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Research Article

Student-Centred Pedagogy Improves Student Skill Proficiency and Surgical Knowledge While Promoting Interest in Pursuing Surgical Specialisation

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Abstract

Many institutes seemingly fail to employ appropriate multimodal teaching methodologies for veterinary students, primarily relying on teacher-centred pedagogy in the teaching of surgery and surgical skills, with limited active-learning, student-centred opportunities. The reason behind this is multifactorial in nature, with institutional factors including how the institution deploys its resources and organises the curriculum, and likely leading to student dissatisfaction and inadequate surgical skill proficiencies. In an effort to improve the practical skills of new graduates, a recent change in the educational paradigm in the medical curricula from a teacher-centred to student-centred approach has been adopted by many teaching institutions. The aim of this study was to quantify the effect of the implementation of a more student-centred learning environment on student skill proficiency and surgical knowledge when compared to a predominantly teacher-centred pedagogy. Further, the author aimed to identify if student-centred pedagogy promotes student interest in pursuing surgical specialisation following graduation. Students were randomly divided into two approximately even groups; Group A (student-centered pedagogy) and Group B (teacher-centred pedagogy). Students were exposed to both subjective and objective assessment, with a global rating scale of operative performance utilised to compare the two groups in areas such as general knowledge, flow of procedure, general concept, level of ease, time and ease of motion, respect of tissues, overall operative performance. The results in this study identify that providing students with increased active-learning, student-centred experiences improved the understanding of surgical anatomy, surgical technique, as well as increases a students' overall confidence in surgical proficiencies and interest in pursuing surgical specialisation following graduation.

Keywords: *Student-Centred Pedagogy; Student; Surgical Knowledge; Pursuing Surgical Specialisation*

Introduction

For most medical students, surgical-specific curricula provides the first exposure to procedure skills training. Student engagement is based on an apprenticeship model of education whereby students observe senior clinicians and residents performing skills, and subsequently perform these skills under supervision. However, students are also offered the opportunity to practice technical skills on cadaveric models and live animal tissue (*in vivo*), isolated tissue flaps (*ex vivo*), or technology-based tools.

It is well recognised that students are now more commonly documenting self-reportedly low levels of proficiencies in specific surgical skills. These deficiencies are also well recognised by supervisors and senior staff members. Luhoway and colleagues [1] note that addressing these discrepancies is important for three reasons; (1) procedural proficiency is required in most postgraduate training programs, (2) the transition to competency-based education is becoming more prevalent and (3) recent data highlights the role of a student's surgical

educational experience in their decision to pursue a surgical career. An increased interest in a career in surgery has also been linked to students becoming more actively involved in the operating room and throughout surgical procedures.

Globally, a decrease in medical graduates applying to surgical specialities as their first choice of residency discipline following graduation is recognised, with the cause of this decrease likely multifactorial in nature. A more dedicated focus on technical skills teaching is recommended and thought to increase the interest in surgical careers. Additionally, Hicks and colleagues [2] note that as medical students decide on a specific specialty to pursue early in their education, integrating a "stronger surgical presence in the early years would not only provide a more robust medical curriculum, but may also improve student interest in pursuing a surgical career". Students report an increased enthusiasm about surgery if they are actively involved during these programs through hands-on participation thus suggesting that targeting interested students for surgical training earlier may improvement preparedness. Further, it is speculated that early exposure to surgery provides students with a more accurate depiction of the speciality whilst eliminating any negative perceptions commonly attributed to the discipline.

In a study by Luhoway and colleagues [1], 92.4% of surveyed students enjoyed performing technical skills, however the only technical skills students felt confident performing independently were sterile technique (96%) and basic suturing (52%). One of the highest reported perceived barriers to the development of technical skill proficiency was a lack of opportunities provided for skills development. However, a study by Tarchala and colleagues [3] identified that pre-education, whether via a didactic or simulator-based model, are both beneficial to a student's knowledge and surgical skill attainment.

The Bachelor of Veterinary Science program at the University Teaching Hospital currently provides fourth year students with a predominantly teacher-centred pedagogy, which includes two semesters of 12-week lectures in small animal surgery as well as a practical classes in suturing and neutering. Over the last 5 years, a steady decline in students pursuing careers in surgery following graduation is recognised, with a decrease in 5.6% of total new graduates undertaking surgery-specific specialist training over this period. Concurrently, the quality of technical skills demonstrated by the students has both subjectively and objectively decreased over the same time period, with students demonstrating lower than expected proficiencies in their technical skills.

A 2017 survey conducted by the University of 87 fourth-year Bachelor of Veterinary Science students set out to identify students' views towards the current design of the University surgical teaching program. Overall, students reported satisfaction with the program, with 62.3% noting that they were happy with the current format. However, 87% of students believed further improvements in the program could be achieved, with 73.4% of students feeling that they lacked some important technical proficiencies deemed a requirement for a new graduate veterinarian. The most notable barrier to the development of technical skill proficiency was reported to be lack of opportunities provided for skills development, which supports the results reported by Luhoway and colleagues [1]. Most alarming, only 11.6% of students reported that they would likely pursue surgical specialisation following graduation.

Upon reflection of such results, our institute seemingly fails to employ appropriate multimodal teaching methodologies, primarily relying on teacher-centred pedagogy in the teaching of surgery and surgical skills, with limited active-learning, student-centred opportunities. The reason behind this is multifactorial in nature, with institutional factors including how the institution deploys its resources and organises the curriculum, and likely leading to student dissatisfaction and inadequate surgical skill proficiencies. In an effort to improve the practical skills of new graduates, a recent change in the educational paradigm in the medical curricula from a teaching-centred to student-centred approach has been adopted by many teaching institutions. The majority of surgical learners prefer to learn in a multimodal fashion, with a coordinated effort to promote a student-centred multimodal learning environmental likely leading to benefit.

Aim of the Study

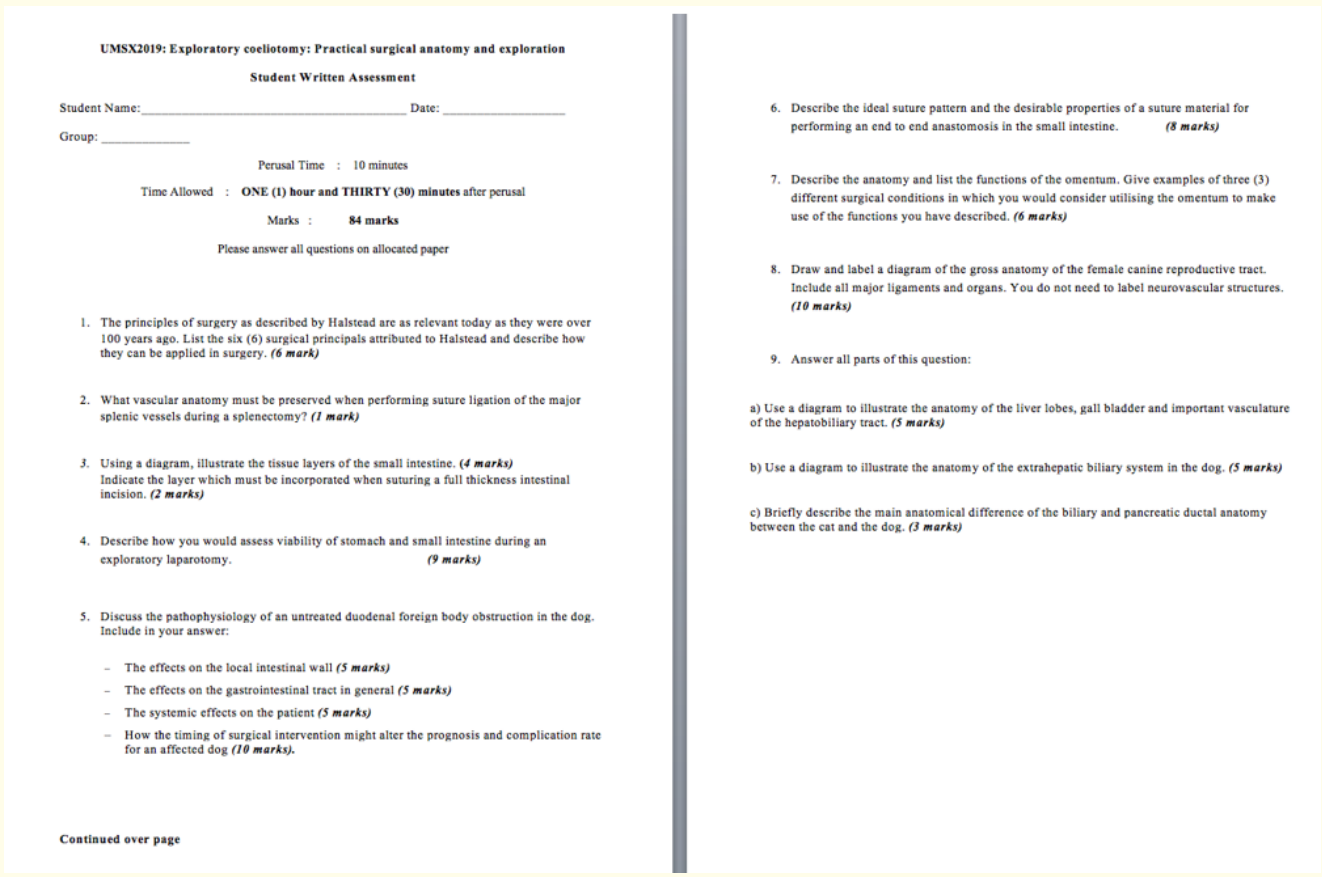
The aim of this study was to quantify the effect of the implementation of a more student-centred learning environment on student skill proficiency and surgical knowledge when compared to a predominantly teacher-centred pedagogy. Further, the author aims to identify if student-centred pedagogy promotes student interest in pursuing surgical specialisation following graduation. The author hypothesises

that students in the student-centred teaching group will demonstrate improved technical proficiency and increased surgical interest when compared to that of the teacher-centred group.

Materials and Methods

The study design was a prospective educational study which was carried out between June and October 2015. The study population consisted of Bachelor of Veterinary Science students in their fourth year of study. Participants consented to participation in the study and for use of the results. These students were randomly divided into two approximately even groups; Group A (n = 41) and Group B (n = 37).

Students in Group A were subjected to teacher-centered pedagogy which consisted of three 50-minute lectures based on canine and feline abdominal anatomy, gastrointestinal disease, gastrointestinal surgery, and appropriate abdominal exploration. All lectures were delivered by a specialist in small animal surgery. Lectures were followed by a 10-minute debrief session during which they could ask questions relating to the presented information. Group A students were then given a 30-minute didactic session by a specialist in small animal surgery on the various components of gastrointestinal surgery and how to appropriate perform an enterotomy. Following completion of the 30-minute didactic session, students were immediately directed to an examination room where they were asked to participate in a written assessment (Figure 1) (84 marks, 90 minute time allocation), and an oral assessment (Figure 2) (16 marks, 15 minute time allocation). The students were then brought individually into a simulation centre and were given one attempt to perform a small intestinal enterotomy for foreign body retrieval. A synthetic material was utilised to simulate the canine intestinal tract and all suture material and required equipment provided by the university. After the students' experience, a standardised feedback questionnaire (Figure 3) was filled out by the students to assess their enjoyment, comfort level, knowledge gained, and interest in pursuing a surgical career.



UMSX2019: Exploratory coeliotomy: Practical surgical anatomy and exploration

Student Written Assessment

Student Name:_____ Date: _____

Group: _____

Perusal Time : 10 minutes

Time Allowed : **ONE (1) hour and THIRTY (30) minutes** after perusal

Marks : **84 marks**

Please answer all questions on allocated paper

1. The principles of surgery as described by Halstead are as relevant today as they were over 100 years ago. List the six (6) surgical principals attributed to Halstead and describe how they can be applied in surgery. ***(6 mark)***

2. What vascular anatomy must be preserved when performing suture ligation of the major splenic vessels during a splenectomy? ***(1 mark)***

3. Using a diagram, illustrate the tissue layers of the small intestine. ***(4 marks)*** Indicate the layer which must be incorporated when suturing a full thickness intestinal incision. ***(2 marks)***

4. Describe how you would assess viability of stomach and small intestine during an exploratory laparotomy. ***(9 marks)***

5. Discuss the pathophysiology of an untreated duodenal foreign body obstruction in the dog. Include in your answer:
   - The effects on the local intestinal wall ***(5 marks)***
   - The effects on the gastrointestinal tract in general ***(5 marks)***
   - The systemic effects on the patient ***(5 marks)***
   - How the timing of surgical intervention might alter the prognosis and complication rate for an affected dog ***(10 marks).***

Continued over page

6. Describe the ideal suture pattern and the desirable properties of a suture material for performing an end to end anastomosis in the small intestine. ***(8 marks)***

7. Describe the anatomy and list the functions of the omentum. Give examples of three (3) different surgical conditions in which you would consider utilising the omentum to make use of the functions you have described. ***(6 marks)***

8. Draw and label a diagram of the gross anatomy of the female canine reproductive tract. Include all major ligaments and organs. You do not need to label neurovascular structures. ***(10 marks)***

9. Answer all parts of this question:

a) Use a diagram to illustrate the anatomy of the liver lobes, gall bladder and important vasculature of the hepatobiliary tract. ***(5 marks)***

b) Use a diagram to illustrate the anatomy of the extrahepatic biliary system in the dog. ***(5 marks)***

c) Briefly describe the main anatomical difference of the biliary and pancreatic ductal anatomy between the cat and the dog. ***(3 marks)***

Figure 1: *Student written assessment.*

UMSX2019: Exploratory coeliotomy: Practical surgical anatomy and exploration

Student Oral Assessment – Marking Rubric

Student Name: _____ Date: _____

Group: _____

Time Allowed : **FIFTEEN (15) minutes**

Marks : **16 marks**

Topic: Describe your approach to exploration of the abdominal cavity following midline incision.

A 9-month old female spayed Labrador Retriever presents to your clinic with a 48-hour history of lethargy, inappetence, and vomiting. Physical examination identifies nausea upon abdominal palpation. You can palpate a round structure in the mid-cranial abdomen. Diarrhoea is evident on rectal palpation. Radiography is then performed and reveals an obstructive intestinal pattern. **[Show slide of radiograph]**

Given the clinical signs and radiographic evidence of a possible foreign body obstruction, you elect to perform exploratory abdominal surgery.

Question 1: Describe your approach to exploration of the abdominal cavity following midline incision. *(12 marks)*

ANSWER KEY (allocate one mark for each point mentioned)

1. *Inspect diaphragm for integrity and presence of metastatic disease*
2. *Inspect/Examine all liver lobes*
3. *Examine gall bladder and bile duct*
4. *Palpate gastroesophageal junction & stomach to the pylorus*
5. *Inspect and gently palpate the duodenum as it descends the right ventral abdominal cavity. Note the right limb of the pancreas, which is readily apparent next to the duodenum*
6. *Trace from the duodenum to the jejunum and the ileum. The ileum is marked by the presence of the antimesenteric vein and ends at the ileocolic junction where the cecum is located.*
7. *Follow the colon to its entrance to the pelvic cavity*
8. *Examine both kidneys by retracting the viscera to each side*
9. *Identify the adrenal glands adjacent to the kidneys*
10. *Examine and palpate the urinary bladder*
11. *If the animal is female and unsprayed the uterus and ovaries can be inspected*
12. *Inspect the prostate*

Question 2: During your exploration, you identify an intestinal foreign body in the jejunum. The intestine has adequate viability and does not required resection. Describe how to perform an enterotomy *(4 marks)*

ANSWER KEY (allocate one mark for each point mentioned)

1. *Isolate affected segment of bowel with moistened swabs and assess viability.*
2. *Make a full thickness incision downstream of the foreign body, remove foreign body, and suction intestinal contents.*
3. *Close the intestine utilising a medium-acting, non-absorbable suture material in a simple interrupted pattern incorporating the strength layer (submucosa).*
4. *Ensure there is no leakage through the suture line*

Figure 2: *Student oral assessment.*

Student Self-Assessment

Student Name:_____ Date: _____

Group: _____

Learning Objectives:

- Demonstrate sound knowledge of the anatomy of the digestive tract, including accessory organs

□ Very confident □ Confident □ Impartial □ Not confident □ Extremely unconfident

- Demonstrate sound knowledge of the anatomy of the hepatobiliary system

□ Very confident □ Confident □ Impartial □ Not confident □ Extremely unconfident

- Demonstrate sound knowledge of the anatomy of the urinary system

□ Very confident □ Confident □ Impartial □ Not confident □ Extremely unconfident

- Demonstrate sound knowledge of the anatomy of the haematopoiec system

□ Very confident □ Confident □ Impartial □ Not confident □ Extremely unconfident

- Identify key abdominal vasculature, including major veins and arteries

□ Very confident □ Confident □ Impartial □ Not confident □ Extremely unconfident

- Be able to appropriately perform an exploratory coeliotomy & enterotomy in an ordered fashion.

□ Very confident □ Confident □ impartial □ Not confident □ Extremely unconfident

- Demonstrate an understanding of basic abdominal surgical procedures, how they are performed and the indications for which they are performed

□ Very confident □ Confident □ Impartial □ Not confident □ Extremely unconfident

Are you currently interested in undertaking surgical specialisation following graduation? Why/Why not?

_____

_____

Figure 3: *Student self-assessment.*

Students in Group B were subjected to student-centered pedagogy which consisted of two 60-minute introductory self-directed tutorials and two 60-minute self-directed practical classes. Throughout these learning events, the sessions are guided by the teacher, however, students will be responsible for implementing collaborative learning by interacting with each other whilst having the ability to ask questions of the supervisor or seek advice. Each student is allocated a particular role within the group, with peer and self-assessment activities performed where students reflect and provide feedback on their own work and that of their peers. The first tutorial aims to address the anatomy of the abdomen and appropriate exploration whilst the second tutorial outlines gastrointestinal surgery and the indications. Anatomy-based videos were watched by the students prior to commencement of the practical component, with students at this stage required to individually label the anatomy of various abdominal systems. Students were then directed to the simulation centre where they were divided into small groups of 4 - 6, with each group given a synthetic canine model for use. Each group had 60-minutes to explore the anatomy of abdomen and practice performing an exploratory laparotomy. An additional 60-minutes was allocated to allow students to practice gastrointestinal surgery, including enterotomy, gastrotomy, resection and anastomosis, etc. Following completion of the practical sessions, students were immediately directed to an examination room where they were asked to participate in a written assessment and an oral assessment. These assessments were identical to those completed by Group A. The students were then similarly brought into the simulation centre individually and were given one attempt to perform a small intestinal enterotomy for foreign body retrieval. The same synthetic material and equipment were utilised by Group B. A standardised feedback questionnaire was filled out by all Group B students.

A marking rubric, provided by two specialists in small animal surgery, was used to guide the allocation of marks for both the written and oral assessments. The time allowed for the written examination was 90 minutes, with 84 marks allocated. The oral examination was to be completed in 15 minutes and was allocated 16 marks. The global rating scale of operative performance (GRS) (Figure 4) was used to compare the two groups in areas such as general knowledge, flow of procedure, general concept, level of ease, time and ease of motion, respect of tissues, overall operative performance. The student was assigned a mark out of 5 for each of the aforementioned categories by one examiner and ascribed a mark out of 60. The average results of all assessments were calculated and compared between groups.

Data was collected in Microsoft Excel, coded and exported into IBM SPSS Version 22 for analysis. Continuous variables were tested for normality using a Kolmogorov-Smirnov test and variables were compared using an independent samples t-test or Mann-Whitney U test as appropriate. Chi-squared (χ^2)/Fisher's exact tests were used to compare categorical variables. Statistical significance was assumed when $p < 0.05$ for all analyses.

Results

Study population

Seventy-eight students from the University Veterinary Teaching Hospital participated in the study. Group A consisted of 41 students, and Group B had 37 students. Females accounted for 64% of the study population, with males representing the remainder of the population. There was no significant difference in previous academic performance between both groups, and no significant difference between previous surgical experiences. The mean age of Group A was 28.3 years (range: 24 - 38) and mean age of Group B was 27.2 years (range 23 - 41).

Written assessment

All students completed all questions of the written assessment. Time to complete assessment was not measured for the written assessment piece. There was no significant difference between mean overall mark between groups, however a trend towards improved marks was apparent with Group B when compared to Group A. The mean mark of Group A was 68.6% (range: 42.3 - 92%), with Group B having a mean mark of 71.2% (range: 39.4 - 94.2%). Students in Group A achieved significantly higher marks for questions relating to pathophysiology ($p = 0.0111$), whereas Group B students achieved significantly higher marks for questions relating to anatomy ($p = 0.0173$).

Oral assessment

All students took part in the oral assessment. Group B students achieved statistically higher marks for this part of the examination

Respect for tissue				
1	2	3	4	5
Frequently used unnecessary force on tissue or caused damage by inappropriate use of instruments		Careful handling of tissue but occasionally caused inadvertent damage		Consistently handled tissue appropriately with minimal damage
Time and motion				
1	2	3	4	5
Many unnecessary moves		Efficient time/motion but some unnecessary moves		Clear economy of movement and maximum efficiency
Instrument handling				
1	2	3	4	5
Repeatedly makes tentative or awkward moves with instruments by inappropriate use of instruments		Competent use of instruments but occasionally appeared stiff or awkward		Fluid moves with instruments and no awkwardness
Knowledge of instruments				
1	2	3	4	5
Frequently asked for wrong instrument or used inappropriate instrument		Knew names of most instruments and used appropriate instrument		Obviously familiar with instruments and their names
Flow of operation				
1	2	3	4	5
Frequently stopped operating and seemed unsure of next move		Demonstrated some forward planning with reasonable progression of procedure		Obviously planned course of operation with effortless flow from one move to the next
Use of assistants				
1	2	3	4	5
Consistently placed assistants poorly or failed to use assistants		Appropriate use of assistants most of the time		Strategically used assistants to the best advantage at all times
Knowledge of specific procedures				
1	2	3	4	5
Deficient knowledge. Needed specific instruction at most steps		Knew all important steps of operation		Demonstrated familiarity with all aspects of operation

Figure 4: *Global rating scale of operative performance.*

compared to Group A students (p = 0.0015). Subjectively, the examiners believed Group B students to appear more confident in expressing their answers.

Practical assessment

All students from both groups completed the practical assessment. A significant difference was identified in overall operative performance, level of ease, and time and ease of motion (p = 0.0003). There was no significant difference in the students' general knowledge, flow of procedure, general concept, or respect of tissues. Generally, students in Group B performed better than those in Group A. The mean Group A score was 54% (range 23 - 74%) and Group B had a mean score of 67% (range 41 - 89%). Respect of tissues was the lowest scoring component of both groups, with general concept the highest scoring component of both groups.

Self-assessment

All students involved in the study completed a student self-assessment. Students in Group B were reportedly more confident in their ability to perform an exploratory coeliotomy in an ordered fashion, as well as performed an enterotomy. There was also a notable difference between Group A and Group B in confidence in correctly identifying abdominal anatomy, with Group B demonstrating more "very confident" results. Overall, 92% of students noted that they were now confident in at least one aspect of abdominal surgery and/or its associated anatomy. Additionally, 72% reported that they are more confident in performing enterotomy surgeries specifically.

Interestingly, students in Group A noted that they were less likely to pursue a surgical career following graduation than students in Group B, with a 13.1% difference between the two groups.

Discussion

Our study examined the Veterinary student experience in learning and performing technical skills when exposed to different types of pedagogy; teacher-centred (Group A) and student-centred (Group B). Assessment of students with subjective and objective measurement tools identified that, overall, students who received a more student-centred had a statistically significant better overall operative experience when performing an enterotomy, significantly higher oral examination scores, and a better overall understanding of anatomy. Interestingly, students exposed to a more student-centred, active-learning pedagogy were significantly more likely to pursue a surgical career following graduation than students who received a teaching-centred approach to learning.

The success of this study was evaluated in multiple facets, including subjective examiner assessment, student self-assessment, as well as objective assessments such as the Global Rating Scale of Operative Performance. The implementation of objectives measures is deemed by many to be essential for objective evaluation of student surgical competence, with the objective measures useful in directing early intervention for students with below-average performance [4]. Further, this tool allows stronger students to be encouraged to progress into a more independent surgical role or more complex surgical procedures. The Global Rating Scale of Operative Performance was deemed advantageous for use in this study as it permits a more comprehensive assessment of technical proficiency than that of subjective measures. Hadley and colleagues [4] note that one of the major challenges of clinical teaching of surgery is that ability to recognise how much a student should be allowed to undertake on their own based on their surgical proficiency, however improved efforts to implement standardised measures to better assess students' competence are ongoing and evolving within teaching hospitals. Accurate self-assessment is reported to be of vital importance in surgical training in order to enhance student proficiency. It allows for identification of strengths and weaknesses in both technical and nontechnical skills specific to each student [5] and allows for subsequent correction of such weaknesses. However, inaccurate self-assessment can be detrimental by increasing the risk of overconfidence when performing surgery, which has the potential to have a direct effect on patient morbidity [5]. Nayer and Colleagues [5] report that accurate self-assessment is essential to ensure appropriate self-reflection from students' experiences when performing surgery. The author believes that the addition of subjective measurements provides a more well-rounded recognition of the students' proficiency.

The use of the Global Rating Scale of Operative Performance has been used previously for measuring outcome measures of surgical competency [3]. The use of this tool in a study by Tarchala and Colleagues [3] was able to identify that students who received a pre-education, student-centred didactic learning opportunity prior to performing surgery achieved higher outcome measures that students who did not receive the same opportunity. Similarly, the results of this study have demonstrated that students exposed to student-centred learning performed better than those that didn't in both oral and practical examination. Despite this, Tarchala and Colleagues [3] note that these tools rely on the observations and judgments of an individual inevitably associated with subjectivity and bias, and do not provide any procedure-specific information on how the trainee should strive to improve.

The observation that hands on practice is required to improve technical skills is self-evident [3] however, the use of objective metrics to substantiate these claims is becoming increasingly more documented within surgical disciplines. Numerous studies have linked first-hand exposure with improved technical skills and enhanced perceptions of surgery, with Luhoway and colleagues [1] identifying that failure to provide students with opportunities to improve their technical skills as a major barrier to the development of such skills. Interestingly, despite such trends being well-recognised, a common finding is that new graduates are underprepared for clinical practice due to a decline in practical skills teaching. The challenge lies within trying to accommodate a program of teaching within the frame of the changes in medical education, and in order to overcome such obstacles, opportunities to apply and integrate knowledge offered to students in an active-learning, practical-oriented environment should be implemented. Preparatory experience, when supervised, has been shown to be highly effective in imparting skills, with research noting that implementation of pretraining curriculums is strongly suggestive of improved educational and technical outcomes. An accelerated acquisition of skill through increased student developmental

opportunities has also been demonstrated. The addition of an additional practical component in this study was thought to complement information obtained through lectures, with the hopes of improving student preparedness for the skills required following graduation.

Limitation of the Study

There are several limitations of this study. There was no validation of the surveys used or the assessment types other than the Global Rating Scale of Operative Performance. Future work toward incorporating more valid questionnaires is recommended. Further, a national set of objectives of technical skills training is not currently recognised. This would likely allow more specific standardisation of teaching and would allow for further study into barriers in skill development and how this may be improved. Interobserver bias may also have been apparent during the evaluation process despite structured assessment criteria. Bias may have been incidentally entered into the study based on student perception of surgery at the time of survey answering. Group B students who had the opportunity to practice their surgical skills prior to examination were subjectively at an advantage compared to Group A students, which may be the reason for the results seen. This was a single institution study of a single cohort of students. In future studies, multi-institutional analysis is recommended to increase the sample size and evaluate site-specific differences. The involvement of multiple centres would allow for a better understanding of the effect of these differences on students' technical skills. Although these results may support the implementation of an active-learning, student-centred approach to teaching, performance of additional cohorts was not performed. This would provide additional and complementary evidence to support the aforementioned claims. The proportion of students reported to have an interest in pursuing a surgical career is subjective at this point in time. There is variable experience within the cohort and variable comfort level in performing such techniques. The learning objectives provided should be entirely assessable and should be capable of differentiating learning between students, which was not the case within this study. The learning objectives provided should have been measurable or more specific. Additionally, the context of this study would have benefitted from being having a more specific focus. Multiple assessments with varying evaluation strategies, including both subjective and objective metrics, were utilised in this study, however, a single objective measure of a single cohort may have proven to be as effective in producing the desired information.

Conclusion

The purpose of this study was to quantify the effect of the implementation of a more student-centred learning environment on student skill proficiency and surgical knowledge when compared to a predominantly teacher-centred pedagogy. The results in this study identify that providing students with increased active-learning, student-centred experiences improved the understanding of surgical anatomy, surgical technique, as well as increases a students' overall confidence in surgical proficiencies. Dedicated skills sessions may be effective in complementing a students' clinical learning to improve technical experience and confidence. Future research is required to further the implementation and development of active learning, student-centred learning strategies in the hopes of improving student outcome measures and surgical interest. The information provided in this study is targeted at veterinary surgical educators and hopes to provide evidence that supports an essential shift in the current surgical paradigm of a teacher-centred pedagogy.

Disclosure

There is no financial or other conflict of interest of any author related to a company or product used in the report.

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