"iBIM" — Internet-based interactive modules: an easy and interesting learning tool for general surgery residents

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Background: The increased use of information technology supports a resident-centred educational approach that promotes autonomy, flexibility and time management and helps residents to assess their competence, promoting self-awareness. We established a web-based e-learning tool to introduce general surgery residents to bariatric surgery and evaluate them to determine the most appropriate implementation strategy for Internet-based interactive modules (iBIM) in surgical teaching.

Methods: Usernames and passwords were assigned to general surgery residents at the University of Alberta. They were directed to the Obesity101 website and prompted to complete a multiple-choice precourse test. Afterwards, they were able to access the interactive modules. Residents could review the course material as often as they wanted before completing a multiple-choice postcourse test and exit survey. We used paired *t* tests to assess the difference between pre- and postcourse scores.

Results: Out of 34 residents who agreed to participate in the project, 12 completed the project (35.3%). For these 12 residents, the precourse mean score was 50 ± 17.3 and the postcourse mean score was 67 ± 14 ($p = 0.020$).

Conclusion: Most residents who participated in this study recommended using the iBIMs as a study tool for bariatric surgery. Course evaluation scores suggest this novel approach was successful in transferring knowledge to surgical trainees. Further development of this tool and assessment of implementation strategies will determine how iBIM in bariatric surgery may be integrated into the curriculum.

Contexte : L'utilisation croissante des technologies de l'information favorise une approche didactique centrée sur les résidents; elle favorise l'autonomie, la flexibilité et une meilleure gestion du temps, en plus d'aider les résidents à évaluer leurs compétences et à améliorer leur conscience d'eux-mêmes. Nous avons conçu un outil d'apprentissage électronique en ligne pour présenter la chirurgie bariatrique aux résidents de chirurgie générale et les évaluer, dans le but d'établir la meilleure stratégie d'application des modules de formation interactive en ligne pour l'enseignement de la chirurgie.

Méthodes : Des noms d'utilisateurs et des mots de passe ont été assignés aux résidents de chirurgie générale de l'Université de l'Alberta. Ils ont ensuite été orientés vers le site web Obesity101 et invités à répondre à un prétest à choix multiples. Ensuite, ils ont pu accéder aux modules de formation interactive. Les résidents ont pu consulter la documentation du cours aussi souvent qu'ils le souhaitaient avant de répondre à un post-test à choix multiples et de quitter le module. Nous avons utilisé le test *t* d'échantillons appariés pour mesurer la différence entre les scores du prétest et du post-test.

Résultats : Sur 34 résidents qui ont accepté de participer au projet, 12 l'ont mené à terme (35,3 %). Chez ces 12 résidents, le score moyen au prétest était de 50 ± 17,3 et le score moyen au post-test était de 67 ± 14 ($p = 0,020$).

Conclusion : La majorité des résidents qui ont participé à cette étude ont recommandé l'utilisation des modules de formation interactive en ligne comme outil pour l'étude de la chirurgie bariatrique. Les scores d'évaluation du cours donnent à penser que cette approche novatrice a été propice au transfert des connaissances aux résidents de chirurgie. Il faudra perfectionner cet outil et en évaluer les stratégies d'application afin de déterminer de quelle façon intégrer au programme les modules de formation interactive en ligne pour la chirurgie bariatrique.

The increased use of information technology (IT) supports a resident-centred educational approach that promotes resident autonomy and flexibility.[1] Information technology has the potential to engender residents with a desire to manage their own learning, which is a valuable step toward lifelong learning. The resident dictates the time, duration, frequency, depth and direction of his or her interactive study. Information technology can also offer opportunities for the residents to assess their own competence, promoting self-awareness. Surgical educators must be proactive in embracing the Internet and other evolving technologies.[2,3] A review of the literature shows that Internet-based training in bariatric surgery, compared with other specialties, is still in its infancy. Therefore, our objective was to establish a web-based e-learning concept demonstrating an introduction to bariatric surgery with interactive modules, including texts, graphics and animation along with audio and video components as study tools. As such, the study was designed to determine whether IT, specifically the Internet-based interactive modules (iBIMs) can be used to design and implement a system capable of delivering a constructive habit, enhanced by iconic imagery, to surgical teaching. Moreover, we attempted to evaluate the response of residents to the integration of such a system to the surgical curriculum.[4]

Methods

An electronic version of written consent was emailed to general surgery residents at the University of Alberta. Those who agreed to participate in the study were assigned usernames and passwords and were directed to the website www.obesity101.ca, which housed the iBIM. To increase the number of participants, residents received a bimonthly reminder email to encourage them either to complete the project or to visit the website to read more about the project objectives, review module sample, and/or start the project.

Obesity101 is a web-based project that uses the Active Server Page (ASP.net) programming language and runs a Microsoft SQL database environment. In addition, the Action Script 3 language and Flash tools were used to design the interactive modules. First, after logging into the website, all participants completed a form, providing demographic information, including number of years in practice, levels of training and completion of any bariatric surgery rotations. No actual names or other identifying data were collected. Second, the residents were required to complete a precourse test assessing their basic knowledge of obesity and bariatric surgery. The test comprised 20 multiple-choice questions and took 20 minutes to complete. Third, residents who completed the demographic form as well as the precourse test were prompted to access the training modules. The modules included interactive animations and images (Fig. 1), videos and texts to introduce the bariatric surgery specialty, basic anatomy and physiology, preoperative assessment, intraoperative and postoperative issues as well as long-term follow-up and outcomes. Residents had the opportunity to review the course material as often as they wanted. The duration of the study was 6 months, beginning the first time the residents used their usernames and passwords to log in to the website. Finally, residents completed a postcourse test (multiple-choice questions) and a short postcourse (exit) survey. The test and the survey took approximately 25 minutes in total to complete. The precourse test, postcourse test and survey questions were validated by a focus group of experts in obesity and bariatric surgery from the Centre for the Advancement of Minimally Invasive Surgery at the University of Alberta.

Statistical analysis

Data were collected through multiple queries, and the results were exported directly to a Microsoft Excel file. The demographic and survey data were summarized as means ± standard deviations or as medians with ranges for continuous data and as percentages for categorical data. We used paired *t* tests to assess the differences between pre- and post-course scores for each participant. Personal data, such as usernames and email addresses, were not included in the analysis.

Results

Of the 52 general surgery residents at the University of Alberta, 34 agreed to participate in the project (65.4%); of those, 22 residents completed the precourse test (64.7%) and 12 residents completed the postcourse test (35.3%). With respect to the 12 residents who completed the project, the precourse test mean score was 50 ± 17.3 and the postcourse test mean score was 67 ± 14. We used a paired *t* test to compare groups ($p = 0.020$; Table 1).

Residents who completed the project were divided into 2 cohorts (junior trainees in postgraduate year 1 (PGY1) and PGY2, and senior trainees in PGY3–5). We used a paired *t* test to compare both the pre- and postcourse test results for both cohorts, and there was no significant difference bewteen the groups (junior residents $p = 0.14$ v. senior residents $p = 0.10$).

Test scores were analyzed according to prior exposure to bariatric surgery. There was no significant difference between the pre- and postcourse test results for the cohort who didn't have prior exposure to bariatric surgery ($p = 0.70$), whereas there was a significant difference between both scores for those who did have prior exposure ($p = 0.011$).

The precourse test scores for both junior and senior cohorts were analyzed, and there was no significant

difference ($p > 0.99$). Similarly, there was no significant difference regarding the postcourse test scores for both cohorts ($p = 0.67$; Table 1).

Furthermore, as shown in Table 1, there was no statistical difference in the precourse test scores for residents without prior exposure to bariatric surgery and the scores of those who did have prior exposure ($p = 0.90$). Likewise, there was no statistical difference regarding the postcourse test scores for these same groups ($p = 0.27$).

Postcourse survey

Three of 10 residents who completed the survey found no difference between iBIM and standard study methods, whereas 7 residents thought that iBIMs are better than ordinary teaching and recommended their use in the surgery curriculum. Box 1 includes comments and suggestions from residents who completed the survey.

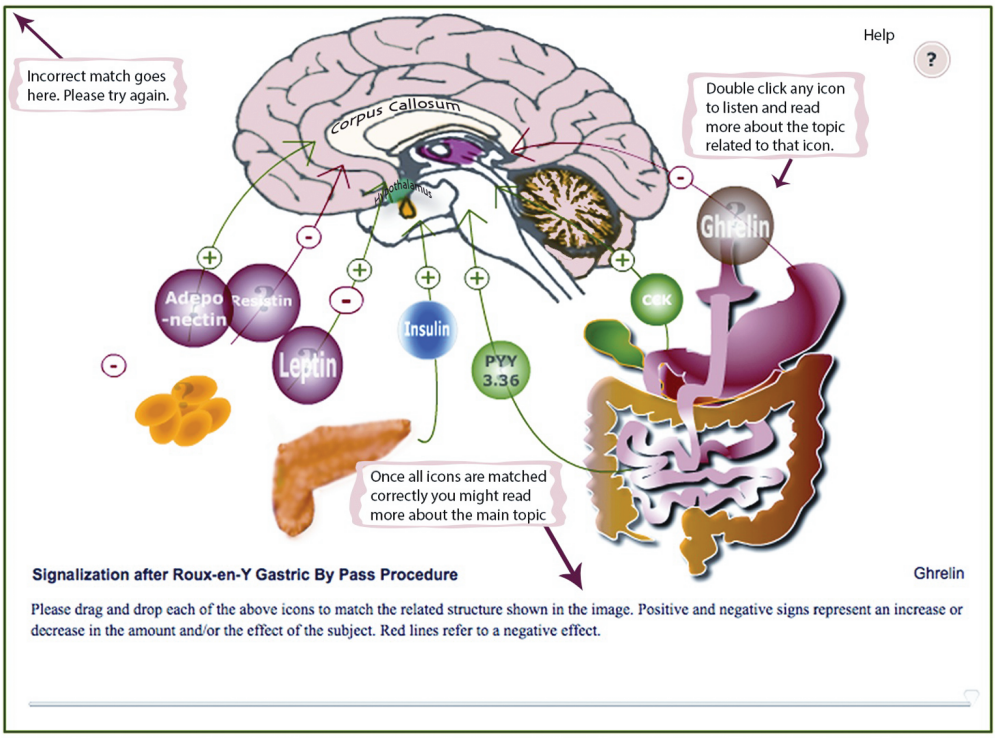

Fig. 1. The diagram shows one of the modules included in the Obesity101 course. This module describes the hormonal changes that take place after the Roux-en-Y gastric bypass procedure. The task is to rearrange the icons in the diagram in order to put each one in the correct place. As such, the user interacts with the picture and builds it up. Hence this module, as well as many other modules included in the course, is described as interactive.

Table 1. Pre- and postcourse test results for all residents, residents grouped by postgraduate year and residents grouped by previous bariatric surgery exposure

Group	No.	Test group; mean ± SD		*p* value
		Pre-course test results	Post-course test results	
Junior residents (PGY1–2)	4	50.00 ± 8.16	70.00 ± 16.83	0.14
Senior residents (PGY3–5)	8	50.00 ± 21.04	65.63 ± 13.48	0.10
Previous bariatric surgery rotation				
Yes	9	49.44 ± 14.88	69.44 ± 14.88	0.011
No	3	51.67 ± 27.54	60.00 ± 10.00	0.70
All residents	12	50.00 ± 17.32	67.08 ± 14.05	0.020

PGY = postgraduate year; SD = standard deviation.
*Results of the junior versus senior residents for the pre- ($p > 0.99$) and postcourse ($p = 0.67$) tests.
†Results of residents who did not have previous rotations in bariatric surgery versus those of residents who did have previous experience for the pre- ($p = 0.90$) and postcourse ($p = 0.27$) tests.

Discussion

The first use of computer-based medical training dates back to 1961.[5] Since then, the rapid development and spread of personal computers and the Internet have caused an increase in the number and variety of software programs available for medical education.[5] Several studies have shown that the interactive use of multimedia components and computer software can successfully be used in medical education to facilitate the learning process.[6–10] There is already a large number of medical iBIMs available for the purposes of medical education as well as patient care, and more are being developed all the time. Examples of iBIMs are the medical calculator,[11] adjuvant online[12] and e-anatomy.[13]

Gorman and colleagues[14] have pointed out that "the future of medical education is no longer blood and guts, it is bits and bytes."[14] Further, they state that the old surgical paradigm of "see one, do one, teach one" is incompatible with today's complex health care system. In turn, they advocate for the use of computer-based programs in surgical specialties. In light of these observations, our goal was to develop a comprehensive and constructive iBIM for obesity and bariatric surgery that would enable surgical residents to prepare for rotations and at the same time stimulate independent study habits. To accomplish this goal we used the obesity101 website to host interactive multimedia training modules that served as a basis for lectures as well as independent studying at home. This study confirms that the widespread use of iBIMs in our general surgery program could be easy, reliable and interesting. It is clear that this technology can change traditional medical education by providing rapid access to information and facilitating the introduction of residents to subspecialties like bariatric surgery efficiently and easily using a dynamic and interactive approach.[5]

Box 1. Comments and suggestions from residents who completed the postcourse survey

Specific comments

- I think this is a great way to study. It is a good start. There were some quirks in the site.
- I think this is a good project. However, I would suggest revising the physiology section as it is continuously being updated.
- It is clear that lots of work was put for this project, yet I prefer using my own books and the paper& pen in my studying.
- I find using the computer screen for long time hard to my eyes and difficult to use for studying. It is easier and more convenient to study from my own books.

Thoughts and suggestions

- Very nice. I think medical education should keep pace with the current advancement of technology. This project is a step ahead toward this direction.
- I liked the way the pre and post-course tests were designed and I suggest using the same concept for assessment of courses and rotations.

Consistent with our results were those of a study involving 116 nursing students starting a "medical-surgical nursing course (MSN)" at the University of Murcia in Spain. Students were divided into 2 randomly formed groups: an experimental group of 54 participants used a web-based tool and a control group of 62 participants received the same training but without using a web-based tool. The results revealed that the competitive e-learning method produced a significant increase in conceptual understanding and cognitive gains for the students in the experimental group.[15]

The Department of Trauma Surgery at the Hannover Medical School has created a web-based multimedia training program with a central data management system that serves as an independent study program. A questionnaire was given to medical students who used the program, and 225 of 309 completed it. The majority of the surveyed students (79.6%) found the web-based program to be constructive and helpful. This study confirmed that web-based learning could play an important role in the future of academic medicine.[16]

A criticism of iBIMs is that they may not be suitable for residents with negative attitudes toward IT, and residents' preference for hard copy material over computer screen presentation has been reported.[17] In addition, continuous use of IT may decrease our attention to the tasks at hand; some have even suggested that new technologies are changing the way that our brains process information, making us skim the surface for information instead of reading in depth.[18]

Limitations

This study was limited in 2 areas. First, sampling bias is likely. Sampling bias is a major problem in learning studies; research has found that individuals who are satisfied and have knowledge about the subject matter are more likely to participate in these educational inquiry studies than those who lack knowledge. Further, nonusers of the technology are less likely to respond to a study about IT and iBIMs.

Second, the participation rate was relatively low. For this study, nonresponders were contacted by email to obtain a response. Overall, the response rate to complete the full online project was 23% of all the general surgery residents and 35.3% of those who agreed to participate in the study, which made the study more qualitative than quantitative. Residents who agreed to participate in the Obesity101 model yet didn't complete the project may have obtained some knowledge about obesity management. However, it is difficult to assess this knowledge in In-Training Evaluation Reports, as obesity management continues to be underrepresented in our resident evaluations. One of the objectives of this study was to increase the awareness of obesity and incorporate this into our evaluations.

Conclusion

We found a significant difference between the pre- and postcourse test results of general surgery residents — especially those who had previous bariatric surgery experience — and this difference was deemed related to participation in our iBIM bariatric surgery course. However, this difference seemed unrelated to PGY. Furthermore, the majority of residents who completed the survey recommended using the iBIMs as an interesting, easy and effective study tool during their bariatric surgery rotations, which also could be integrated in the surgical curriculum. This is a pilot study to investigate the preference and effectiveness of the iBIM modules. Based on our data, the Bariatric Surgery department at the University of Alberta will design a new trial to further test if this approach is superior to the existing training approaches.

Competing interests: S. Karmali is a consultant for Ethicon EndoSurgery and Covidien, and has received speaker fees from Ethicon EndoSurgery. D.W. Birch is a consultant for and has received educational grants from Johnson& Johnson, Ethicon EndoSurgery and Covidien. No other competing interests declared.

Contributors: N. Azer, C. de Gara, S. Karmali and D.W. Birch designed the study. N. Azer and X. Shi acquired and analyzed the data, which C. de Gara, S. Karmali and D.W. Birch also analyzed. N. Azer wrote the article, which all authors reviewed and approved for publication.

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