An Interactive, Student-Centered Approach to Teaching Large-Group Sessions in Veterinary Clinical Pathology

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ABSTRACT

Introduction – The purpose of this study was to describe and evaluate an interactive, student-centered approach to teaching large-group sessions in Veterinary Clinical Pathology. The strategy was designed to operate in the place of expository lectures and to encourage a deep approach to learning through discussion and problem solving.

Methodology – The teaching strategy ran over two hours and required students to answer a series of questions on the topic to be discussed before attending the session. In the first part of the session, limited information and laboratory data related to a series of cases were presented to the students for discussion and analysis. These cases were selected on the basis of their usefulness for discussion in relation to the answers to the previously set questions and to reinforce an approach to the analysis of laboratory data. After a break, students were given a series of multiple-choice questions, related to the topic previously discussed, to answer. Students were given the opportunity to discuss the reasons for their answers. Finally, the students were given information and laboratory data from an unknown case and asked to analyze them, through a mechanism previously practiced in small-group tutorials, in order to reach conclusions and to consider the need for further investigation and implications for case management. A consensus diagnosis and plan for the case was reached after reflective observation and discussion. The teaching strategy was evaluated, utilizing teacher reflection and a student questionnaire, on the basis of its success in encouraging active and simulated experiential learning.

Conclusion – The evaluation of one session indicated that students strongly valued the strategy in relation to actively engaging them in discussion, providing feedback on how they were learning, and enhancing their understanding of how theoretical knowledge can be applied to actual clinical cases. These pedagogical principles appeared to give students greater confidence in analyzing laboratory data through a mechanism of diagnostic reasoning. More sessions of this kind, tied to specific content or skills areas, will allow better evaluation of the perceived student outcomes, which can then be correlated with actual student outcomes through formal assessment.

Key words – student-centered learning, experiential learning, reflective observation, diagnostic reasoning

INTRODUCTION

Recent literature indicates a strong shift from teacher-centered learning activities to student-centered activities. This shift is driven by the acceptance that student-centered activities encourage a deep approach to learning, an approach that leads to meaningful memory and understanding. Student-centered learning activities are by nature interactive and commonly rely on dialogue and group discussion to bring about altered understanding. The process leading to altered understanding is dependent on students being given the opportunity to learn with one another through variable amounts of direction from the teacher, who acts as a facilitator of discussion and learning.

Historically, lecturing as a form of teaching has been associated with student-centered activities. The traditional lecture has largely involved expository teaching that tends to encourage a superficial approach to learning. For this reason, there has been strong demand for traditional lectures to be replaced by other forms of group teaching. In some circumstances, this call has involved a shift to smaller-group teaching because of the relative ease of introducing student-centered activities. However, it can be argued that this is inappropriate because of the trend in higher education to increasing class sizes. Consequently, it has been suggested that lectures to large groups should remain, but that they should move from being expository to heuristic, so that students would learn things for themselves by adopting strategies to encourage active learning. In effect, lectures would be altered to mimic large tutorials in which students are asked to solve problems. Many strategies for achieving this have been documented.

To avoid confusion with expository traditional lectures, some educationalists now prefer to use the term “large-group teaching” when describing the use of student-centered approaches to learning in such situations. However, irrespective of these labels, it is now clear that there is increasing pressure to reduce telling and listening time and increase thinking, analyzing, and evaluating time in lectures. The purpose of this article is to present an example of a strategy, and its preliminary evaluation, for encouraging a deep approach to learning in a lecture situation. This strategy attempts to incorporate the pedagogical principles of active listening, experiential learning, and self-reflection in a large-group situation. The strategy relies heavily on the use of case-based problem solving, which is accepted as essential for developing diagnostic reasoning in veterinary clinical pathology, and has attempted to instill confidence in students in analyzing laboratory data and to enhance their capacity to reflect on their learning.

METHODOLOGY

Introduction

Veterinary Clinical Pathology is taught in year 4 of a five-year course at the University of Sydney. Although a distinct unit of study, it is interconnected with Veterinary Medicine
through practicals and tutorials that emphasize the importance of developing diagnostic reasoning through case-based problem solving. These tutorials are restricted to a maximum of 15 students and provide training in, and a framework for, case report analysis. The final written assessment is based on the analysis of four case reports in the setting of an open-book examination. Currently, lectures in Veterinary Clinical Pathology are conducted in a didactic fashion and consist of presentation of principles and case reports to illustrate their application. Student involvement is limited to questions and a general discussion of a case report at the end of the lecture. In order to align lectures better with assessment and tutorials, and to encourage a deep approach to learning, a strategy was designed to increase student involvement. The strategy assumed that 50–60 students would attend the lectures, but was developed to accommodate increasing class sizes, which will approach 100–120 in the next two years. Since lectures in Veterinary Clinical Pathology are timetabled in pairs, the strategy was designed for an approximate two-hour session. However, the strategy could be easily adapted to two separate one-hour sessions.

The session topic for implementation of the strategy was “Cytology and fluid analysis: Why is it important in case report analysis?” Students were advised of the topic and the strategy a week in advance and provided with a handout containing all relevant information. It was clearly explained that the strategy was experimental and that they would be asked to evaluate the session. Students had been prepared for the type of involvement that would be expected in the session through training in active listening, teamwork, and self-reflection during previous tutorials in both Veterinary Medicine and Veterinary Clinical Pathology units.

The handout for the students, which could also have been provided through a Web site, contained information on the aims and goals of the session, the expected learning outcomes, a series of questions related to the learning outcomes, and an outline of the strategy to be adopted. Students were expected to read the information and answer the questions before the session began. To complete this task, students were provided with a unit of study handbook containing relevant information and details of appropriate texts. They were also given the option of performing the task individually or in pairs, and they were asked to bring their prepared answers with them to the session. The following is an example of a learning outcome and a related question:

**Learning outcome:** By the end of this session, you are expected to distinguish between the basic pathological processes that can be detected by synovial fluid analysis.

**Related question:** How do gross assessment, protein estimation, total cell counts, and cytological smear evaluation assist in distinguishing acute and chronic degenerative changes, non-septic and septic exudates, and neoplastic effusions in joints? Are any other tests required to assist the distinguishing process?

**Strategy**

The following is an outline of the timing of the strategy:

- **50 minutes:** whole-class discussion of laboratory material from five cases
- **10-minute break**
- **20 minutes:** multiple-choice quiz followed by discussion of reasons for choices
- **5 minutes:** data from unknown case report presented for individual open-book assessment
- **10 minutes:** students discuss case assessment with partners
- **15 minutes:** whole-class discussion of case assessment and presentation of material for the next session

At the beginning of the session, students were reminded of the format for the session and that any difficulties they had with answering the set questions could be raised during the first component of the session. Limited information and laboratory data related to five cases were then presented to the students for analysis and discussion. These cases were selected on the basis of their usefulness for discussion on the answers to the set questions and to reinforce an approach to the analysis of laboratory data. For example, laboratory data from a case of immune-mediated polyarthritis in a dog were presented to reinforce the method of synovial fluid analysis and to answer the question related to distinguishing between basic pathological processes. The case also emphasized the need for further testing (e.g., microbiological culture, detection of antinuclear antibodies) in the analytical process. It was during the discussion of these cases, mainly through questioning, that principles were reinforced and misconceptions removed. Each case took about 10 minutes to present and discuss. It should be emphasized that students were familiarized with a technique of analysis of laboratory data at the beginning of the unit of study and practiced this technique continually during tutorials and lectures.

After a 10-minute break, the students were then provided with five multiple-choice questions related to diagnostic cytology and fluid analysis. They were asked to select an answer and write down the reason for their choice. They then passed their answers to the student next to them for marking. Those students with correct answers were asked to give their reasons. The questions were selected on the basis of reinforcing principles of diagnostic cytology and fluid analysis. They allowed the students to reflect on their learning during the session and the teacher to get immediate feedback on their understanding. This component of the session lasted about 20 minutes.

The final component of the session was to present and analyze an unknown case report in a similar format used for the final written examination. The case report chosen for the session was cryptococcal meningitis in a dog. The results of cerebro-spinal fluid (CSF) analysis were provided along with relevant case background information. This component was essential to ensure that the principles of diagnostic cytology and fluid analysis were applied in context to “real” laboratory investigations of diseased animals (i.e., the holistic view). This component is designed to be logical and step-wise so that the students learn a technique of analysis as well as developing an understanding of the application of principles.

The approach to analysis for the unknown case report had been presented and practiced a number of times in tutorials and lectures before this session. Students were able to use
their unit of study handbook for this component. Before evaluating the laboratory data, the students were asked to think about possibilities of diseases based on the relevant case background material. They could also ask for more information at that stage. The students were asked to work logically through the laboratory data before reaching a conclusion. It was expected that most would come to the conclusion that the dog had inflammatory central nervous system (CNS) disease and would be able to suggest further investigations. It was not necessary for them to reach a specific diagnosis. Specific instructions to the students were as follows:

1. Read the case information and take that into consideration when interpreting data.

2. Identify abnormal clinical pathological data and comment on the magnitude of abnormality (reference ranges and orders of magnitude of increases were provided in the unit of study handbook).

3. Think of reasons for the abnormalities and relate these to the case information you have been given.

4. Can you come to any conclusions about the case? That is, do the abnormal data and case information suggest one or more problems (e.g., liver disease, renal disease)? Does the case need further investigation, and if so, what should be done?

5. What implications does the conclusion have for case management?

Conclusions for most cases are not clear-cut. Therefore, most require further investigation through further laboratory testing and the use of other diagnostic aids (e.g., image analysis, exploratory laparotomy, electrocardiogram). Sometimes students come to different conclusions, but these are accepted if they can be supported by their analysis of laboratory data. Knowledge of disease processes is never certain. The final aspect of the component, that is, implications for case management, is intended to make the students realize how the Veterinary Clinical Pathology and Veterinary Medicine units are interrelated: that laboratory data assist diagnosis, prognosis, and, consequently management of the case.

The approach used for this unknown case report component was stepwise and involved students working alone in silence for about five minutes to identify abnormal data and the magnitude of the abnormality. The students then paired up for about 10 minutes to discussed the possible reasons for abnormalities and draw any conclusions. The teacher then asked students for any conclusions and wrote these on the board. Students were asked to defend conclusions if questioned by other students. Finally, the students were asked how they would approach further investigation and what implications conclusions and further investigation had for case management. In essence, a consensus plan for the case was reached, which took about 15 minutes.

Finally, the students were given the information and any preparation for the next double lecture block.

RESULTS OF EVALUATION OF THE TEACHING STRATEGY

The teaching strategy was evaluated through teacher reflection and a questionnaire completed anonymously by students at the end of the two-hour session (Table 1). Criteria for evaluation of the success of the strategy included its ability to engage the students in active learning, to engage them in simulated experiential learning, and to deliver good feedback.

During the first component of the session, it was difficult to engage a substantial number of students in the discussion of the cases used to illustrate principles and to answer questions set as preparation for the session. Many students appeared to want the teacher to dominate the discussion, and directed questions were required to get discussion moving. Questioning seemed best directed at pairs of students rather than at one student, and pairs were given the option of transferring the question to colleagues, at their own peril, if they were unsure of the answer. The multiple-choice question component of the session took longer than anticipated. This was because students wanted to discuss the validity of options for the questions. This discussion was encouraged, as it was characterized by lively debate over principles of diagnostic cytology and fluid analysis. However, this left less time for the analysis of the unknown case report.

Overall, the student questionnaire revealed that preparation for the session was not too onerous and that students thought it was fun. This finding was supported by the fact that the students appeared keen to complete the questionnaire, despite having to do so after the end of the session. The majority of students also found that the session actively engaged them in discussion, made them realize how theoretical knowledge can be applied to actual animal cases, and gave them good feedback on their learning. In addition to the information presented in Table 1, students also provided some freehand comments, expressing, among other things, a desire to have some traditional lectures (2 responses), a desire to expand and have more time for the multiple-choice questions (3 responses), and a desire to speed up the first component (1 response). One student stated that she liked homework!

DISCUSSION AND CONCLUSIONS

The teaching strategy employed for the group session was designed to be student-centered so as to encourage a deep approach to learning. Most student-centered activities involve active learning, mainly through discussion, which is accepted as the best means by which altered and improved understanding can be achieved for students.4, 12 This acceptance is based on the premise that all knowledge is created from within and that it is dependent on both individual and social activity. This is the central theme of constructivism and highlights the importance of students’ developing ownership of any created or altered knowledge.13, 14

Apart from the success of the student-centered strategy relying heavily on dialogue through questions and answers, it also depended on providing and working through relevant case material. This latter component was a form of simulated experiential learning, where the central concept is that significant learning takes place only when the student acquires a meaningful understanding of the experience as it relates to his or her life situation. Experiential learning is becoming increasingly accepted in veterinary education, especially for clinical teaching,15 and is easily adapted for teaching the Veterinary Clinical Pathology unit, where there
is a need for developing diagnostic reasoning through case report analysis. Therefore, the final component of the teaching strategy gave the students the opportunity to practice diagnostic reasoning by analyzing an unknown case report. Moreover, it ended with the students considering the implications of the results for case management and constructing a consensus plan on the approach to further investigation. In essence, this was a period of debriefing or reflection for the students, and it was an essential finish for the component because reflective observation is regarded as pivotal in completing the learning process by turning experience into learning. It was anticipated that through this reflection the students would develop self-confidence and skill in conceptualizing the process of analysis in order to apply what they had learned to other case investigations in veterinary medicine.

Table 1: Student questionnaire on teaching strategy for the large group session (combined results for all 53 students)

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
<th>Average grade mark* and standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I found preparation for the session too demanding</td>
<td>17%</td>
<td>66%</td>
<td>11%</td>
<td>4%</td>
<td>2%</td>
<td>2.1 ± 0.78</td>
</tr>
<tr>
<td>2. It was clearly explained what the session was about and what it involved</td>
<td>0</td>
<td>4%</td>
<td>15%</td>
<td>62%</td>
<td>19%</td>
<td>4.0 ± 0.71</td>
</tr>
<tr>
<td>3. I found the session gave me the opportunity to become involved in discussions and express my opinion</td>
<td>0</td>
<td>4%</td>
<td>15%</td>
<td>70%</td>
<td>11%</td>
<td>3.9 ± 0.64</td>
</tr>
<tr>
<td>4. The session gave me good feedback on how I was going with my learning and understanding</td>
<td>2%</td>
<td>11%</td>
<td>17%</td>
<td>64%</td>
<td>6%</td>
<td>3.6 ± 0.84</td>
</tr>
<tr>
<td>5. The session allowed me to understand how theoretical knowledge can be applied to actual animal cases</td>
<td>0</td>
<td>0%</td>
<td>4%</td>
<td>74%</td>
<td>22%</td>
<td>4.2 ± 0.48</td>
</tr>
<tr>
<td>6. I found the session to be fun</td>
<td>0%</td>
<td>8%</td>
<td>19%</td>
<td>62%</td>
<td>11%</td>
<td>3.8 ± 0.76</td>
</tr>
<tr>
<td>7. I liked the quiz, as it helped me to know how much I understood</td>
<td>4%</td>
<td>19%</td>
<td>17%</td>
<td>60%</td>
<td>0%</td>
<td>3.3 ± 0.91</td>
</tr>
<tr>
<td>8. I found the session too confusing and poorly organized</td>
<td>14%</td>
<td>67%</td>
<td>17%</td>
<td>2%</td>
<td>0%</td>
<td>2.1 ± 0.62</td>
</tr>
<tr>
<td>9. I would have liked the teacher to explain more in relation to answers to the homework/preparation questions</td>
<td>2%</td>
<td>45%</td>
<td>23%</td>
<td>26%</td>
<td>4%</td>
<td>2.8 ± 0.97</td>
</tr>
<tr>
<td>10. I prefer a lecture where the teacher does most of the talking and explaining</td>
<td>10%</td>
<td>39%</td>
<td>27%</td>
<td>20%</td>
<td>4%</td>
<td>2.7 ± 1.03</td>
</tr>
<tr>
<td>11. I would like all lectures to be altered to this type of session</td>
<td>13%</td>
<td>27%</td>
<td>33%</td>
<td>23%</td>
<td>4%</td>
<td>2.8 ± 1.08</td>
</tr>
</tbody>
</table>

*Average grade mark for each question based on summary results for all students. Responses were allocated as follows: “strongly disagree” = 1, “disagree” = 2, “neutral” = 3, “agree” = 4, and “strongly agree” = 5. One student did not answer all questions.

The multiple-choice questions proved to be very useful in providing feedback to both teacher and students, as well as in encouraging active discussion on principles of diagnostic cytology and fluid analysis. In effect, they provided another opportunity for reflection. Their usefulness may have been assisted by the fact that they were not summatively assessed and that reasons for answers were required. Multiple-choice questions are often criticized for simply testing rote learning, but it is accepted that if they are well constructed, they can test understanding of concepts. Moreover, they have a role to play in formative assessment, as they can provide rapid feedback to students on their learning.

Despite the widespread acceptance that student-centered activities best encourage understanding, teacher-centered activities, especially the expository lecture, continue to dominate in higher education. This incongruence between espoused theory and theory in practice can be partly explained by the fact that the use of student-centered activities is not without risk. For example, teachers can lose control and a sense of power by moving to student-centered activities. Moreover, student-centered activities take longer to complete, which will have an impact on content covered. Of course, there is a far longer list of reasons given by teachers as to why they continue to lecture in a traditional manner, but most of these are not valid if teachers truly want
their students to understand rather than learn by rote. This is not to say that room does not exist for the occasional expository lecture or for a component of expository teaching. However, it is probably best to limit this to 15–20 minutes, and to use it to introduce a new topic or to provide an overview of the relations between topics. Moreover, expository teaching could be used to describe student-centered teaching strategies and thereby set the scene for active learning.

Teachers’ reliance on expository lectures is sometimes matched by the students’ dependence on this form of teaching. This is not unexpected, as students’ approaches to learning are heavily influenced by their teachers’ approaches to teaching. Once students are accustomed to this form of passive learning, considerable effort is required to wean them off and move them to active learning. This fact is highlighted by the students’ response to the final three questions in the questionnaire on the evaluation of the student-centered teaching strategy, which indicated a desire by a significant number of students to have more explaining and not to remove traditional lectures completely—this despite the fact that many students had enjoyed the session, gained feedback on their learning, and increased their understanding of the use of laboratory data for case diagnosis. Possibly, more sessions of a similar type and a belief that these would not jeopardize their assessment would have led to less hesitancy in answering those final questions in the negative.

The method of evaluation of the student-centered teaching strategy deliberately employed teacher reflection and student evaluation to achieve balance. Self-reflection is an exercise that all teachers should engage in if they are to align their approaches to teaching with their students’ approaches to learning. This congruence is necessary if the desired student learning outcomes are to be achieved. However, one limitation of this method of evaluation was the lack of involvement of peers in the large-group session. The use of colleagues in evaluating teaching is a valuable tool for improving teaching, as it provides feedback in a relatively non-threatening way. Student questionnaires are an important tool for evaluating the effectiveness of teaching and providing feedback in order to improve; but such questionnaires are only as good as the questions asked, and a possible limitation of the designed questionnaire related to its choice of all or none for traditional lectures versus large-group sessions for question 11. The response might have been very different if students had been asked whether more large-group sessions should be included at the expense of traditional lectures. Moreover, responses to student questionnaires are also affected by other components of the curriculum. For example, the response to question 1, namely that the majority of students felt the time required for preparing for the session was not too demanding, might have been answered very differently if other units of study within the curriculum were also demanding this type of preparation.

It must also be stated that the student questionnaire provided a limited evaluation of the success of the strategy, namely satisfaction of the perceived outcomes. True student outcomes are dependent on the results of assessment. Consequently, evaluation of the success of the strategy in assisting in the transition from teacher-centered to student-centered education should include measurement of true student outcomes and perceptions.

In conclusion, this preliminary evaluation of the strategy is encouraging because the students found it challenging and interesting, while the teacher seemed satisfied that the goals and learning objectives could be achieved. The prospect of moving to more of these sessions is both feasible and exciting, as the students have already shown their interest in this approach, it will provide them with more practice for the final assessment method, and it will allow further evaluation of the strategy in producing self-confidence and a deep approach to learning. If the results prove just as positive, then the pedagogical principles will have provided students with the confidence and methodology to tackle case report analysis and to understand the role veterinary clinical pathology plays in case diagnosis, prognosis, and management. Diagnostic reasoning is an acquired skill based on adequate knowledge, common-sense application of pathophysiological principles, and a logical, mechanistic approach to case report analysis. It can be regarded as a hierarchical process that leads to high-order thinking. It should form the basis for the primary learning outcome for the Veterinary Clinical Pathology unit and, consequently, for the assessment process.

**SUMMARY**

An interactive, more student-centered teaching strategy was developed for large-group sessions in Veterinary Clinical Pathology. The strategy relied heavily on case material in encouraging dialogue and was evaluated through a student questionnaire. The results of evaluation of one session suggest that student satisfaction was high and that the strategy succeeded in actively engaging all students in discussion, in providing feedback on how they were learning, and in assisting their understanding of how theoretical knowledge can be applied to actual clinical cases. It is anticipated that these pedagogical principles will provide students with the confidence to analyze laboratory data through a mechanism of diagnostic reasoning and will further enhance their capacity to reflect on their learning. Support for these conclusions will require the analysis of further sessions and a correlation of perceived student outcomes with actual student outcomes through formal assessment.

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