Student perceptions of the use of presentations as a method of learning endocrine and gastrointestinal pathophysiology

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Higgins-Opitz SB, Tufts M. Student perceptions of the use of presentations as a method of learning endocrine and gastrointestinal pathophysiology. Adv Physiol Educ 34: 75–85, 2010; doi:10.1152/advan.00105.2009.—Second-year medical students at the Nelson R. Mandela School of Medicine (Durban, South Africa) were given a brief to prepare oral presentations on topics related to disorders of the gastrointestinal tract and endocrine system in the form of “patient-doctor” role play and to submit written documents about their topics. This initiative was introduced to assist medical students in their application and understanding of physiology to clinical situations. The aims of the student presentations were to improve the understanding of the physiological basis of diseases; promote independent research, active, and group-based learning; encourage social interactions; and develop presentation and peer review skills. Students rose to the challenge, producing a variety of presentations reflecting a wealth of creativity, humour, sensitivity to local cultural issues, and analytic thinking skills. The quality of the supporting posters and computer-generated slides was outstanding. Numerous “fun” prizes for specific individual and group performances were given based on peer and staff evaluations. This exercise ran over a 5-yr period before the introduction of a problem-based learning medical curriculum. Student feedback obtained over these years is reported here. Students were asked to complete semistructured questionnaires, which elicited feedback on various aspects of the learning exercise, including whether it should be continued and how it could be improved upon, especially if they were in groups that did not function well. The feedback obtained revealed that most students perceived the presentations to be fun, informative, creative/innovative, and, most importantly, beneficial to their learning. The majority of students felt that this exercise improved their understanding of pathophysiology, taught them to research independently, and encouraged better class interactions and group learning. The inclusion of such initiatives is beneficial not only to students’ understanding and their experience in studying physiology but also for the development of skills useful in their future careers. Presentations as a teaching method; medical students’ perceptions; South Africa

Physiology has long been recognized to be a subject that is difficult for students to master (17). Many students battle to link theory with practice (18, 29). Medical students, in particular, often fail to appreciate the relevance of learning and understanding normal bodily functions for their clinical studies (29). This is particularly evident in systems such as the endocrine, gastrointestinal, and renal systems. Over the past two decades, there has been increasing recognition in the physiology education literature as to how innovative interventions can be used to address such issues. Not only has there been the importance of teaching and learning styles been highlighted (12–15, 24, 31) but also the need for greater student participation in the learning process to promote more active learning (5, 9, 22, 27, 23). While we have been able to find a number of reports detailing a variety of methodologies to promote students’ learning of endocrine physiology, ranging from case-stimulated and problem-based learning (PBL) (31, 32), patient-centered learning (30), multiple format sessions (13), and early clinical exposure (21), we have been unable to find similar studies involving gastrointestinal tract (GIT) physiology, even though there have been two American Physiological Society Refresher Courses on this topic. We have, however, discovered reports published in 1998, 1999, and 2009 detailing the use of educational card games (19), educational puzzles (2), a virtual rat model (10), and a live rat model (26) for understanding GIT physiology, respectively.

Physiology at the Nelson R. Mandela School of Medicine (NRMSM; Durban, South Africa) has been traditionally taught in a didactic fashion with little, if any, room for student participation. Up to 2001, the medical curriculum was a 6-yr, discipline-based curriculum. The second year of this curriculum was devoted to the study of anatomy, histology, medical biochemistry, and physiology. The time allocated to these disciplines was 50%, 12.5%, 12.5%, and 25%, respectively. Details of the physiology course have been previously published (29). Briefly, it consisted of ~140 h of lectures supplemented with 36 h of practicals. The practical sessions were designed not only to expose students to the practical aspects of physiology but also to highlight the clinical relevance. Noninvasive techniques were used where possible. Staff were able to actively interact with students and thus informally assess students’ levels of understanding and comprehension of theoretical aspects of physiology underpinning the practical. Importantly, these sessions also served a remedial function by giving staff the opportunity to tackle any misconceptions that students may have had.

In our context, it was difficult for various reasons, such as lack of animals, financial, and equipment constraints, to conduct a sufficient number of meaningful noninvasive practicals for both gastrointestinal (GIT) and endocrine physiology to assist medical students in their application and understanding of physiology to clinical situations. A pilot initiative was carried out in 1996, in which students were asked to participate in role-play enactments. Some students played the role of patients presenting with a GIT-associated complaint, others played the role of healthcare professionals, and yet others assumed the role of patients’ friends and families. After the encouraging results of this initiative, we embarked on a more...
formalized approach involving not only GIT physiology but also, later, endocrine physiology.

The present study not only describes the learning exercise that we used over a 5-yr period to complement the theoretical inputs provided by staff by means of didactic lectures but also reports the feedback received from the students on a number of aspects. These include whether or not the exercise assisted them to link their theoretical physiology knowledge of the GIT and endocrine systems with the pathophysiology seen in typical clinical disorders, encouraged active participation in their own learning, and promoted their writing, presentation, and computer skills.

MATERIALS AND METHODS

Context. This study was carried at NRRSM (Durban, South Africa). During the period of 1997–2001, second-year medical students, as part of their physiology course, participated in a group-based learning initiative designed to complement the didactic lectures and to enhance students’ learning of gastrointestinal and endocrine physiology.

Topics and organization. At the onset, in 1997, only GIT topics were covered in this exercise. In subsequent years (1998–2001), the topics included both GIT and endocrine disorders (Table 1). In 1997, there were 12 GIT topics. In 1998, four of the GIT topics (gastritis, peptic ulcer, irritable bowel syndrome, and sprue) were collapsed into two broader categories: namely, gastric ulcer and malabsorption syndrome, respectively. From 1999 to 2001, an increase in class size necessitated a further increase in the number of groups: some of the original GIT topics were reintroduced, and the endocrine topic, diabetes mellitus, was split into the two types, giving a total 10 GIT and 10 endocrine topics (Table 1).

Toward the beginning of the first or second term, depending on the year (Table 2), before the commencement of GIT and endocrine lectures, second-year medical students were briefed about the exercise and asked to allocate themselves voluntarily into groups. After a suitable period of time, those members of the class who as yet had not joined a group were allocated to a group by us. Initially (1997), groups comprised 12–13 students each; in 1998, the group size was reduced to 9–10 students, whereas from 1999 onward, each group comprised of a maximum of 8–9 students each. Each group was asked to select a group representative, who not only coordinated the activities of the group members but also participated in the draw for the selection of the GIT and endocrine topics to be researched by the group. In addition to their overall group coordination function, group representatives were also required to act as chairpersons for another group’s presentation slot (see APPENDIX A in the Supplemental Material). 1 This entailed introducing the topic, introducing the group, and initiating and directing the discussion.

Format and scheduling of presentations. A suggested format for the presentation was conveyed to the students in lectures, via notices placed on the notice board, and via e-mail. Although the format of this exercise gradually changed over the 5-yr period, the central theme of encouraging students to introduce their presentation with a simulated role play of a patient and his/her family presenting to medical or other health care professionals was retained (see Supplemental Material, APPENDIX A). Suitable morning and afternoon time slots were allocated to the group presentations. Attendance to all these sessions was compulsory. Each group was allocated a total of 20 min for the presentation (10–15 min) and 2) their discussion (5–10 min). A typical presentation schedule is shown in APPENDIX B in the Supplemental Material. At the end of the last session, prizes were awarded based on the combined mark of students and staff for the three best presentations. Numerous “fun” prizes were also awarded for specific individual and group performances.

Resources available to students. Students were given a minimum of 4 wk to prepare for their presentations. We (S. B. Higgins-Opitz and M. Tufts as well as our now-retired colleague Alina Marszalek), as detailed in APPENDIX C in the Supplemental Material, not only guided and assisted the groups in their research and monitored their progress but also liaised with other faculty staff to facilitate students’ access to

<table>
<thead>
<tr>
<th>Year</th>
<th>Class Size, n</th>
<th>Content</th>
<th>Number of Groups</th>
<th>Average Group Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>147</td>
<td>GIT only</td>
<td>12</td>
<td>12.3 9–15</td>
</tr>
<tr>
<td>1998</td>
<td>159</td>
<td>GIT and endocrine</td>
<td>16</td>
<td>9.9 9–11</td>
</tr>
<tr>
<td>1999</td>
<td>196</td>
<td>GIT and endocrine</td>
<td>20</td>
<td>9.8 9–10</td>
</tr>
<tr>
<td>2000</td>
<td>172</td>
<td>GIT and endocrine</td>
<td>20</td>
<td>8.6 8–9</td>
</tr>
<tr>
<td>2001</td>
<td>173</td>
<td>GIT and endocrine</td>
<td>20</td>
<td>8.7 8–9</td>
</tr>
</tbody>
</table>

n, Number of students.

1 Supplemental Material for this article is available online at the Advance in Physiology Education website.

Table 1. Summary of GIT and endocrine presentation topics covered by year

<table>
<thead>
<tr>
<th>Year</th>
<th>GIT No. of Topics</th>
<th>Endocrine No. of Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>12</td>
<td>N/A</td>
</tr>
<tr>
<td>1998</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>1999–2001</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>
resources such as specialist books, pathological specimens, typical patient data and features, audiovisual material, and visits to specialist units at the teaching hospital attached to the medical school. In addition, it should be noted that student presentations (documents, posters, and slides) from previous years were also available.

Evaluation of student presentations. Since the subject matter covered in the presentations was fully exāminable, each group was required to provide a written document on their topic together with their oral presentation for subsequent electronic circulation to all members of the class. Feedback was given by staff during the discussion of specific topics and on completion of the exercise as a whole. More formal evaluation of the groups’ performance, including evaluation by peers, was also undertaken. The marking schedule, designed and subsequently refined for this purpose, awarded the different groups marks for content, visual presentation, oral presentation, response to questions, and participation of group members (see Appendix D in the Supplemental Material). This served to reward the efforts of the participants (i.e., student groups) in the preparation and delivery of their presentations. An added benefit was that the students could judge the usefulness of the presentations as a resource for their learning and understanding of the physiological concepts underpinning pathological conditions. Staff members, on the other hand, were able to detect misconceptions on the part of the students. It should be noted that the marks awarded did not contribute to the students’ year marks.

Student feedback. Student feedback was obtained both informally and formally by means of a questionnaire administered either at the midyear revision test or the class test immediately after the exercise. The informal feedback carried out in some years was acquired immediately after the completion of the presentations. Students were asked in class to anonymously write down three aspects of the exercise that they liked and three aspects that they did not like (see Appendix E in the Supplemental Material).

The questionnaire given to students underwent various modifications over the 5-yr period that the learning exercise was in operation (Table 3). In 1997 it consisted of 6 major sections and 38 questions, whereas in 2001 there were 53 questions broadly divided into 10 broad categories ranging from demographics and the course in general to an evaluation and a couple of open-ended questions. The questionnaires included simple yes/no options, questions, or statements requiring responses from students using a four-point Likert scale (where 1 = strongly agree and 4 = strongly disagree) as well as open-ended questions (see Appendix F in the Supplemental Material).

By 2001, the questionnaire elicited demographic data on home language and sex as well as student feedback about the course in general, including preferred textbooks, the ideal test format, and the time spent studying physiology compared with histology and anatomy. Students were also asked to indicate their average performance in physiology tests written to date. The remainder of the questionnaire was devoted to acquiring student feedback about the GIT and endocrine presentations. Questions were aimed at probing students’ interest and perceived benefits of this exercise and whether the exercise assisted students in their understanding not only of endocrine and GIT physiology but also of how physiology contributes to their comprehension of clinical medicine. Student learning in a group work setting, including their process and perceptions of the willingness of staff members, both within and outside the discipline of physiology, to assist them formed the basis of another set of questions. Questions probing presentation skills, poster and slide preparation, and their uses as a learning resource were also included in the questionnaire. Furthermore, there were a number of questions devoted to exploring students’ use of various resources, such as written material and electronic media; faculty staff for the preparation of their assignments; students’ computer skills and their perceived need for additional training; and how they felt about peer and staff evaluation of their presentations. Finally, students were asked, with open-ended questions, to comment on the continuation of the exercise, how it could be improved upon, and to suggest possible solutions if they were in groups that did not function well.

Positive student responses were categorized as “yes” or “strongly agree” (1) and “agree” responses (2), respectively, whereas negative responses were categorized as “no” or “strongly disagree” (4) and “disagree” (3), respectively. They were then entered into a spreadsheet (Microsoft Office Excel 2003) and analyzed quantitatively. Results were expressed as percentages of the numbers of respondents to each question. Qualitative data were grouped into themes and categories based on the issues raised in the student comments. For the purposes of analysis and reporting, the results of the categorization were expressed as percentages of the number of students who provided comments and/or explanations. Mean values over the 4-yr period (1997 and 1999–2002) were calculated for each category/theme. The means, in turn, were used to determine the overall rank for the categories/themes over the period that the exercise was conducted.

Ethical approval (HSS/0722/08) was obtained for the study from the Human Sciences Ethics Committee of the University of KwaZulu-Natal. The necessary steps were taken to ensure the security and confidentiality of student inputs.

RESULTS

For the purposes of the present study, we will concentrate only on those survey questions that were relevant to the aims of the study. Thus, we are not going to report on the demographic data or on the student feedback from the second-year textbooks and physiology course as a whole, both of which were included in the questionnaires for the years of 2000 and 2001 (Table 3) for other purposes.

Student responses obtained quantitatively are shown in Tables 4–6 and are presented according to the various themes as outlined in MATERIALS AND METHODS. The number of students in each year cohort who responded to each statement in the questionnaire was calculated. This ranged in 1997 from 89 to 140 students from a class of 147 students. When expressed as a percentage, this represented a response rate ranging from 61% to 95%. Similar such information about class size and response rates is given for each year cohort in Tables 4–6. The minimum response rate for a given statement was 61% (in 1997), and the maximum response rate achieved was 100% (in 1999).

Table 3. Summary of information probed in the student feedback questionnaires (1997–2001)

<table>
<thead>
<tr>
<th>Year</th>
<th>Demographic Data</th>
<th>Type of Presentation</th>
<th>Evaluation</th>
<th>No. of Questions</th>
<th>Additional Issues Probed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>No</td>
<td>Oral/role play/Posters</td>
<td>Peer</td>
<td>38</td>
<td>Resources</td>
</tr>
<tr>
<td>1998</td>
<td>No</td>
<td>Oral/role play/Powerpoint slides</td>
<td>Peer</td>
<td>45</td>
<td>Textbooks</td>
</tr>
<tr>
<td>1999</td>
<td>No</td>
<td>Oral/role play/Powerpoint slides</td>
<td>Peer and staff</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>2000*</td>
<td>Yes</td>
<td>Oral/role play/Powerpoint slides</td>
<td>Peer and staff</td>
<td>52</td>
<td>Course</td>
</tr>
<tr>
<td>2001*</td>
<td>Yes</td>
<td>Oral/role play/Powerpoint slides</td>
<td>Peer and staff</td>
<td>53</td>
<td>Course</td>
</tr>
</tbody>
</table>

*Essentially the same questionnaire was used.
For the purposes of reporting and discussing the results, percentages of the respondents who agreed with the statement, rounded off to the nearest whole number, are shown in Tables 4 – 6. These were calculated from the number of students answering positively and the total number of students who responded to the statement. Information from those respondents who indicated they had no opinion is not shown. It is worth noting, however, that this involved only a few respondents.

Student responses for each year group were, on the whole, remarkably similar. This observation is based not only on the mean scores and SDs obtained for the positive, negative, and overall responses given by students for each statement, respectively, but also in terms of the percentage of student respondents who answered positively and negatively for each statement. For example, student responses for the statement "the exercise was a waste of time" yielded mean (SD) positive scores of 1.7 (0.47), 1.8 (0.48), 1.7 (0.51), 1.6 (0.54), and 1.6 (0.49) for the years of 1997, 1998, 1999, 2000, and 2001, respectively. It was thus decided for both practical purposes and to make it more understandable and informative to the reader to express our findings in terms of percentages of respondents who gave positive feedback to the various statements. To assist with the detection of variability over the years, variances in student responses over the 5-yr period were calculated. The results of these calculations (means, SDs, and coefficients of variation) are also shown in Tables 4 – 6.

Table 4. Students’ interest and perceived benefits of the GIT and endocrine presentations (1997–2001)

<table>
<thead>
<tr>
<th>Year</th>
<th>1997</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>Mean</th>
<th>SD</th>
<th>Coefficient of Variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of respondents</td>
<td>89–140</td>
<td>112–151</td>
<td>160–196</td>
<td>124–151</td>
<td>121–166</td>
<td>103</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>No. of student/year cohort (class size)</td>
<td>147</td>
<td>159</td>
<td>196</td>
<td>172</td>
<td>173</td>
<td>166</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage of the year cohort that responded</td>
<td>61–95</td>
<td>70–95</td>
<td>82–100</td>
<td>72–88</td>
<td>70–96</td>
<td>79</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Student perceptions of this learning experience

<table>
<thead>
<tr>
<th>Year</th>
<th>1997</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>Mean</th>
<th>SD</th>
<th>Coefficient of Variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The topics were relevant.</td>
<td>89</td>
<td>92</td>
<td>93</td>
<td>87</td>
<td>86</td>
<td>89</td>
<td>3.0</td>
<td>5</td>
</tr>
<tr>
<td>The role play made the presentations more entertaining.</td>
<td>N/A</td>
<td>N/A</td>
<td>87</td>
<td>85</td>
<td>84</td>
<td>85</td>
<td>1.5</td>
<td>3</td>
</tr>
<tr>
<td>The topics were interesting.</td>
<td>89</td>
<td>87</td>
<td>90</td>
<td>83</td>
<td>85</td>
<td>87</td>
<td>2.9</td>
<td>5</td>
</tr>
<tr>
<td>The exercise should be continued.</td>
<td>71</td>
<td>82</td>
<td>78</td>
<td>83</td>
<td>N/A</td>
<td>79</td>
<td>5.4</td>
<td>4</td>
</tr>
<tr>
<td>The poster/Powerpoint presentations were informative.</td>
<td>88</td>
<td>81</td>
<td>84</td>
<td>76</td>
<td>72</td>
<td>80</td>
<td>6.3</td>
<td>5</td>
</tr>
<tr>
<td>The oral presentations were informative.</td>
<td>73</td>
<td>71</td>
<td>79</td>
<td>76</td>
<td>69</td>
<td>73</td>
<td>3.8</td>
<td>5</td>
</tr>
<tr>
<td>Presentations should be part of the second-year curriculum.</td>
<td>N/A</td>
<td>N/A</td>
<td>59</td>
<td>62</td>
<td>62</td>
<td>61</td>
<td>1.7</td>
<td>3</td>
</tr>
<tr>
<td>I had difficulty in following and understanding the presentations.</td>
<td>50</td>
<td>53</td>
<td>48</td>
<td>45</td>
<td>43</td>
<td>48</td>
<td>4.0</td>
<td>5</td>
</tr>
<tr>
<td>I’ve become more enthusiastic toward my studies.</td>
<td>54</td>
<td>48</td>
<td>63</td>
<td>44</td>
<td>65</td>
<td>55</td>
<td>9.1</td>
<td>5</td>
</tr>
<tr>
<td>Presentations should be extended to other sections.</td>
<td>46</td>
<td>49</td>
<td>57</td>
<td>50</td>
<td>49</td>
<td>53</td>
<td>6.5</td>
<td>5</td>
</tr>
<tr>
<td>The exercise was a waste of time.</td>
<td>28</td>
<td>34</td>
<td>31</td>
<td>34</td>
<td>36</td>
<td>33</td>
<td>3.1</td>
<td>5</td>
</tr>
<tr>
<td>There should be exercises like this later in studies.</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>60</td>
<td>60</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>I enjoyed the final feedback session.</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>79</td>
<td>79</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

Improved understanding of the physiological basis of disease

<table>
<thead>
<tr>
<th>Year</th>
<th>1997</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>Mean</th>
<th>SD</th>
<th>Coefficient of Variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>I had better understanding when the symptoms were role played.</td>
<td>N/A</td>
<td>N/A</td>
<td>82</td>
<td>72</td>
<td>75</td>
<td>76</td>
<td>5.1</td>
<td>3</td>
</tr>
<tr>
<td>The presentations helped me to understand the relevance of my studies.</td>
<td>77</td>
<td>69</td>
<td>78</td>
<td>71</td>
<td>70</td>
<td>73</td>
<td>4.2</td>
<td>5</td>
</tr>
<tr>
<td>The presentations helped me to integrate the material covered in the physiology course.</td>
<td>77</td>
<td>81</td>
<td>82</td>
<td>69</td>
<td>75</td>
<td>77</td>
<td>5.2</td>
<td>5</td>
</tr>
<tr>
<td>The topics helped me to understand the normal functioning of the gastrointestinal system.</td>
<td>78</td>
<td>77</td>
<td>74</td>
<td>66</td>
<td>80</td>
<td>75</td>
<td>5.5</td>
<td>5</td>
</tr>
<tr>
<td>The topics helped me to understand the normal functioning of the endocrine system.</td>
<td>N/A</td>
<td>74</td>
<td>74</td>
<td>64</td>
<td>72</td>
<td>71</td>
<td>4.8</td>
<td>4</td>
</tr>
</tbody>
</table>

For the purposes of reporting and discussing the results, percentages of the respondents who agreed with the statement, rounded off to the nearest whole number, are shown in Tables 4 – 6. These were calculated from the number of students answering positively and the total number of students who responded to the statement. Information from those respondents who indicated they had no opinion is not shown. It is worth noting, however, that this involved only a few respondents.

Student responses for each year group were, on the whole, remarkably similar. This observation is based not only on the mean scores and SDs obtained for the positive, negative, and overall responses given by students for each statement, respectively, but also in terms of the percentage of student respondents who answered positively and negatively for each statement. For example, student responses for the statement “the exercise was a waste of time” yielded mean (SD) positive scores of 1.7 (0.47), 1.8 (0.48), 1.7 (0.51), 1.6 (0.54), and 1.6 (0.49) for the years of 1997, 1998, 1999, 2000, and 2001, respectively. It was thus decided for both practical purposes and to make it more understandable and informative to the reader to express our findings in terms of percentages of respondents who gave positive feedback to the various statements. To assist with the detection of variability over the years, variances in student responses over the 5-yr period were calculated. The results of these calculations (means, SDs, and coefficients of variations) are also shown in Tables 4 – 6.

The learning experience. As shown in Table 4, over 80% of the respondents found the topics and presentations relevant, entertaining, interesting, and informative. Almost 80% of the overall respondents recommended that the exercise be continued, whereas only 33% felt that it was a waste of their time. On the whole, 61% of the responding students felt that they would have put more effort into the presentations if the marks awarded had contributed to their year mark. A similar percentage thought that the presentations should form part of the second-year curriculum. However, only 49% of the respondents wanted such presentations to be extended to other sections of the second-year course. The percentage of respondents who agreed that they had become more enthusiastic toward their studies varied from a minimum of 44% in 2000 to 63% in 2001.
and 65% in 1999 and 2001, respectively. Approximately 50% of the overall respondents did indicate that they had difficulty in following and understanding the presentations.

**Understanding of the physiological basis of diseases.** Over 70% of all the respondents indicated that the presentations and topics had helped them not only to understand normal function and the relevance of their studies but also to integrate the material covered in the physiology course. Interestingly, an average of 76% of the student respondents felt that role-playing symptoms led to a better understanding of the respective disorder (Table 4).

**Independent research.** On average, over two-thirds of the students who responded felt good about being in control of their own learning (Table 5). Over 50% of the respondents indicated that the presentations had encouraged them to read more about the two physiological systems. In most years, a similar percentage also confirmed that they had read about GIT and endocrine topics other than that presented by their own group. The use of internet sites, the prescribed textbook, and other related textbooks were cited by the highest number of respondents (80%), whereas the three resources reported to least used by the students were journals (39%), physiology staff (33%), and the media services of the NRMSM (33%). With regard to the use of the internet, almost 70% of the overall respondents reported having visited multiple websites, with almost two-thirds of the

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**Table 5. Students’ opinions on active and group-based learning (1997–2001)**

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of respondents (class size)</th>
<th>No. of Year cohort that responded</th>
<th>Mean SD</th>
<th>No. of Years From Which the Data Were Averaged</th>
<th>Coefficient of Variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>89–140</td>
<td>61–95</td>
<td>68</td>
<td>6.6</td>
<td>5</td>
</tr>
<tr>
<td>1998</td>
<td>112–151</td>
<td>70–95</td>
<td>54</td>
<td>8.1</td>
<td>5</td>
</tr>
<tr>
<td>1999</td>
<td>160–196</td>
<td>82–100</td>
<td>56</td>
<td>5.3</td>
<td>4</td>
</tr>
<tr>
<td>2000</td>
<td>124–151</td>
<td>72–88</td>
<td>53</td>
<td>7.0</td>
<td>5</td>
</tr>
<tr>
<td>2001</td>
<td>121–166</td>
<td>70–96</td>
<td>53</td>
<td>7.0</td>
<td>5</td>
</tr>
</tbody>
</table>

**Promoted independent research**

- It felt good being in control of my own learning. 78
- The presentations encouraged me to read more about the gastrointestinal system. 60
- The presentations encouraged me to read more about the endocrine system. N/A
- I have read about topics other that that presented by my group. 49
- These resources were used: Medical media services N/A
- Internet N/A
- Prescribed textbook N/A
- Other textbooks N/A
- Journals N/A
- Physiology staff members N/A
- I visited a number of websites. N/A
- I checked the validity of internet information. N/A

**Encouraged social interactions**

- The physiology staff members that I approached were helpful. 86
- The presentations enhanced class “camaraderie.” 76
- The presentations encouraged contact with other faculty members. 66
- I found that faculty members were willing to assist me. 81
- I found that having to make contact with faculty members made me feel more responsible for my learning. 83

**Promoted group-based learning**

- All members of the group contributed. N/A
- I found group work to be useful. N/A
- There was good group cooperation. 65
- The group work was beneficial to my learning. 54
- I would have preferred to work on my own, not in a group. N/A
- The groups are too large. 48
respondents indicating that they checked the validity of information retrieved from the internet against information obtained from other sources. It is interesting to note that 56% of the overall respondents found the information they had retrieved from the internet to be at a more superficial level than that required for their second-year studies (Table 5).

Social interactions. As shown in Table 5, student respondents reported that the learning exercise enhanced class camaraderie (74%), the contact with faculty members made them feel more responsible for their learning (74%), and, when approached, the physiology staff were helpful (78%) and the faculty staff were willing to assist them (68%). Only 45% of the respondents, however, stated that the exercise per se encouraged contact with other faculty members.

Group-based learning. As shown in Table 5, more than two-thirds of the respondents agreed that the group work was useful, that all members of the group contributed, and that their groups cooperated well. Only just over a third of the respondents felt that the groups were too large and that they would have preferred to have worked on their own and not in a group.

Presentation and peer review skills. Table 6 shows student responses regarding their involvement in the presentations and their opinions about peer review. The number of respondents who acknowledged that they participated as one of the presenters almost doubled from 1997 to 2001 (36% and 70%, respectively). A large percentage of respondents (65%) felt that they had retrieved from the internet to be at a more superficial level than that required for their second-year studies (Table 5).

Audience feedback was helpful in identifying deficiencies (67%). A large percentage of respondents (60%) indicated that they had little computer experience in generating computer-based presentations. Interestingly, a similar percentage (67%) also agreed that their peers had been willing to assist them generate computer-based presentations.

The qualitative feedback obtained from student comments is shown in Tables 7 and 8. Students were asked to explain why they thought that the exercise should or should not be continued (except for the cohort in 2001) and were also invited to give any additional comments. For the purpose of the present study, we limited the analysis of the student comments only to their experiences with the exercise. Unfortunately, there are no data available for 1998. The response rates, as calculated from the number of questionnaire respondents who made comments, were 39% (54 of 140 students), 81% (159 of 196 students), 74% (111 of 151 students), and 9% (15 of 166 students) in 1997, 1999, 2000, and 2001, respectively (Tables 3, 7, and 8). This equates to comments from 339 students over the period in question (339 of 653 students = 52%).
beneficial (up to 60% of the respondents; Table 7) or gave constructive feedback to improve the exercise or highlighted negative features of the exercise as perceived by students (no more than 20% of the respondents; Table 8). It should be noted that, to avoid duplication and skewing of the results, feedback was allocated to a category only once, even though students may have raised the same issue more than once in their comments. The three most beneficial features of the exercise as

### Table 7. Analysis of student comments (1997 and 1999–2001) regarding the benefits of the exercise

<table>
<thead>
<tr>
<th>Year</th>
<th>1997</th>
<th>1999</th>
<th>2000</th>
<th>2001*</th>
<th>Mean</th>
<th>Overall Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of students who commented</td>
<td>54</td>
<td>159</td>
<td>111</td>
<td>15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Beneficial aspects**

- Entertaining, funny, fun, humour, acting part, role playing
- Interesting, enlightening, informative, educational, intellectual stimulation
- Creativity, originality, innovative, different/good learning
- Working with groupmates, team effort, group participation, getting to know fellow students
- Simpler way to explain, easier to understand, better understanding, easier to remember, integrative
- Developing skills (acting, creative, researching, presentation), confidence, self-learning

Values for beneficial aspects are percentages of students who provided comments and explanations for questions pertaining to the continuation/discontinuation of the exercise and the request for constructive comments. *In 2001, student feedback was obtained only as a result of prompting students for “any constructive comments.” The overall ranking was determined using mean values calculated as detailed in MATERIALS AND METHODS.

### Table 8. Analysis of student comments (1997 and 1999–2001) regarding constructive feedback and negative features of the exercise

<table>
<thead>
<tr>
<th>Year</th>
<th>1997</th>
<th>1999</th>
<th>2000</th>
<th>2001*</th>
<th>Mean</th>
<th>Overall Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of students who commented</td>
<td>54</td>
<td>159</td>
<td>111</td>
<td>15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Constructive feedback and negative features**

- Time and timetable issues
  - Time consuming in preparation
  - Timetable of presentations
  - Not enough time for presentations and preparation/allocate more time
  - Presentations/session too long
- Content and topics
  - Lack of balance between content and acting, lack of focus
  - Assignment of topics/reluctance to study other topics/perceived unfairness
  - Inadequate explanation of content/additional content required during presentations
  - Additional input from staff required (guidance/notes/worksheets/computer-assisted learning/formal lectures)
  - Unsure of content requirements
- Peers and groups
  - Lack of peer enthusiasm, participation, poor group dynamics
  - Lack of attendance
  - Smaller groups requested/groups too large
  - Group lacked appropriate presentation skills
  - Students do not take exercise seriously
- Marks and assessment
  - Lack of marks toward year mark
  - Problem with scoring/lecturers only should mark
  - More stringent assessment/evaluation of presentations/posters
  - Lack of beneficial aspects
    - Boring at times
    - Prefer to work alone/waste of time
    - Stressful/daunting/inhibits learning

Values for constructive feedback and negative features are percentages of students who provided comments and explanations for questions pertaining to the continuation/discontinuation of the exercise and the request for constructive comments. *In 2001, student feedback was obtained only as a result of prompting students for “any constructive comments.” The overall ranking was determined using mean values calculated as detailed in MATERIALS AND METHODS.
revealed by the analysis of the students’ comments was the informative, interesting, and intellectually stimulating nature of the exercise, together with the fact that it facilitated integration and made it simpler and easier for students to understand and remember their work. Students also found it to be a different way of learning that was fun, active, and encouraged them to be creative (Table 7).

The students’ comments also provided us with valuable insights as to how the exercise could be improved. The issues raised by students centered around five broad themes: namely, time and timetables, content and topics covered, peer involvement and group work, marking and assessment, and the fact that the exercise did not provide any benefit (Table 8). The five issues consistently raised over the years were as follows (in rank order): the time consumed in the preparation of the presentations that could have been used for studying other subjects, the timetable of the presentations within the second-year curriculum, insufficient time allocation for the presentations and their preparation, the need for additional inputs by staff, and, finally, the perception that the exercise was a waste of time and that students preferred to work alone.

DISCUSSION

The innovative exercise described above was carried out over a period of 5 yr, immediately before the introduction of a new PBL medical curriculum in 2001. Physiology at this time was primarily taught during the second year of study in a teacher-driven didactic lecture format and through the use of practicals, which were not available for GIT and endocrine physiology for reasons already explained in the Introduction. The exercise, which was designed to integrate GIT and endocrine physiology with pathophysiology and clinical signs and symptoms of disease, was done in a manner that promoted the active involvement of students within large classes (n = 147–196) in the learning process, facilitated expression of their creativity, and allowed for the development of new skills in a context that was aimed at being nonthreatening and entertaining. Despite this work having being completed over 5 yr ago, the student feedback reported here is as relevant today as it was then (7, 11, 20):

- “It is interesting. Second you learn to be self responsible. You discover many facts and lots of information relevant to [your] career.” (1997 student)
- “It makes it possible to relate to the actual world of medicine. It has a psychological impact on those students who are really serious with their work. It paves the way for them. It is really motivating.” (1997 student)
- “It is different from the manner in which we are normally taught. It is fun and interesting. It helps us use the ideas and creativity to make studying enjoyable. It requires effort by individuals if they have to present.” (1999 student)
- “It reveals hidden talents, interesting, funny and very informative.” (2000 student)
- “It takes too much of time to prepare, time that could be spent studying for all the tests that we have. It was a very stressful experience and it was difficult to find time suitable for everybody in the group to discuss the topics and prepare.” (1997 student)
- “Students need to be given time to go and research about their presentations. We really did not have time to do thorough research since (we have) other things to commit ourselves to e.g. tests, lectures, practical, DH (anatomy) etc.” (1999 student)
- “Its negative outweighs its positive attributes. It is far too time consuming especially when we have constant high pressure work to do which is more important.” (2000 student)

This is perhaps not surprising, particularly in the light of sentiments expressed recently by DiCarlo (7), who stated that “learning with understanding requires time...Students need time to explore underlying concepts and to generate connections with other information.” It is worth noting too that in a study done in Sri Lanka, in which first-year medical students were asked to voluntarily participate in an information technology-based activity in physiology education, Kommalage and Gunawardena (12) also found that workload in parallel subjects negatively impacted on students’ time to participate and/or complete the assignment.

A feature of the present exercise was the inclusion of role play for the learning of GIT and endocrine physiology and associated diseases. Although role play per se is not novel, being used extensively in clinical settings through the use of standardized patients, this is, to the best of our knowledge, the first report of its use in the teaching of GIT and endocrine physiology. Students were very innovative in their approach. The type of role play they used was not the formal simulated patient-doctor relationship but rather took the form of short skits/sketches, which ranged from a dramatic emergency situation, such as is seen in a diabetic patient, to consultation with
both Western and traditional health practitioners in some GIT cases, to a group of specialists formally presenting and discussing a case, and even through the use of satire, mimicking staff members. This generated a great deal of laughter as well as interest from other faculty staff and students. This was a positive aspect, which was commented about long after students had completed their second-year studies. It was thus gratifying that over 85% of the students, irrespective of the years, found this feature to be beneficial. As Sturges et al. (28) found in their recent study, our students also reported that role play made the presentations more fun, informative, entertaining, and, above all, enhanced class camaraderie. Role play of clinical features was perceived by students to also improve their understanding of the physiological basis of GIT and endocrine disorders. These sentiments are embodied in the following student comments:

- “Not only did we learn about GIT and endocrine but we also learnt a lot about each other and that makes the learning of the disorder fun because we remember the roles we played.” (1999 student)
- “The role play was funny and the humour helped to keep certain facts in my mind.” (2000 student)
- “It reveals hidden talents, interesting, funny and very informative.” (2000 student)
- “It removes the class tense atmosphere and encourages camaraderie.” (2000 student)

The questionnaires permitted the students to provide us with constructive feedback, allowing them to suggest ways in which the exercise could be improved:

- “Allocate groups in the beginning of the year. Schedule presentations in a period that is not close to other tests or examinations. More time for preparation. Allocate marks for presentations.” (1997 student)

This impacted not only on the organization of the exercise from one year to another but also on the evolution of the questionnaire to further probe the issues that the students raised (Table 3). For example, one of the issues raised by students of the 1997 cohort pertained to the sizes of the groups. As shown in Table 2, the average group size in 1997 was 12.3 students. This declined to an average of 8.7 students/group, even though class sizes increased substantially (40% over time). Interestingly, this reduction in group size was accompanied by a steady decline in the percentage of respondents who stated that the groups were too large. It was particularly encouraging to note, too, the concomitant steady increase in the percentage of respondents who reported that group work was beneficial to their learning (Table 5). This is in keeping with the literature, which indicates that group work and group dynamics are optimal in groups of six to eight students for this type of exercise (4).

Despite 80% of the respondents indicating that the exercise should continued, approximately one-third of them nevertheless perceived the exercise to be a waste of time (Table 4) and indicated that they would have preferred to have worked on their own (Table 5). Although at first glance these responses appear to be contradictory, they need to be interpreted in the context of the second-year curriculum at our institution. As previously stated, it also consisted of anatomy and histology, both of which entailed a great deal of self-study by students. In addition, there were regular anatomy spotter tests, which added to the demands on students’ time. Thus, while the majority of students appreciated the benefits of the presentations to their learning of GIT and endocrine physiology, there was definitely tension in terms of time allocation by students to the various tasks.

These sentiments were also borne out in student comments (Table 8):

- “The work for second year is too much so these presentations were a waste of time.” (1999 student)
- “The benefits are outweighed by the waste of time.” (2000 student)
- “Waste of time and effort, boring and dull.” (2000 student)
- “Lectures and notes on the subject matter would have been better.” (1999 student)
- “I prefer learning from sources by myself. I think that the information asked in the exam papers will be easier if I did the whole topics by myself.” (1997 student)

Despite the large number of negative issues raised by the students (Table 8), it is important to realize that these comments were made by no more than 20% of the respondents who offered comments. In contrast, although there were fewer categories, up to 60% of the respondents offered positive comments (Table 7).

It must be acknowledged, as well, that there are always going to be students that do not adapt well to other forms of learning, including group work. In recent years, there has been an increasing focus on student learning style preferences and how they can impact on student involvement in medical and allied health sciences course activities (3, 8, 25). These studies have indicated that while the majority of students prefer using multiple learning styles, there is a significant number of students (~10–30%) who prefer learning using reading and writing skills only (8, 25). Furthermore, Chapman and Calhoun (3) identified a number of learning style constructs including individual versus group learning in their medical student population. In their study, they found that students were more likely to be individual rather than group learners. These authors also highlighted the importance of identifying students learning preferences so that students can be assisted to adapt to different teaching and learning methods.

In this study, we chose to allow students to self-select their groups and only assigned students to groups when necessary. The reasons for this were complex and were informed largely by some research carried out by one of our colleagues at the time. Michelle McLean (16). She studied student associations in 1998 among first- and second-year medical students, i.e., the same set of students who participated in the present study, namely, in 1998 and 1999. In her study, she reported that 89% of the students surveyed stated that they should be allowed to choose with whom they formed groups. Some of the reasons most frequently cited by the students centered around such issues as home language, the ability to communicate confidently in English, travel arrangements, and on-campus versus off-campus residence. It is important to note that at our institution it is difficult for students who rely on public transport to work late on campus. While we acknowledge that it may be educationally preferable to assign students to groups so that they can learn to work effectively in teams (16) and be exposed...
to students of other backgrounds and opinions, it was deemed prudent to allow students to self-assign themselves into groups, since the presentations were only a relatively short-term group-based exercise (the maximal duration being 4–6 wk).

One of the exercise’s features that the students really valued was the prize-giving event, during which the efforts of students were recognized through the award of “token” prizes. Rewards were given for the best overall presentation, the best GIT assignment, and the best endocrine assignment as well as to individuals and groups for creative talents as demonstrated in their role play, Powerpoint design, and group involvement. The marking rubric used was thus not designed to provide an accurate assessment of the groups’ performance but rather encouragement to students for developmental purposes. Hence, the rubric did not make provision for the allocation of marks in a “poor” category. It was interesting to note that despite peer evaluation being consistently harsher than that provided by staff, the relative rankings of the presentations were consistently similar (unpublished observations).

Staff also corrected any misconceptions and content inaccuracies in the students’ presentations. This was done through questions and discussion during the presentation sessions, screening and vetting of the posters and Powerpoint slide presentations before making them accessible to students for revision purposes, and through formal scheduled question and answer sessions throughout the course. Despite the fact that students in the latter years had access to the posters, documents, and slides that other students had generated in the earlier years, only one instance of outright plagiarism was detected.

There were, of course, a number of limitations to the present study. First, we had to rely primarily on student perceptions to assess the efficacy of this exercise. Second, we were unable to validate the impact of this exercise on students’ knowledge and understanding as pre- and posttests were not be done. The applied aspects of the physiology course, which contributed to 22.5% of the students’ final mark, were assessed by means of a midyear test and an end-of-year examination. Thus, the only quantitative evidence we can provide is a comparison of the students’ results for those questions based on the practical work with their achievements in questions based on material covered in the presentations. As shown in Table 9, students’ performance in the applied GIT and endocrine questions was, over the years, no worse than that in the questions based on their practical work in other systems. Third, time constraints, due to an already congested second-year curriculum, did not permit us to assess students’ writing, computer, and communication skills before and after the exercise. Interestingly, in this regard, Ahsen et al. (1) recently reported, using a pre- and postintervention study method, that the communication skills of fourth-year medical students were significantly improved by the use of interactive methods such as role-play and recorded video scenarios. Finally, we were not able to directly monitor student participation and group interactions as the students met at various times, predominantly after hours and not necessarily on campus. It is for this reason that we were reluctant to award formal marks to student groups. Furthermore, the assessment criteria for the determination of the year mark did not allow us to include such marks into the calculation of an individual student’s course mark.

Despite the limitations enumerated above, it is evident from the student feedback that the exercise described in the present study encouraged active learning, cooperation among students, and the integration of basic medical sciences with clinical sciences. It also enhanced class camaraderie (by providing opportunities for students to learn from each other and showcase their diverse talents) and facilitated interactions with staff, all of which are included in the seven principles for good practice in undergraduate education (5). This is embodied by the following student comments, even though some students indicated their disappointment that the time and effort spent preparing for their presentations did not directly contribute to their year marks:

- “It makes it possible to relate to the actual world of medicine. It has a psychological impact on those students who are really serious with their work. It paves the way for them. It is really motivating.” (1997 student)
- “I was very impressed by the time and effort put in by the lecturers at the final prizegiving; I thought it was a very nice touch and appreciated it as I am sure did all the students.” (1999 student)
- “I would like to encourage the co-ordinators of such presentations to keep it up and also to make it contribute to the class mark at the end of the year so that students will be encouraged.” (1999 student)
- “Should at least give 5% year mark because we put a lot of effort.” (2000 student)

In conclusion, presentations such as these can be used successfully as a substitute for interactive practicals without seemingly negatively influencing student performance in practical/applied tests/examinations. We have also demonstrated that it is possible in a didactic non-PBL curriculum to make the learning of physiology more active and fun by allowing students to take responsibility for their own learning and to showcase their creativity. An added benefit is that it allows students in a large and diverse class to get to know one another. Although this study was carried out in a South African context, where most of the students entered their university studies directly from school, we nevertheless believe that exercises such as this are applicable worldwide. As has been recently reported by Cheng (4), an innovative exercise, such as the intermedical school physiology quiz, is even now being used to stimulate student interest in physiology internationally and to assist students and staff from multicultural and multilingual backgrounds.

Table 9. Comparison of student performance in practical- and presentation-based questions

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Students</th>
<th>Performance in Practical-Based Questions, %</th>
<th>Performance in Presentation-Based Questions, %</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>June</td>
<td>159</td>
<td>51 ± 19.2</td>
<td>39 ± 19.0</td>
<td>&lt;0.01*</td>
</tr>
<tr>
<td>November</td>
<td>159</td>
<td>43 ± 13.9</td>
<td>48 ± 19.9</td>
<td>&lt;0.01*</td>
</tr>
<tr>
<td>1999</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>November</td>
<td>195</td>
<td>46 ± 17.2</td>
<td>43 ± 18.6</td>
<td>&lt;0.05*</td>
</tr>
<tr>
<td>2000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>June</td>
<td>170</td>
<td>46 ± 19.0</td>
<td>48 ± 15.2</td>
<td>0.05</td>
</tr>
<tr>
<td>Overall mean</td>
<td></td>
<td>47 ± 3.0</td>
<td>44 ± 3.9</td>
<td>&gt;0.05</td>
</tr>
</tbody>
</table>

Values for student performance are means ± SD. The medical students traditionally fared better in theory components than in the applied sections, which contributed 77.5% and 22.5% of the assessments. *Significant difference.
backgrounds to network. Physiology, it would appear, is indeed an international language!

From our experience, to set up an innovative exercise, as described in our study, involves a number of factors. Students have to be allocated into groups, relevant topics must be selected, and one must design objectives for the exercise and ensure that students are kept suitably informed. One also needs to ensure that appropriate resources are identified and made available for the students, that assignments are marked in a timely manner, that student feedback is regularly obtained and incorporated into one’s planning, and last (but not least) that suitable timetable slots and venues are found. As with all new ventures, it is really important to obtain the support of one’s colleagues and faculty management as well as that of students by involving them in the planning as much as possible, as this facilitates buy-in. Although such an undertaking seems to require a lot of effort initially, we have found it to be really worthwhile. It is a memorable experience that both staff and students have come to value, and the benefits remain for years to come. We derived a great deal satisfaction over the years that we were able to conduct this exercise and, judging from their responses, so did our students.

- “This exercise allowed me to be more interactive in my learning. It aids in remembering the material covered. It teaches the value of teamwork, the relevance of our studies and the need to apply knowledge. It creates a healthy relationship between class members and is very entertaining.” (1999 student)
- “Continue with the presentations for the subsequent years. It’s fun; we need that in this place; moreover it is informative in a relaxed manner.” (1999 student)
- “It was a very good learning experience; it encourages learning and also made me realize just how interesting physiology is and made me want to know more so that I could apply it in situations.” (1999 student)
- “It was fun to do, helped to make new friends, interesting method of learning, more entertaining—a break from lectures—gave insight into GIT section and endocrine.” (2000 student)
- “Personally I find that I can remember more info about the GIT and endocrine and presentations even while revising/studying for the test because the visual is stuck during the presentation.” (2000 student)

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DISCLOSURES

No conflicts of interest, financial or otherwise, are declared by the author(s).

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