant and young child feeding", which includes strategies to promote, protect and support breastfeeding, also for their involvement in policy formulation in this area and the Baby Friendly Hospital Initiative as well as on-going training in breastfeeding on national and provincial level | | |
| Division of Human Nutrition, SU lecturers – selected for their experience in breastfeeding training at tertiary institutions | 4 | 3 |
| Lecturers from sister departments at other Western Cape universities – selected for their experience in breastfeeding training at tertiary institutions | 2 | 1 |
| Lecturers from universities outside of the Western Cape – selected for their experience in breastfeeding training at tertiary institutions | 5 | 3 |
| Other SU departments (Obstetrics and Gynaecology, Paediatrics and Nursing) – selected for their experience in training on issues pertaining to maternal and child health at tertiary institutions | 4 | 3 |
| Non-governmental organisations involved in breastfeeding training – selected for their expertise and experience in breastfeeding training and consultations at community and individual level | 3 | 0 |
| Private practicing breastfeeding consultants and counsellors – selected for their expertise and experience in breastfeeding training and consultations at community and individual level | 6 | 4 |
| Study leaders – selected for their experience in the use of the software program,VTS | 3 | 2 |
| **Grand total** | **36** | **19** |

The student reviewers who were invited to evaluate the face and content validity of the adapted breastfeeding training module included 23 third-year students (class of 2006), since they had been exposed to undergraduate breastfeeding training during their second year of study (2005) and included all students who gave informed consent. The student reviewers were also provided with a CD-ROM with instructions on how to work through the adapted module and a student reviewer questionnaire. Most of the questions in the students' questionnaires were similar to or exactly the same as those used for the peer reviewers, as the information needed to be gathered was similar.

A list of discussion points was compiled from the feedback and comments received from the third-year SU student reviewers on the completed questionnaires, and a focus group discussion (FGD) was conducted with the same group of students. The first author explained the purpose of the FGD and initiated the session by mentioning the themes that emerged from the comments received. Each theme was then individually put forward for discussion. The first author transcribed the comments and repeated the comments to the students to ensure accuracy of recording. After all the themes were discussed individually, the students were given the opportunity to make any additional comments and suggestions. It is acknowledged that this was a large group for an FGD, but since the students already had an opportunity to make written comments on the questionnaire, and themes already emerged from those comments, the FGD was yet one more avenue to extract more detail on the comments.

After feedback from the third-year students, further minor module editing, related mostly to formatting, was effected.

*Acquisition of knowledge*

The study population to evaluate the impact of the adapted module on acquisition of knowledge included 14 second-year SU and 15 University of the Western Cape (UWC) Dietetic students (class of 2006), since they had not been exposed to undergraduate breastfeeding training before, and included all students who gave informed consent. The acquisition of knowledge was evaluated by means of pre- and post-knowledge tests.

The pre- and post-knowledge tests included 14 multiple choice questions, 10 questions with statements where the students had to indicate which statement they agreed with and 19 statements that they had to rate on a Likert scale of "Strongly agree" to "Strongly disagree" or "Cannot answer this question", based on a previously developed and validated pre- and post-knowledge test questionnaire from the Breastfeeding Education Programme.[21] There was a section at the end of the post-knowledge test where students could give additional comments.

**Data analysis**

All data were captured and analysed using *Microsoft Excel 2000 and Statistica 7.1*. All statistical analyses were done at a significance level of 5%. Descriptive statistics, including frequency tables and histograms, were used to analyse the initial data. Demographic and other characteristics of peer reviewers and students were compared using t-tests and chi-square tests, as appropriate. Means and standard deviations for continuous variables were calculated. For pre- and post-knowledge test analyses of data, repeated measures ANOVA were used.

## Results

**Content and face validity of the adapted module**

In total, 19 out of 36 peer reviewers completed and returned the evaluation questionnaires, resulting in a response rate of 53%. The mean age of the peer reviewers was 41.5 years (SD 10.2), 79% (n = 15) were women and 21% (n = 4) were men. The majority of the peer reviewers were dieticians (37%; n = 7) or lecturers in tertiary training/education institutions (32%; n = 6), followed by paediatricians (16%; n = 3) and breastfeeding consultants (16%; n = 3).

Of the 23 third-year SU Dietetic students, 17 completed and returned the student reviewer questionnaires, which was a response rate of 71%. Of these students, 22 took part in the FGD. The mean age of the student reviewers was 21.3 years (SD 1.1) and they were all female students.

The responses of the peer reviewers (n = 19) and student reviewers (n = 17) were pooled for data analysis for some questions that were very similar or exactly the same. However, data was also analysed separately and differences in responses are reported as such. The pooled answers from the two groups are hereafter referred to as "the combined group" (n = 36) and where responses were individually reported or where questions differed, reference is made to "the peer reviewers" and "students reviewers" as separate groups.

**Administrative aspects of the adapted module**

Seventy-six per cent of the combined group (n = 26) strongly agreed that their IT skills were sufficient to complete the module and 24% (n = 8) agreed to the statement. None felt that their IT skills were not sufficient.

Ninety-four per cent (n = 17) of the peer reviewers indicated that they had adequate IT facilities in their institutions to administer such a module/course and 6% (n = 1) indicated otherwise. One did not respond to this question.

**Content aspects of the adapted module**

Most reviewers of the combined group (91%; n = 32) were of the opinion that the information in the adapted module was appropriate for the specific needs and cultural context in South Africa. Eighty-six per cent (n = 31) of the combined group indicated that the information in the adapted module was sufficient to enable the students to take necessary preventive/treatment action according to their profession or area of interest. Fourteen per cent (n = 5) indicated otherwise. The five reviewers who indicated that the information was insufficient were all peer reviewers. The peer reviewers suggested a few additional inclusions. These suggestions were incorporated in the module-editing process. When the responses of the peer reviewers and student reviewers were analysed separately, the peer reviewers and student reviewers differed significantly (p = 0.0076) over the question whether the content of the adapted module could be regarded as sufficient (Figure 4).

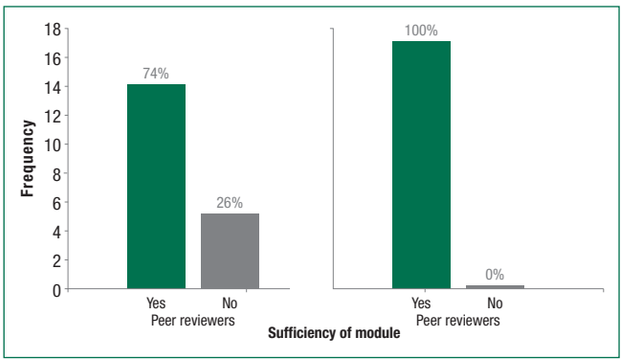


Figure 4: Opinions of peer reviewers and student reviewers on sufficiency of the information in the South African VTS breastfeeding training module

### The mode of presentation of the adapted module

Most reviewers in the combined group (94%; n = 34) indicated that they would recommend CBL for other courses, e.g. in-service training, all under-graduate studies for health professions and any course covering infant feeding. All the peer reviewers (n = 18), except one who did not answer the question, would recommend the VTS delivery mode for the presentation of these courses.

The peer and student reviewers had overwhelmingly positive attitudes towards certain statements regarding the aesthetics of the screens of the adapted module, including the window size being optimal, the icons being familiar and the colour scheme being pleasing to the eye. Reviewers were also asked questions about their interaction with the material and seemed to find it easy and useful (Table II).

**Table II: Responses of the combined group of reviewers on statements related to the interactivity aspects of the South African VTS breastfeeding training module**

| Statement | Yes | No | Did not answer[1] |
|---|---|---|---|
| The following are easy to follow and use: | | | |
| Icons | 94% (n = 33) | 6% (n = 2) | 1 |
| Menu tabs | 97% (n = 35) | 3% (n = 1) | 0 |
| Indicate the links you used: | | | |
| Keywords | 100% (n = 36) | 0% | 0 |
| Internal links | 100% (n = 36) | 0% | 0 |
| External links | 54% (n = 15) | 46% (n = 13) | 8 |
| Did you find the internal links: | | | |
| Distractive | 0% | 100% (n = 22) | 14 |
| Useful | 100% (n = 32) | 0% | 4 |
| Time-consuming | 24% (n = 6) | 76% (n = 19) | 10 |
| Did you find the external links: | | | |
| Distractive | 0% | 100% (n = 14) | 22 |
| Useful | 93% (n = 26) | 7% (n = 2) | 7 |
| Time-consuming | 43% (n = 6) | 57% (n = 8) | 21 |
| Costly | 29% (n = 4) | 71% (n = 10) | 22 |
| Could you relate to the visuals (video clips/sound/pictures) used? | 91% (n = 29) | 9% (n = 3) | 4 |
| Did the visuals contribute to enhancing/clear understanding? | 88% (n = 29) | 12% (n = 4) | 3 |

[1] The high non-response regarding the internal and external links is ascribed to reviewers indicating the most appropriate answer rather than responding to each aspect listed.

All reviewers agreed that they enjoyed the presentation and delivery method of the adapted module, of which 56% (n = 20) felt strongly about it. When the level of IT skills was compared to the level of enjoyment of the adapted module, the combined group with a higher self-rated level of IT skills tended to rate their enjoyment of the adapted module higher, but the difference was not significant (p = 0.06).

### Perceived efficiency of the adapted module

Only 11% (n = 4) of the combined group rated the adapted module as "less effective" than conventional lectures, whereas 36% (n = 13) rated it to be "more effective". Fifty-three per cent (n = 19) rated the adapted module to have been "equally effective" compared to conventional lectures. When asked to explain their responses in an open question, the group that was of the opinion that it was "less effective" said that personal contact was necessary to teach and explain breastfeeding concepts and clinical skills. The group that was of the opinion that it was "equally effective" said that both lectures and computer training have advantages and disadvantages. CBL was experienced as being different and interactive and it was considered a positive aspect that students can complete it at leisure. It was felt that it depended on the type of learner and might suit the motivated learners better than those needing more personal attention. The group that was of the opinion that it was "more effective" said that it was very user-friendly and visually stimulating and that one can work at one's own pace in one's own time. They indicated that recapping was possible with the module and that the quizzes aided concentration.

All peer reviewers (n = 18), except one who did not answer the question, said they would recommend the adapted module to other teachers/trainers. The answer was justified by stating that it was easy to use and suitable for distance education and self-education/study, thorough and complete, easy to follow and understand and provided all needed information in a comprehensive, concise format. It was stated that the recapping function and quiz sections reinforced knowledge learnt. A recommendation stated by five peer reviewers also emerged from this question, indicating that the adapted module could be used as a self-study module and could decrease contact training time for hospitals striving to become baby friendly. All student reviewers (n = 17) indicated that they would recommend the adapted module to other students.

Thirty-three per cent (n = 6) of the peer reviewers said that they would recommend the adapted module as an exclusive learning experience in breastfeeding and 67% (n = 12) would not make this recommendation. One did not answer the question.

### Focus group discussion with third-year student reviewers

Emerging positive and negative statements (Table III) from the third-year student reviewers towards the adapted module were recorded and summarised during the FGD. These statements primarily related to the benefits and risks that the adapted module offered as a learning medium as well as comments on their enjoyment of it and the technical problems they encountered with the delivery medium.

**Table III: Emerging positive and negative statements from third-year student reviewers towards the South African VTS breastfeeding training module and the delivery mode of the module**

| Positive themes | Summary discussion |
|---|---|
| The module is different/gives variation from normal lectures | Compact. Gives a lot of information, but it is easily accessible from the CD. |
| One can work at one's own pace | Mode of learning gives flexibility and is convenient. When lecturers explain difficult concepts in class, they move on and you do not necessarily stop them if you are not completely "with" them. With VTS, you repeat a section until you understand it. |
| Module is interactive | Stimulating, not boring. Interesting. You do more than you thought you would, i.e. use keywords, read more after using links. |
| Enjoyed the module | Well laid out. Logic structure. Enjoyed the module. It is a nice "helping tool"/add-on. It enhances learning of the topic. |
| **Negative themes** | |
| Need self-discipline to work through module on one's own | The lecturer takes a risk to rely on student's self-discipline to work through the module in their own time! |
| There is nobody to ask questions to | Opposite from comment under "Positive": When lecturers explain difficult concepts in class you can stop them if you do not understand and then they can explain it in a different way or in different words. With VTS, you have to repeat the same section to try and understand. Would be nice if there was an e-mail link option, to e-mail the lecturer with questions or comments. |
| Difficult to remain focused and keep concentration | It is easier to listen to a lecturer for an hour than to sit and read on your own for an hour. |
| Technical issues | It is easier to read from printed material. Would like to have module in manual format to study from. It is easier to page to a place than to browse for a place in a module. One cannot make one's own notes on a PC – easier to highlight notes and write one's own comments on it.<br>Internet access is a problem. If you are not online, you cannot access the external links. It is fine when you are on campus – computers are available, but not everyone has a computer at home. So some students are restricted to learn when they are on campus only.<br>The program makes the computer slow. When you have the program open, you cannot work in other programs.<br>Students do not necessarily use links. If information is vital, it should be put IN the module, not as a link. |

### Evaluation of acquisition of knowledge: Pre- and post-knowledge test

Fourteen second-year students from SU (48%) and fifteen second-year students from UWC (52%) completed the pre- and post-knowledge test, resulting in a 100% response rate (n = 29). Most of the second-year students (83%; n = 24) fell in the age range of 19 to 21 years. They were mostly female (93%; n = 27) and English (41%; n = 12) or Afrikaans (38%; n = 11) speaking.

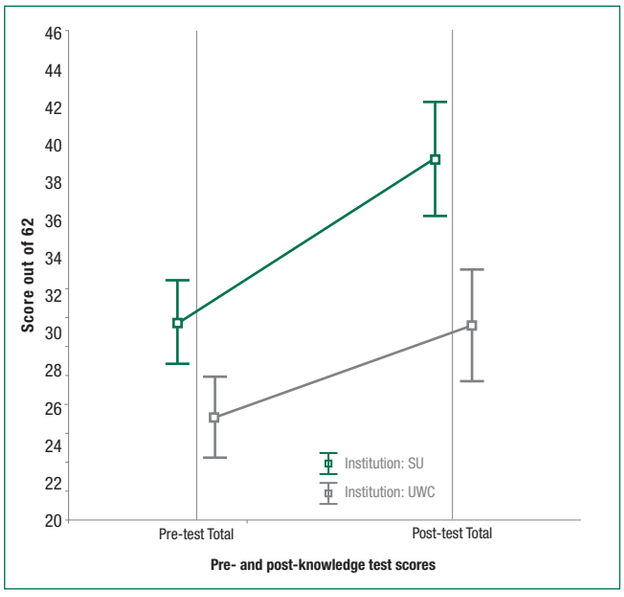


Figure 5: Pre- and post-knowledge test scores of second-year students at SU and UWC

The pre- and post-knowledge test scores counted out of 63 marks. The mean pre-test score for the group was 27.9 (SD 4.8) and the mean post-test score was 34.7 (SD 7.2). The mean score increased by 6.8. There was a significant increase in the pre- and post-knowledge test scores for both groups (SU $p < 0.0001$ and UWC $p < 0.00115$, Bonferroni multiple comparisons) (Figure 5).

The student reviewers also offered additional comments on a section in the post-knowledge test. These were summarised (Table IV) and it primarily related to the difference and effectiveness that the adapted module offered as a learning medium as well as comments on their enjoyment of it and the format that was appealing to them.

## Discussion

In this study the majority of peer and student reviewers were of the opinion that their IT skills were sufficient to complete the adapted module. This finding is important, since it has been reported in the literature that CBL could deter students and teachers from the study course or material if they feel they are not equipped to master this form of technology.[17,18,22] All reviewers enjoyed the CBL mode of the adapted module. It could be expected that those with a higher level of IT skills would enjoy the adapted module more than those with a lower level of IT skills, since reviewers with a higher level of IT skills might have a higher comfort level with the technology. The difference shown in this study, however, was only modest.

Most of the peer reviewers indicated that they had adequate IT facilities in their institutions and that it was practical to administer such a course. This is a positive point, since it indicates that some barriers to effective e-learning, such as infrastructure, support,

**Table IV: Comments from second-year students on the South African VTS breastfeeding training module**

| Theme and number of comments | Sample quotes |
|---|---|
| Different (9) | Program nice, user-friendly<br>Interactive<br>Provides fun<br>Makes learning easier and quicker<br>Women who see this CD will want to breast-feed their children<br>Have the chance to work in own time |
| Enjoyed it (7) | Interesting and nice to work on<br>Enjoyed the CD – thanks for the initiative<br>Much appreciated |
| Learning medium (18) | Learned a lot – very effective way of learning<br>Visuals more stimulating than written text<br>Good use of repetition helps to remember info<br>Effective learning medium<br>Very interesting and practical way of learning<br>Helped to increase breastfeeding knowledge<br>What I have learned will help me as a mother and help other mothers<br>Info will be used in the future |
| Format (10) | Format (10) Pretty and complete<br>Well structured and easy to work with<br>Very comprehensive information – well laid out<br>It was very interesting – information was easily understandable |

funding and administration for the e-learning environment,[18] which cause concern for managers, lecturers and students, had been addressed at the particular teaching facilities.

One of the main advantages of CBL is said to be the flexible learning environment it creates.[16–18,22,23] The students in this study also cited the flexibility of the adapted module as a positive attribute, but at the same time stated that self-discipline was needed to work through the adapted module on their own and that it was difficult to remain focused and keep their concentration while working through it. The absence of a teacher or class interaction seemed to be challenging for them. Students enjoyed the variation that the adapted module added from normal lectures and the interactivity it provided as well as the stimulating effect it had on them in wanting to learn more. These findings support previous research in this field.[16–18,22,23]

Technical problems with CBL have been shown to detract from the learning experience and cause frustration.[18,22] This reflects findings in the present study where some of the technical problems mentioned were that it was easier to read from printed material, internet access sometimes caused problems and that not all students had access to a computer off campus. A few of the reviewers found the links to be time-consuming since they could not go back to the section where they left off. This "losing of your place" when you click to view an internal or external link is indeed a limitation of the VTS program, but the designers of the software have indicated that enabling this functionality would greatly increase the size of the program, while the small size is currently one of its benefits.

All peer reviewers would recommend CBL to other teachers and most would also recommend VTS for the presentation of a host of other courses. The majority of the combined group was of the opinion that the mode of presentation was appropriate for teaching the adapted breastfeeding module. This indicates that both peer reviewers and students feel that CBL has a role to play in multimedia methods of teaching to enhance learning in general,[24] but also specifically in breastfeeding training.

The significant difference in opinion between peer reviewers and student reviewers regarding the sufficiency of the information contained in the adapted module, before module editing, can be explained by the difference in the experience levels of the reviewer groups. Students might think that the adapted module on its own is sufficient since they have not been in a position to take necessary preventative/treatment action, whereas the peer reviewers would know from experience that the adapted module does not cover each and every problem scenario. This corresponds with the finding that the majority of the peer reviewers would not recommend the adapted module as an exclusive learning experience in breastfeeding and stresses the opinion that CBL should not be used as a sole source of teaching,[24] especially with a topic such as breastfeeding, where practical exposure and skills are of the essence.

Overall the adapted module was rated as being more effective, or at least as effective, as conventional lectures by the reviewers. The third-year student reviewers concluded during the FGD that they were very satisfied with the presentation mode of the adapted module, but since they do a lot of work on computers, CBL should not replace lectures but be used in combination with lectures. Similar remarks on CBL have also been documented in the literature.[18,24–26]

The peer reviewers would all recommend the adapted module to other teachers. All the students would recommend the adapted module to other students. This demonstrates the recognition from both the peer reviewers and students that breastfeeding training is extremely important and should form a part of most undergraduate courses of healthcare professions. Furthermore, although the adapted module was initially intended for use by undergraduate Dietetic students, the recommendation from the peer reviewer group that "this tool could be used as a self-study module and could decrease contact training time for hospitals striving to become baby friendly" is very important. It broadens the potential application of the adapted module to include not only Dietetic students or students of healthcare professions, but also HCWs. More and more health care facilities in South Africa are equipped with computers, making this tool a viable option as a self-study module in these settings. It is not assumed, however, that a "one-size-fits-all" model is appropriate for different healthcare practitioners. The same principles need to be taught, but the level of detail will vary by practitioner group. The availability of computers is, however, essential for CBL and the application could be hampered in resource-poor settings.

Most of the combined reviewer group was of the opinion that the information in the adapted module was appropriate for the specific needs and cultural context in South Africa. This is reassuring, since it is extremely important that students are able to apply their knowledge and skills outside the boundaries of the tertiary institution and their immediate surrounding communities. It also broadens the possible application of this adapted module to beyond the Dietetic students at SU and UWC in the Western Cape to students of healthcare professions and HCWs in other provinces in the country.

The improvement in the post-knowledge test scores for both SU and UWC students, although not a major improvement indicates that there was an increase in the knowledge from baseline. This shows that for students who have not had previous exposure to breastfeeding lectures, this module will lead to an increase in knowledge on the topic. As this module is not intended to be used as the sole source of instruction, but in conjunction with other learning modalities, the improvement in knowledge should be further enhanced.

In conclusion, it is recommended that validated computer-based breastfeeding training modules be integrated as part of multi-media methods in breastfeeding training for undergraduate Dietetic students. Other students of healthcare professions and HCWs in institutions striving to become baby friendly may also find these modules beneficial, provided that computers are available.

Such programs may contribute to the alleviation of the increasing pressures to introduce training courses and materials on IYCF into the curricula of pre-service training institutions in order to increase the sustainability and coverage of HCWs and enhance the breastfeeding-learning experience in the national and international effort to optimally promote, protect and support breastfeeding.

## Limitations

A good response rate was reached from the peer reviewers with fair national representation. Notwithstanding repeated efforts to improve the response rate, it was unfortunate that no feedback was received from the government sector as well as non-governmental organisations involved in breastfeeding training. Only three of the six universities outside the Western Cape that offer a degree course in Human Nutrition/Dietetics responded.

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## References

1. Brown JE. Nutrition and lactation. In: Nutrition through the life cycle. Place: Wadsworth, 2005; p. 173–197.
2. LeóN-Cava N, Lutter C, Ross J, Martin L. Quantifying the benefits of breastfeeding: A summary of the evidence. Pan American Health Organization. c2002 [cited 2009 Jan 13]. Available from http://www.paho.org/english/ad/fch/BOB-Main.htm
3. Horta BL, Bahl R, Martines JC, Victora CG. Evidence of the long term effects of breastfeeding, systematic reviews and meta-analyses. Geneva, Switzerland: World Health Organization; 2007.
4. World Health Organization. Department of Child and Adolescent Health and Development. Nutrition: Implementing the global strategy for infant and young child feeding. Meeting report. c2003 [cited 2009 Jan 16]. Available from http://www.who.int/child_adolescent_health/documents/infant_feeding/en/index.html
5. Department of Health. South African Demographic and Health Survey (SADHS), Preliminary Report 2003. Pretoria: Department of Health. c2004 [cited 2009 Jan 13]. Available from http://www.doh.gov.za/docs/index.html
6. Save the children. State of the world's newborns report. c2001 [cited 2009 Jan 13]. Available from www.savethechildren.org/publications/newborns_report.pdf
7. Savage-King F. Helping mothers to breastfeed. Rev. ed. Nairobi: African Medical and Research Foundation; 1992.
8. World Health Organization. Department of Child and Adolescent Health and Development. Child and adolescent health: Progress report 2000–2001. c2001 [cited 2009 Jan 16] Available from http://www.who.int/child_adolescent_health/documents/child/en/index.html
9. Menghini KG. Designing and evaluating parent education materials. Advances in Neonatal Care 2005;5:273–283.
10. UNICEF Nutrition. UNICEF in action. Key publications and links. [cited 2009 Jan 16]. Available from http://www.unicef.org/programme/breastfeeding/links.htm
11. UNICEF Nutrition. Baby-friendly hospital initiative: Revised, updated and expanded for integrated care. 2006 [cited 2009 Jan 16]. Available from http://www.unicef.org/nutrition/files/BFHI_Revised_Section1.pdf
12. Wellstart International. Featured Wellstart Publications [homepage on the Internet]. No date..[cited 2009 Jan 16]. Available from http://www.wellstart.org/resources.html
13. Health Systems Trust. South African Health Review. c2005. [cited 2009 Jan 16]. Available from http://www.hst.org.za/uploads/files/sahr05_chapter6.pdf
14. Belton V, Elder M, Thornbury H. Early experiences of mentoring: Design and use of multimedia materials for teaching OR/MS. Omega, Int. J. Mgmt Sci. 1997;25:659–676.
15. Lockitt B. Unlocking the potential of Information Learning Technology (ILT). A 3T Post 14 occasional paper. 2004 [cited 2009 Jan 13] Available from http://www.learninglab.org.uk/papers/Bill_Lockitt_ICL_Potential.pdf
16. Farrior ES, Gallagher ML. An evaluation of distance education. Topics in Clinical Nutrition 2000;15:10–18.
17. Herriot AM, Bishop JA, Truby H. The development and evaluation of student training, education and practice for dietetics CD-ROM: A computer assisted instruction programme for dietetic students. Journal of Human Nutrition and Dietetics 2004;17:35–41.
18. Childs S, Blenkinsopp E, Hall A, Walton G. Effective e-learning for health professionals and students – barriers and their solutions. Health Information and Libraries Journal 2005;22:20–32.
19. Education for Health. Volume 19, Issue 3. Book reviews. c2006 [cited 2009 July 20]. Available from http://www.educationforhealth.net/articles/ArchiveVolume19.asp
20. cnet.com downloads [homepage on the Internet]. No date. [2009 Jan 13]. Available from http://download.cnet.com/Virtual-Training-Studio/3000-2051_4-10278582.html
21. Cape Town Breastfeeding Liaison Group. Breastfeeding Education Programme. An 8-hour training programme for health workers. Bellville, South Africa; 2001.
22. Kenny A. Online learning: Enhancing nurse education? Journal of Advanced Nursing 2002;38:127–135.
23. Edwards PA. Impact of technology on the content and nature of teaching and learning. Nursing Education Perspective 2005;26:344–347.
24. Killian C. F2F Why teach online? Educom Review 1997;37:31–34.
25. Litchfield RE, Oakland MJ, Anderson JA. Improving dietetics education with interactive communication technology. Journal of the American Dietetic Association 2002;100:1191–1194.
26. Chumley-Jones HS, Dobbie A, Alford CL. Web-based learning: Sound educational method or hype? A review of the evaluation literature. Academic Medicine 2002;77:S86–S93.