Understanding Student Experiences of Blended Learning Clinical Education

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Abstract

Clinical reasoning in professional students can be successfully achieved by an active engagement of students in the learning process and can be maximized in early stages of the curriculum through blended or flipped approaches to instruction. Yet, there can be several challenges to implementing a successful blended classroom. This study utilized a mixed methods, Sequential Explanatory Design to identify potential student barriers to success when a blended course design is used to teach clinical reasoning in a Veterinary Radiology course. Results suggest that student approaches to learning, student study habits, and the synchronization of course activities with other non-blended courses are critical considerations that must be addressed to foster positive clinical reasoning outcomes. Findings also demonstrated a need for re-examining how students can be better prepared for courses that address higher-order thinking and clinical problem solving when blended learning is incorporated into the course design.

Keywords: Medical Education; Educational Technology; Blended Learning; Flipped Classroom; Clinical Reasoning; Problem Solving; Instructional Design; Health Sciences.

Introduction

One of the primary challenges to professional education in the Health Sciences is how to best develop clinical reasoning skills and problem solving competence in students that have little experience in a health care environment. This challenge becomes more intensified when juxtaposed with the increasing need for medical practitioners that can successfully perform critical thinking in regards to negotiating, assessing, and synthesizing various streams of information in the formulation of diagnoses and courses of treatment (Plack & Santasier, 2010; Hazel, Heberle, McEwen, & Adams, 2013). To produce graduates that can effectively assimilate into this high demand environment, educators at many institutions are looking for solutions that result in a curriculum that provides extensive opportunities for students to engage in the acquisition and distributed practice of clinical problem solving skills. However, this can often seem like an insurmountable task when faced with robust content requirements, time restrictions, burdensome student academic loads, and limited opportunities to engage actual patients or clients in a clinical setting.

Often, in health professions education, the bulk of clinical learning experiences are programmed into the later stages of the curriculum. The guiding principle for this type of sequence is that a student must first acquire and comprehend prerequisite content knowledge before they are ready to face the types of problems they will encounter in a clinic. In this model, students are first accelerated through basic sciences in a standard didactic fashion. The students are expected to memorize and take tests that often evaluate levels of memorization and comprehension of concepts. This promotes educational interactions that favor a one-way communication of information approach, with instructor-cantered strategies.
such as lecture, tutorials, large-group discussions, demonstrations, and standardized tests serving as the primary methods of instruction and assessment.

While a didactic approach to education in the health sciences may have many logistical and administrative advantages for institutions, it is becoming less and less sufficient for the preparation of future practitioners who will need to integrate a fast-growing body of information and knowledge with an expanding need for sophisticated decision making, and situate their clinical practice within an increasingly complex healthcare environment. Further, in addition to the change in desired student competencies upon exiting training programs, there has also been a change in the characteristics of students entering clinical health sciences education. Millennial and Gen Z students have already arrived on the campuses of institutions that prepare future health professionals, and with them a new set of learning preferences. These new students tend toward experiential learning, collaboration, using technology to access information, and a strong goal orientation (Oblinger, 2003). To address these challenges, many programs are now utilizing blended learning approaches.

Blended learning facilitates many practices that can effectively address the need to graduate expert clinical problem solvers and still accommodate the huge content requirements of a curriculum while leveraging the learning preferences of a new generation of students. Blended learning can also help create instructional opportunities for higher levels of critical thinking, reinforcing basic data acquisition, and assimilating that information in a clinically relevant fashion.

Literature Review

The characteristics of blended learning align well with developing clinical reasoning skills and sophisticated problem solving expertise in future practitioners. The strategic use of technology to deliver content online that addresses lower level learning objectives focused upon basic knowledge acquisition, comprehension of central concepts, and the application of rudimentary techniques creates more space in the face-to-face classroom to employ teaching methodologies that are better aligned with learning objectives focused upon analyzing information and phenomena, evaluating and interpreting situational possibilities, and synthesizing solutions to complex and ill-defined problems. The teaching methodologies that are required to facilitate student mastery of higher level objectives are best done in a face-to-face, interactive setting, where the instructor can authentically model problem solving thought processes, create problem scenarios where students collaborate in the presence of the instructor, provide real-time feedback to student problem solving attempts, and can spontaneously provide remedial instruction to alleviate obvious discrepancies in the comprehension of prerequisite concepts (Laster, Otte, Picciano, & Sorg, 2005).

At the core of clinical reasoning skill is the ability to solve problems in a specific health sciences domain of knowledge. A reliable predictor of success in solving problems is the student’s level of specific domain knowledge and how well it is organized (Jonassen, Beissner, & Yacci, 1993). To successfully solve problems in the manner of an expert clinician, students must be able to access a high level of domain knowledge and utilize it to comprehend the nature of the problem and then synthesize an effective solution. When approaching an ill-defined problem, it is more advantageous to have an extensive level of domain knowledge that can be utilized than it is to have an increase in mental capability (Ericsson, Chase, & Faloon, 1980). Yet, before it can support problem solving, this knowledge must be active and integrated in such a way that it can be considered structured, with students being able to discern the interrelatedness of information. Traditional, primarily didactic, approaches to teaching are limited in their ability to foster expert problem solving, since the domain knowledge produced in these approaches typically remains inert and less available for effective access (Bereiter & Scardamalia, 1985; Brown, 1985). In traditional curricula, it isn’t until the later stages of educational programming, specifically clerkships, that students encounter multitudes of clinical problems that facilitate an active structure of their domain knowledge.

One advantage of incorporating blended learning into a health sciences curriculum is that it allows for juxtaposing the acquisition of information with the simultaneous engagement of meaningful problems in a mentored, instructor-guided environment that produces interactions that resemble an apprentice/expert exchange. When these types of learning activities are synchronized, students experience the practicality of domain knowledge to problem sets, which helps them to construct cognitive schemata that improve access. Research findings from studies that examined this type of synchronization of learning suggest that problem solving competence is best developed simultaneously with the acquisition of domain knowledge (Anderson, 1984; Mayer, 1983).

A cognitive skill that experts employ when solving problems is their sophisticated ability to recognize external problem states and use mental representations to manipulate the internal problem space. When expert problem solvers encounter a problem, they are more likely to recognize the problem state, which reduces the amount of searching through their mental problem space, thus freeing up cognitive resources for synthesizing solutions. This ability is best acquired through meaningful problem solving activity where there is reciprocal feedback between meaningful action and domain knowledge (Jonassen, 2000). Thus, meaningful problem solving activities in the classroom where the instructor can reinforce meaning-making, is more likely to produce problem solvers with advanced schemas that are employed automatically (Sweller, 1988).
When cognitive schemas are accessed during problem solving activity, it does not promote the ability to think further ahead in the decision tree of the problem, but instead it promotes qualitatively superior decisions. This is because expert problem solvers have a greater capacity to recognize patterns and remember them because they can associate them with meaningful situations (Chase & Simon, 1973). In addition to facilitating a more active domain knowledge for problem solving, blended learning creates more opportunities for meaningful experiences as students work together to solve real problems. Yet, with all the known advantages of blended learning, there are challenges that greatly impact success. Students must adjust to a pedagogy that may be unfamiliar or uncomfortable to them. Additionally, students must adopt new approaches to learning that may conflict with the strategies they employ for concurrent didactic courses. Understanding how students navigate these issues is critical for implementing blended learning in any health curriculum.

In this article we will investigate the use of blended learning in a clinical course, particularly as a learning format that strategically integrates the use of technology and face-to-face instruction to maximize learning and create opportunities for more collaborative, guided, problem solving activity in the classroom. The purpose of this study was to explore student learning behaviors, student perceptions, and insights gained from students experiencing blended learning in a veterinary radiology course.

Methodology

The veterinary radiology curriculum at the University of Florida is spread out over the four years and includes 3 core courses and 4 elective courses. The first year course presents the principles of interpretation, a review of radiographic anatomy, and an interpretation paradigm for the evaluation of small animal musculoskeletal cases. The sophomore course emphasizes the difference between normal and abnormal as it relates to the abdomen and thorax. This course essentially reviews radiographic anatomy, normal breed variations and an interpretation paradigm to approach thoracic and abdominal radiographic abnormalities. The core of this course is the interpretation of images, not a reflux of memorized data. The student is expected to apply the learned abnormalities to a number of radiographic cases that are presented as unknowns throughout the course. The emphasis then is recognizing abnormal and why the particular area or structure should be considered to be abnormal. Secondarily, the students learn ways to summarize the interpreted findings so that differential lists could be obtained based on the recognized abnormality. The clerkship course emphasizes final outcomes and next steps so that each of the three core courses build on each other through the progression of the student’s education.

For this study, the sophomore course (class size of 113 students) was taught as a blended or hybrid class where the students listened to lectures online and reviewed laboratory cases (n=4) prior to coming to the first laboratory related to the subject. The students were then tested as individuals and then also in teams during the face-to-face class session. The collective team (n=3 students) then evaluated two new cases and had time to review the original four cases while being able to interact with the course instructor. Additionally, an hour of review was provided during the face-to-face session each week of the course for review of additional cases and clarification of concepts as needed based on email feedback to the instructor. A mid-term written and a final oral and written examination served as methods for testing the mastery of the clinical skill set for radiographic interpretation. All test questions were related to cases presented in a clinical fashion and specifically to interpretation paradigms taught in the online portion of the course and reiterated during the face-to-face laboratory sessions.

All procedures used for the course were reviewed by the University of Florida’s Institutional Review Board for use of human subjects and found to be exempt. For participating in the study (tracked based on a student identification number), the students received 10% of possible exam points as a bonus to the final written examination.

Student perceptual data were collected through two online surveys (Pre/Post) with questions related to the process of a blended classroom and student perceptions toward this method of teaching. The first survey was administered at the beginning of the course to measure pre-conceived perceptions of blended learning and the course before students engaged the new format. The second survey was administered at the end of the course to measure how those perceptions changed after completing the course. The questions in each survey were identical, except that the wording changed from future tense on the first survey to past tense on the second survey. Both surveys were composed of Likert-type items that included measures of affect, measures of self-efficacy, measures of course satisfaction, and measures of perceived learning levels with components of the course such as technologies and methods used. Measures of affect were adapted from the Positive and Negative Affect Schedule (PANAS) developed by Watson, Clark, and Tellegen (1988). Measures of self-efficacy were adapted from the Control, Agency, and Means-end Interview (CAMI) developed by Little, Oettingen, and Baltes (1995). Additional open-ended questions were also included in the survey to identify unique student perceptions. All results were tabulated and analyzed with SPSS for Windows version 19, and evaluated for differences in perceptions related to the blended style of teaching.

Since the overall methodology was a sequential explanatory design, in addition to analyzing quantitative survey data, at the end of the course a focus group consisting of 15 students was conducted to record subjective responses related to any changed perceptions identified through the survey data. The focus group was conducted in a semi-structured fashion,
with an initial interview guide, yet when new phenomena surfaced and were recognized by the facilitator as relevant for understanding student experiences, probing questions were introduced to elicit student responses that would help the researchers better understand the effects. The focus group lasted for one hour, with an audio recording device. The audio file was transcribed without personal identifiers, and analyzed using open coding to identify themes and patterns

Results

Pre- and post-course surveys were completed by 106 of 113 students in a Small Animal Diagnostics Radiology course. Of those students, 50 indicated on the pre-course survey that they had never taken a blended format course prior to beginning the semester. Interestingly, 67 students indicated that they had never taken a blended format course on the post-course survey. This is likely due to the students’ having a better understanding of the characteristics of blended learning after completing this particular course. Since the researchers did not collect demographic information on the surveys, there was no attempt to connect student responses to any other student attributes. For Measures of Affect, Self-efficacy, and general perceptions about learning, ordinal data is presented as mean ± standard deviation (SD).

To compare pre- and post-course survey ordinal data, the researchers used a paired Wilcoxon signed rank test, with a p value of <.05 being considered statistically significant. Changes in students’ perceptions regarding Measures of Effect (Table 1) revealed significant increases for the following items: upset (P < .05); irritable (P < .05); and strong (P < .001). A significant decrease was also observed for the following items: inspired (P < .05); and enthusiastic (P < .05). Overall, most of the means for items related to adverse perceptions about the course (afraid, upset, irritable, and nervous) increased, with the item (distressed) decreasing slightly. Items related to favorable perceptions about the course were mixed, with the items (excited, enthusiastic, proud, inspired, determined, and interested) decreasing; and the items (strong, alert, attentive, and active) increasing.

Table 1: Differences in Pre-course and Post-course Measures of Affect (N = 106)

<table>
<thead>
<tr>
<th>When it comes to this course, I expect to be/When it came to this course I was.</th>
<th>Pre-course Mean ± SD</th>
<th>Post-course Mean ± SD</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afraid</td>
<td>2.59 ± 1.34</td>
<td>2.72 ± 1.34</td>
<td>0.22</td>
</tr>
<tr>
<td>Distressed</td>
<td>3.34 ± 1.10</td>
<td>3.00 ± 1.10</td>
<td>0.77</td>
</tr>
<tr>
<td>Excited</td>
<td>3.10 ± 0.94</td>
<td>2.91 ± 0.94</td>
<td>0.10</td>
</tr>
<tr>
<td>Upset</td>
<td>2.30 ± 1.10</td>
<td>2.60 ± 1.24</td>
<td>0.01</td>
</tr>
<tr>
<td>Strong</td>
<td>2.61 ± 1.08</td>
<td>3.94 ± 0.77</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Enthusiastic</td>
<td>3.27 ± 0.93</td>
<td>3.08 ± 0.94</td>
<td>0.04</td>
</tr>
<tr>
<td>Proud</td>
<td>2.62 ± 1.17</td>
<td>2.48 ± 1.13</td>
<td>0.26</td>
</tr>
<tr>
<td>Irritable</td>
<td>2.51 ± 1.14</td>
<td>2.85 ± 1.25</td>
<td>0.01</td>
</tr>
<tr>
<td>Alert</td>
<td>3.51 ± 0.93</td>
<td>3.65 ± 0.97</td>
<td>0.24</td>
</tr>
<tr>
<td>Inspired</td>
<td>3.01 ± 1.03</td>
<td>2.79 ± 1.06</td>
<td>0.03</td>
</tr>
<tr>
<td>Nervous</td>
<td>3.33 ± 1.18</td>
<td>3.51 ± 1.25</td>
<td>0.11</td>
</tr>
<tr>
<td>Determined</td>
<td>3.77 ± 0.95</td>
<td>3.76 ± 0.97</td>
<td>0.76</td>
</tr>
<tr>
<td>Attentive</td>
<td>3.94 ± 0.79</td>
<td>3.98 ± 0.87</td>
<td>0.69</td>
</tr>
<tr>
<td>Active</td>
<td>3.66 ± 0.93</td>
<td>3.74 ± 0.96</td>
<td>0.49</td>
</tr>
<tr>
<td>Interested</td>
<td>4.00 ± 0.78</td>
<td>3.94 ± 0.77</td>
<td>0.37</td>
</tr>
</tbody>
</table>

Data based on 106 pre- and post-course survey responses. SD indicates standard deviation. Likert scale items measured on a five-point scale: 1 = not at all; 2 = a little; 3 = moderately; 4 = quite a bit; 5 = very much.

Changes in students’ perceptions regarding Self Efficacy (Table 2) revealed a significant increase for the following item: “I will not have/did not have the ability to do well” (P < .05). A significant decrease was also observed for the following
items: “I will be/was able to put in the necessary effort” (P < .05); “I will encounter/encountered problems and unlucky events” (P < .05); “I will be/was able to achieve good grades when I want” (P < .001); and “I will be/was able to avoid making mistakes and losing points when I want” (P < .01).

<table>
<thead>
<tr>
<th>When it comes/came to performing well in this class…</th>
<th>Pre-course Mean ± SD</th>
<th>Post-course Mean ± SD</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>I will be/was able to put in the necessary effort.</td>
<td>4.18 ± 0.75</td>
<td>4.02 ± 0.94</td>
<td>0.04</td>
</tr>
<tr>
<td>I will not be/was not able to make myself work hard enough.</td>
<td>2.20 ± 1.12</td>
<td>2.37 ± 1.24</td>
<td>0.26</td>
</tr>
<tr>
<td>I will have/had the necessary “smarts”.</td>
<td>3.43 ± 1.04</td>
<td>3.24 ± 1.14</td>
<td>0.10</td>
</tr>
<tr>
<td>I will not have/did not have the ability to do well.</td>
<td>2.17 ± 0.97</td>
<td>2.45 ± 1.20</td>
<td>0.01</td>
</tr>
<tr>
<td>I will have/had lots of luck.</td>
<td>2.26 ± 0.93</td>
<td>2.32 ± 1.08</td>
<td>0.55</td>
</tr>
<tr>
<td>I will encounter/encountered problems and unlucky events.</td>
<td>3.06 ± 0.99</td>
<td>2.76 ± 1.11</td>
<td>0.02</td>
</tr>
<tr>
<td>I will be/was able to get help I need from instructors or TA’s.</td>
<td>3.75 ± 1.02</td>
<td>3.71 ± 1.05</td>
<td>0.78</td>
</tr>
<tr>
<td>I will be/was able to achieve good grades when I want.</td>
<td>3.08 ± 1.09</td>
<td>2.64 ± 1.11</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>I will be/was able to avoid making mistakes and losing points when I want.</td>
<td>2.60 ± 1.08</td>
<td>2.28 ± 1.05</td>
<td>&lt;.01</td>
</tr>
</tbody>
</table>

Data based on 106 pre- and post-course survey responses. SD indicates standard deviation. Likert scale items measured on a five-point scale: 1 = hardly ever; 3 = sometimes; 5 = almost always.

Changes in students’ perceptions regarding general learning (Table 3) revealed a significant difference for the following items: “I will be/was more likely to ask questions in a blended course” (P < .05); and “There will be/were more opportunities to collaborate with others in a blended course” (P < .01).
### Table 3: Differences in Pre-course and Post-course General Perceptions

<table>
<thead>
<tr>
<th>Survey Question</th>
<th>Pre-course Mean ± SD</th>
<th>Post-course Mean ± SD</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>I will be/was more likely to ask questions in a blended course.</td>
<td>2.78 ± 1.04</td>
<td>2.56 ± 1.04</td>
<td>0.03</td>
</tr>
<tr>
<td>There will be/were more opportunities to collaborate with others in a blended course.</td>
<td>2.46 ± 1.05</td>
<td>2.11 ± 1.08</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>My blended course experience will increase/increased my opportunity to access and use information.</td>
<td>2.57 ± 1.02</td>
<td>2.53 ± 1.14</td>
<td>0.65</td>
</tr>
<tr>
<td>I will have/had more opportunities to reflect on what I have learned in this blended course.</td>
<td>2.60 ± 0.99</td>
<td>2.54 ± 1.13</td>
<td>0.45</td>
</tr>
<tr>
<td>Blended learning will help/helped me better understand course material.</td>
<td>2.79 ± 1.14</td>
<td>2.69 ± 1.21</td>
<td>0.31</td>
</tr>
<tr>
<td>Generally, I will be/was more engaged in my blended course.</td>
<td>2.58 ± 1.16</td>
<td>2.42 ± 1.17</td>
<td>0.17</td>
</tr>
</tbody>
</table>

Data based on 106 pre- and post-course survey responses. SD indicates standard deviation. Likert scale items measured on a five-point scale: 1 = strongly agree; 2 = agree; 3 = neutral; 4 = disagree; 5 = strongly disagree.

The qualitative coding of transcripts collected during the focus group revealed several themes that related to the delivery of this blended course and provided some clarification of the results of quantitative data.

**Value**

The following comments indicate that students valued the blended format for its ability to promote learning as well as its ability to accommodate their unique student characteristics:

I like the blended, I think it is an improvement. (S2)

I preferred lectures online so I can fit it into my schedule. (S7)

I am not an auditory learner. I miss 75% of what is going on in class. At home I can pause lectures. (S8)

**Study Habits Inefficiency.**

One of the unanticipated themes that surfaced in the focus group data was the tension created between the study habits of students and the increased interactivity of blended learning. Students identified several sources of stress that were a result of their being accustomed to traditional courses where the instructors transmitted through lecture the most relevant information in class and assigned homework as a supplemental activity. Additionally, students identified their need for having points attached to learning activities, thus providing an extrinsic motivator for them to expend effort. For example, several students commented,

I did poorly on quizzes because I didn’t yet have an explanation. (S1)

I am not the best at doing all my homework. (S6)

Students will study harder when there are points involved. (S7)

I think it is better to have something that forces students to come to a discussion hour. (S5)

Along these same lines, students identified a preference for learning that is teacher centered and rewards the ability to memorize information and processes:

We waited to hear what he [the instructor] had to say. We waited until he told us the answer before we committed it to our minds. (S6)

I would like to have the teacher available for a question while going through the lecture. (S1)
A day before the exam go through case after case. (S5)

Assessment Frustration

One of the biggest sources of stress identified by students was the format of the examinations, which employed a linear, one-way progression through cases to assess the student’s ability to problem solve in a forward-thinking manner, utilizing interpretation paradigms and evidence from radiographic images. When taking the examinations, students were not allowed to navigate backward to change their answers on previous questions. This effectively limited a student’s ability to lean upon common test-taking strategies, where they might find clues to previous examination questions in the text of subsequent questions. These common test-taking strategies rely heavily upon the ability to memorize information through associations to related information. Even though students were advised of the linear format of the examinations at the beginning of the course, they still expressed their frustration and angst:

I feel the linear exam penalized you for changing your mind. (S6)
I should be rewarded for seeing my error, for seeing something later in the exam. (S1)
Yes, sometimes the other questions help you see things you didn’t see before. (S5)
Once I submitted my answer it is done. I can’t go back and flip flop. (S8)

Additionally, students advocated for some form of point-awarding mechanism for the restriction upon their ability to utilize efficient memorization aptitudes and test-taking skills.
If given a linear exam, where you can’t go back, then you should get some partial credit. (S5)
I put forth the effort, so I should be rewarded for my effort on the exam. (S6)

Student Self-Awareness

Students’ comments also revealed that the course served as a catalyst for them to think in a more metacognitive manner about how they learn, how their study habits interacted with their learning, and how they should interact with the instructor to better facilitate learning.

Students should watch the lectures before class. (S7)
I find myself with a lot of questions. Asking questions can facilitate my learning. (S8)

Moreover, students also revealed some reflective thinking about the design of the course and how it contributed to their learning.
I think that no matter how many credits this course is, the fact that it does get you to get more into the material and to spend more time than another one credit class for example, is kind of indicative of the success of this method. (S3)
The class got me thinking more like a Radiologist, putting you in real cases constantly. (S2)

Overall, students saw the value in the blended method and its ability to facilitate a higher level of clinical reasoning, yet still expressed the tension between the blended methods, the need for them to achieve higher levels of learning, and their own approach to academic success.

It was a great way to get us to develop our eye, unfortunately the way to do that means a lot of success and failure, which hurt our grades. We are here to learn and I should be happier, but grades do matter. (S1)
Students are lazy and will complain even when it is their own fault. (S7)
You have to be thrown into the fire to learn. (S3)

Discussion

The decision to incorporate a blended learning approach into a veterinary radiology course was motivated by the need to achieve higher student levels of clinical reasoning through more meaningful and interactive learning experiences during face-to-face class time. It was also hoped that the face-to-face interactions with the instructors would be more centered around authentic problems where the students would experience exchanges that resembled master/apprentice or mentor/mentee collaborations.

For this study, the intent of the research presented in this article was to better understand how blended learning could transform student engagement in the classroom, encourage deeper processing of domain knowledge, promote metacognitive approaches to personal study, and facilitate meaningful learning activities that should accelerate a student’s path toward becoming an expert clinical problem solver. Further, a clearer understanding of how students perceived and interacted with blended learning was examined to gather insights into how to improve upon course design as well as how to better prepare students for a blended classroom.
The measures of effect quantitative data indicated that blended learning contributed to a significant increase to students’ levels of feeling “strong” about themselves in regard to the course, yet at the same time data indicated that blended learning contributed to a significant increase to students’ levels of feeling “upset” and “irritable” in regard to the course. This revealed a potential phenomenon in the course characterized by students regarding themselves as stronger when it came to course competencies, yet having considerable negative feelings toward the blended methods that likely contributed to their learning.

Additional quantitative data indicated that blended learning contributed to a significant decrease to students’ levels of self-efficacy for their ability “to put in the necessary effort”; “to do well”; “to achieve good grades when I want”; and “to avoid making mistakes and losing points when I want”. There was also a significant decrease to students’ levels of self-efficacy for their perceived likelihood of encountering “problems and unlucky events”. This aspect of the quantitative data, combined with the measures of effect and qualitative data, suggests that students had negative perceptions of blended learning in regard to their ability to successfully score high grades, yet had positive perceptions of blended learning in regard to its ability to foster their clinical reasoning skills. This pointed to a dynamic where students seemed to disassociate learning gains from the ability to achieve good grades.

Quantitative data measuring students’ general perceptions about the impact of the blended course upon typical learning activities during the semester indicated significant increases in two areas: “I was more likely to ask questions in a blended course,” and “There were more opportunities to collaborate with others in a blended course.” These indications, combined with the qualitative data and the modest perceptual increases to other engagement activity in the course, suggest that students attributed their increased engagement and learning gains to the blended format of the course.

This dichotomy of student perceptions toward blended learning may be a product of tension between the desire to learn and the perceived program expectations for grades, combined with the competition within the cohort for grade-based opportunities such as awards, fellowships, and desirable internships. Evidence that student’s recognized this tension can be found in the student comments:

This course should be a pass/fail course. (S3)

It was a great way to get us to develop our eye, unfortunately the way to do that means a lot of success and failure, which hurt our grades. We are here to learn and I should be happier, but grades do matter. (S1)

Conclusion

In summary, the findings from this study have revealed a demonstrated need for reexamining how students can be better prepared for courses that address higher-order thinking and clinical problem solving when using blended learning. Student study habits, that may be effective for memorizing content and using associations to successfully navigate test questions, can lead to increased frustration when utilized for assessments that measure clinical reasoning skills. There may be a need to help students transition their study skills to more active engagement strategies that emphasize understanding, the application of concepts, and self-regulation of learning. While blended learning has been shown to produce increased learning gains when used in college courses (McLaughlin, Gharkholonarehe, Khanova, Deyo, & Rodgers, 2015; Prince, 2004), the nature of highly competitive graduate and professional programs may require further study to determine the most effective approaches to fully realize blended learning’s potential. These types of programs may need to assess how the entire curriculum, student orientation, and academic policies should be designed to create a learning culture that reduces the tension between a student’s desire to learn and the pressure to maintain a competitive grade point average. It is hoped that the findings generated from this study can help guide the future design of courses, curricula, and supportive programs when clinical reasoning and high levels of problem solving are target competencies.

References


