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INSTRUCTIONAL DESIGN AND ASSESSMENT

Online Debates to Enhance Critical Thinking in Pharmacotherapy

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Objectives. To assess the impact of teaching strategies on the complexity and structure of students' arguments and type of informal reasoning used in arguments.

Design. Students were given an introduction to argumentation followed by 2 formal debates, with feedback provided in between.

Assessment. Four debate groups were randomly selected for evaluation. In debate 1, all groups posted 1 argument, and all 4 arguments were rationalistic and ranked as high-level arguments. In debate 2, members of the 4 groups posted a total of 33 arguments, which were evaluated and received an overall median ranking lower than that for debate 1. All debates were categorized as rationalistic.

Conclusion. Students were able to formulate rationalistic arguments to therapeutic controversies; however, their level of argumentation decreased over the course of the study. Changes planned for the future include conducting the debates in the context of patient scenarios to increase practical applicability.

Keywords: debate, online, pharmacotherapy, critical thinking.

INTRODUCTION

Pharmacotherapy teaching at Curtin University has traditionally involved the lecture and tutorial format common to most units. Lectures are given on a variety of topics, ranging from nutrition to oncology by experts in their respective fields. The tutorials are intended to consolidate learning gained from the lectures by putting them in the context of patient cases. Few changes to this model of teaching pharmacotherapy have been made over the last 3 years; however, given administrative and logistical changes to the fourth-year (final) pharmacy calendar, the adoption of a blended-learning environment needed to be considered. Notably, the time fourth-year students spent on campus was reduced from 12 weeks to 6 weeks. The resulting decrease in face-to-face time led to reconsideration of how the pharmacotherapy course could be better delivered. To reduce the number of face-to-face tutorials in the 6 weeks of time spent on campus and offer students more flexibility in their schedule, an online component was implemented.

Faculty members believed that introduction of an assessment that focused on critical-thinking skills would be beneficial. In Australia, pharmacy students require the development and growth of a multitude of skills during the 4 years of training preceding their 1-year internship. These include skills in communication, evaluation, interpretation, and critical thinking.[1] These skills are part of accreditation standards in various jurisdictions, and, as such, require activities that foster and assess these skills.[1,2]

Clinical decision-making and problem-solving with regard to patient care are difficult skills for pharmacy students to master, as they involve critical-thinking skills. One of the issues with teaching and learning in pharmacy education is that they often promote rote learning.[3] Students often cite rote memorization as a preferred learning strategy as it has either previously brought them success, or requires less mental fortitude than would a strategy incorporating deeper learning, such as critical-thinking skills.[4]

Debate and argumentation have been proposed and evaluated as a method to develop these skills.[6-8] Informal reasoning, which is the thought process involved in working out contentious problems with no clear answers, is also part of the argumentation process. Bloom's taxonomy identifies critical thinking and reasoned argument as high-level thinking associated with evaluation skills.[5]

Debates allow students an opportunity not only to identify that there is a problem or issue to resolve but also to demonstrate a deeper analysis of the issue at hand. These expectations include identification of evidence, appraisal and critique of evidence, and reasoning of the issue for a potential solution. These skills are also necessary because healthcare professionals are continually inundated with

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new evidence, and the only way to separate the valid from the invalid is to appraise and critique the evidence.

Debates have been used in the education of healthcare professionals.[6,7] There are a few examples in the literature describing the use of debates in pharmacy curricula.[9-11] All of these examples have used debates in practice-related courses on the health system, legislation, and regulatory issues. One example included the use of debates in a pharmacokinetics course.[8] All of these studies are similar in that no specific validated measure was used to assess the student's level of debate or critical-thinking skills. Primarily ad hoc ratings by faculty members were used to assess level of debating skills.

Given the changes in the unit structure and calendar, along with an identified need to introduce assessments intended to encourage higher-level critical thinking, online debates of therapeutic controversies were considered potentially beneficial in addressing the problem. Additionally, an analytical framework for evaluating argument structure and complexity and type of informal reasoning would be used to investigate the impact of this teaching strategy.

The purpose of this research was to determine the effect of a teaching strategy that involved providing pharmacy students with information regarding the concept of argumentation, involving them in online debates, and providing feedback on their informal reasoning and ability to structure arguments. Objectives were to assess the impact of teaching strategies on the complexity and structure of students' arguments and type of informal reasoning used, and the usefulness of online debating and generating arguments as taught in the context of pharmacotherapy.

DESIGN

In this study, *informal reasoning* was the reasoning students engaged in to work out contentious problems that had no clear-cut solutions. *Argumentation* was the expression of informal reasoning.[13] *Debate* was the term used to describe the overall topic (ie, Is cranberry juice effective in reducing the risk of urinary tract infections in the elderly?). *Argument* was the term used to describe each discrete post submitted by a group of students to support their side of the debate. This research is an example of case study research using a before-after experimental design. This design allowed for the comparison of informal reasoning, complexity, and structure of argument generated before and after formative feedback was provided.

All students in a final-year pharmacotherapy (therapeutics) unit of a bachelor of pharmacy program were invited to participate. Ethics approval was granted from the Human Ethics Board, Curtin University. All students whose arguments were evaluated in results provided consent. During orientation to the unit, students were provided with a brief introduction to argumentation and given a scenario of its potential usefulness in practice. Students were then asked to break into groups of 3 to 5 students, resulting in 32 groups being formed. Each group was assigned a number and a random number generator was used to select 4 groups (representing 18 students) for analysis.

Two debates were scheduled during the students' 6-week term. The first debate was to be for formative feedback only. Students were to engage in an online debate, with participation ending on a specified date (2.5 weeks after the topics were posted). Topics included pharmacotherapy-related items from their previously completed pharmacotherapy units. Faculty members then provided feedback related to the structure of students' arguments and use of Toulmin's argumentation pattern (Figure 1), as presented during orientation.[14] After this feedback was given, students were assigned debate 2. The second debates were based on topics from the current pharmacotherapy unit and were graded as part of their final assessment. Examples of topics included, "Do folic acid supplements cause cancer?" and "Is there a benefit of aspirin in the treatment of infertility?" Students again had 2.5 weeks to participate in this debate. Each group was sequentially assigned a topic and a side of the debate to argue for or against. Debates were conducted online at www.createdebate.com. This site had a private feature that allowed debates to be seen only by the students enrolled in the unit. A domain specific to the unit was created and students were provided with information to create a group-specific logon. The site was set up with a separate Web page for each debate, with the 2 sides of the debate (for and against) labeled. The course coordinator checked the posts weekly to ensure that groups were actually engaging in the debates and that any posted arguments were confined to the topics provided.

EVALUATION AND ASSESSMENT

This study used analytic frameworks for both informal reasoning and argument structure and complexity that were used in previous studies.[12,13] Two independent reviewers participated in the analysis. Both were pharmacist academics who had previously participated in this kind of analysis, and 1 was completing graduate work in the area of argumentation. The reviewers blind-coded all arguments and the agreement rate was calculated. Any resulting disagreement in category was resolved by discussion and consensus.

The reviewers initially coded each argument (each post was assumed to be a distinct argument) for informal reasoning using a method of categorization previously described (Table 1).[13] In this categorization, arguments

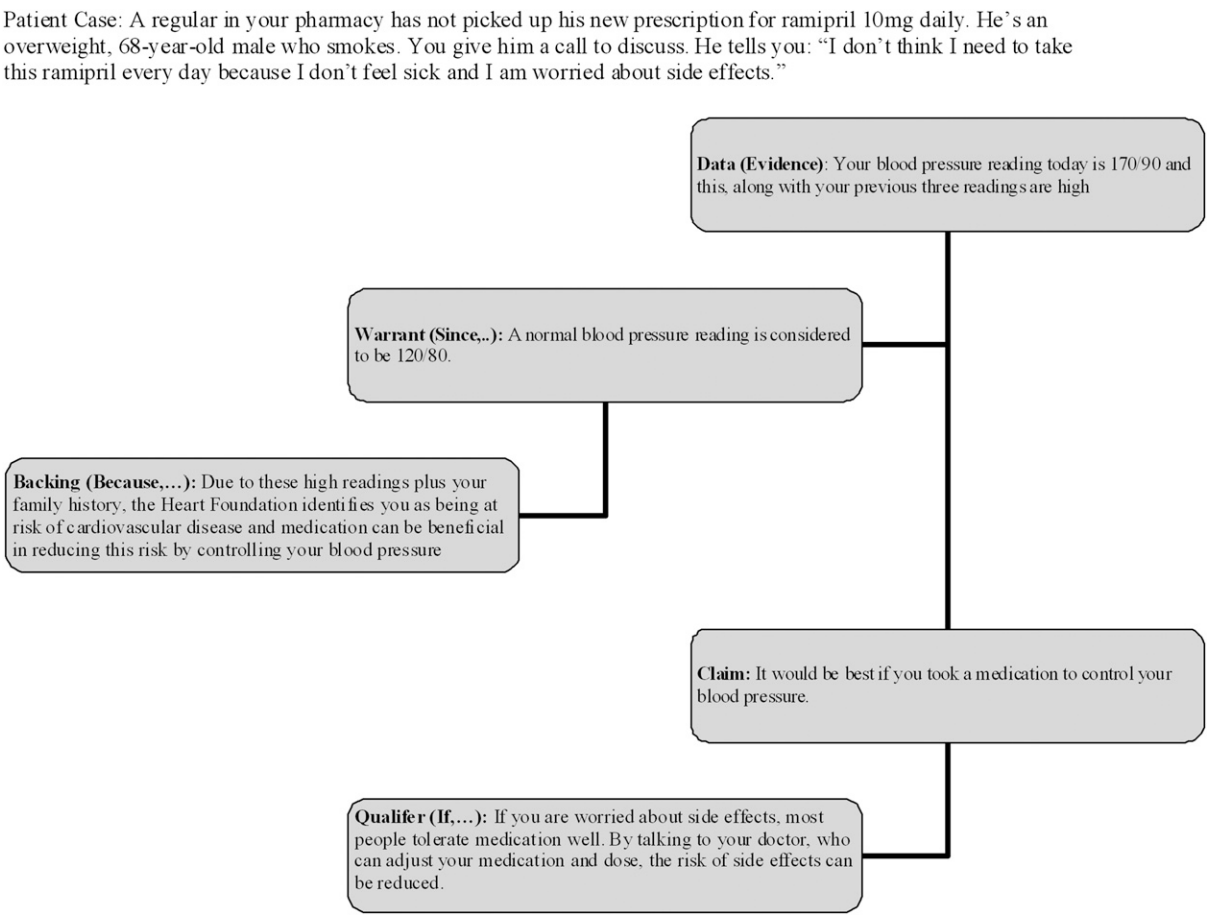

Figure 1. Example of adaptation of Toulmin's Argument Diagram[14]

were classified as using rationalistic (category 3), emotive (category 2), intuitive (category 1), or a combination of reasoning types. Each argument was then assessed for level of argumentation, based on a previously established method (Table 2).[12] This classification scheme is based on an argumentation pattern in which each argument is classified on the basis on whether it includes each of the parts of an argument (ie, claim, data, warrants, backings, qualifiers) (Figure 1). Using this method, arguments were classified according to their complexity from level 1-4, with level 1 arguments consisting of only a claim; level 2 consisting of a claim, data, and/or warrants; level 3 consisting of a claim, data and/or warrant, and backing or a qualifier; and level 4 consisting of a claim, data/warrants, backing, and a qualifier. Level-4 arguments were considered the most complex arguments. While this method allowed for the evaluation of argument structure and complexity, it did not assess whether the argument was correct or flawed. This aspect of the evaluation was conducted separately during the grading of the activity (not presented here).

Descriptive statistics were used to analyze the data, along with a calculation of kappa with linear weighting to determine level of agreement among reviewers. Students

Table 1. Categories of Informal Reasoning in a Study of Online Debates to Improve Critical Thinking Skills in Pharmacology

Category	Description	Example
Rationalistic	Logical; scientific reasoning	Antihypertensives lower blood pressure and, therefore, are essential in the management of hypertension.
Emotive	Empathic, sympathetic; focused on human elements	If an antihypertensive made someone feel unwell, I would understand if they didn't want to take it
Intuitive	Gut feeling; immediate response	People should take their antihypertensives because their doctor prescribed them.

Table 2. Ranking of Arguments Based on Components of an Established Argument Diagram[14]

Level of Argument	Description
1	Claim, conclusion, proposition or assertion
2	Claim, data (the evidence that supports the claim), and/or warrant (an explanation of the relationship between claim and data)
3	Claim, data/warrant, backing (basic assumptions to support the warrant) or qualifier (conditions under which claim is true)
4	Claim, data/warrant, backing, and qualifier

were provided with the criteria on which the debates would be graded as a group. Online presence and engagement in the debate accounted for 30% of the grade; whether evidence was provided and the student's evaluation of that evidence, 30%; and strength of argument and whether the argument conformed to correct argument structure, 30%. The final report (10%) was graded individually and the students were asked to consider the following points: (1) Did the debates reinforce material you learned in the lectures and tutorials? (2) What challenges did the debate assignment pose to you? (3) Can you see the usefulness of this skill in practice? (4) Why or why not? Student responses in this final report provided evidence of student perceptions of the usefulness of the teaching strategy and whether any issues were associated with the activity. Responses were reviewed and themes identified.

Debates from 4 randomly selected groups were analyzed. As groups were allowed to post as many arguments as they wanted during a set time period (2.5 weeks/debate), each group had a different number of arguments that were analyzed over the study period. When categorizing informal reasoning, reviewers had 100% agreement. For measure of concordance when assessing level of argument, the calculated kappa was 0.63.

In debate 1, all 4 groups posted 1 argument that was capable of being analyzed. All arguments were rationalistic and ranked at a level 3 (100% of posts). For debate 2, 33 arguments were evaluated on level of argumentation and informal reasoning. The median number of debate posts per group was 7.5 (range, 4-14). As with debate 1, informal reasoning was categorized as rationalistic in 100% of debates. Table 3 shows the average level of ranking for arguments by each group.

Overall, students were proficient at providing data for each claim they made; 94% of arguments in debate 2 were level 2 or higher. Students provided significant amounts of evidence in each argument; in several arguments, 5 references were provided as evidence. Regarding level 3 arguments, 75% of arguments in debate 1 were categorized as level 3 based on having a qualifier. In debate 2, 50% of level 3 arguments had qualifiers and 50% had backing.

Table 3. Post-Feedback Ranking of Arguments in a Study of Online Debates to Improve Critical Thinking in Pharmacology

Debate Group	Arguments Posted, No.	Ranking of Arguments, Median (Range)
1	8	2.5 (2-3)
2	4	2.5 (2-3)
3	14	2 (1-3)
4	7	2 (2-3)

The main themes of student reflections and comments were related to workload, applicability, and feedback. Students generally felt that the workload for this assessment was too much, considering that it accounted for only 15% of their final grade. They spent a great deal of time meeting with their group members and searching for data to support their side of the debate. Even though the debate was presented to the students as an opportunity to reduce their on-campus time, they still felt the need to meet with their other group members in person, therefore diminishing the flexible learning environment the task was meant to provide.

For applicability of the skills being taught and fostered through this assignment, the students had a hard time processing that these skills were applicable in "real life." They were provided with an example in the introduction to the unit (similar to the example in Figure 1) to give the task some context; however, students were not able to link this to the applicability of the skills. In the feedback session between debate 1 and 2, how the skills applied to succeeding in the final examination seemed to resonate with some of the students; however, the practical nature of the task was still not apparent to them. The students also felt that the feedback provided was too generic and not directed enough. The students overwhelmingly wanted specific feedback for their group rather than the class as a whole.

DISCUSSION

With this debate assignment, students were presented with an entirely different type of assessment compared with previous assessments conducted within their pharmacotherapy units. The activity required them to engage in a variety of experiences, including group work, online learning, researching, writing, evaluating, analyzing, and communicating.

It took several days before any arguments from debate 1 were posted, and then, as evidenced in the results, few arguments were posted at all. Some groups posted no

arguments and thus were not included in the analysis. However, the arguments that were posted were of high quality, ie, all level 3. None of the debates involved any type of rebuttal, given that only 1 argument per team was posted. Therefore, there was no interaction between the groups. Also, none of the arguments posted in debate 1 used the structure provided to them in the orientation (Figure 2).

For debate 2, students seemed to focus on posting as many arguments as possible, which could explain why the level of argument was slightly lower in debate 2. The number of arguments increased significantly from debate 1 (1 argument per group in debate 1 vs 7.5 median arguments per group in debate 2). The other major difference was that students engaged in rebuttals, so that there was interaction between the 2 groups, including addressing and responding to arguments. In debate 2, students were also more consistent with labeling their arguments (ie, claim, data, backing, qualifiers) as recommended during the feedback they received between debate 1 and 2. However, as arguments were reviewed, students' labels were found to be inconsistent with those of reviewers. For example, students often erroneously labeled data provided from research as a qualifier or backing.

Regarding the impact of the teaching strategy on the students' structure and complexity of arguments and informal reasoning, the strategy revealed that the students engaged in rationalistic reasoning, demonstrating logic and scientific understanding and language, the type of reasoning expected to be used in clinical decision-making in professional practice. The study also revealed students could articulate arguments that provided evidence to support a claim, although the more arguments students generated, the less complex the arguments were.

Student perceptions revealed that the teaching strategy could be improved by providing more specific feedback to each group regarding their performance in debate 1 and basing debates more on patient-focused scenarios, thereby improving student awareness of the connection between their arguments and clinical decision-making.

This teaching strategy represents a new and innovative way to encourage critical thinking within pharmacotherapy, building on previous work using debates in pharmacy curricula by formalizing the analysis of debate structure and level of reasoning. The assessment can be used to further students' knowledge within a specific subject area while developing useful skills for future practitioners. This study has several limitations. The decision to analyze arguments produced by only 4 of the 32 groups in the 2 debates introduces potential sampling error. Although the random selection of 4 groups limits the findings of this study, it was considered a reasonable selection of arguments that could be analyzed in a convenient timeframe. Analysis of all groups would have required evaluating over 250 arguments. In addition, only 2 reviewers were involved in the analysis of results, which increased the risk of introducing bias into the findings. The analysis of argument structure and complexity and informal reasoning based on previous work[12] was chosen to provide a better insight into the level of argument and type of reasoning used by pharmacy students, but it did not take into consideration the correctness of the students' argument. Quality was taken into consideration during the grading of the assessment and was separate from this study.

CONCLUSION

Pharmacy students need to undertake assessments to improve clinical decision-making, and debating has been proposed as a method for development of these skills. The introduction provided to students on argumentation led the students to have a high level of argument in the first debate; however, feedback provided little additional improvement in their level of argumentation. Students' level of informal reasoning (rationalistic) was appropriate to the type of debates given, but they had a hard time trying to associate the debates with real-life scenarios and felt that there was little contextual application to the skills. This finding will encourage teaching staff members to change the style of debate to scenarios that are more focused on patient cases to improve students' understanding of the practical applicability. Future research will directly measure critical thinking to determine if critical thinking skills improve with participation in the debates.

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