RESEARCH ARTICLE

Supplemental instruction in pharmacy education: Lessons learned from collected perceptions

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Abstract

Introduction: Supplemental Instruction (SI) is an internationally-recognised academic support programme serving students in historically challenging courses across higher education via peer-assisted learning. **Methods:** A survey was deployed to gather perceptions of SI among student pharmacists, near-peer leaders, faculty, and staff of a traditional, four-year doctor of pharmacy programme hosted by a private institution in the United States. **Results:** Ninety-eight participants shared perceptions and viewpoints of the SI programme. Overall, positive perceptions were expressed and were independent of proximity to either attending sessions (students) or teaching activities (faculty). Student respondents identified audience-response polling or "gamification" as the most effective modality while the traditional use of student small groups was deemed less useful. Curiously, the student results also support SI improving student-faculty interactions. **Conclusion:** Given the current landscape of pharmacy education, it is critical to provide the best resources possible to ensure student success, and SI is an easily adaptable model to support student pharmacists.

Introduction

Supplemental Instruction (SI) is an internationally-recognised academic support programme rooted deeply in educational research that exists to support students in difficult courses utilising a peer-to-peer tutoring model to improve student performance and increase retention (Martin & Arendale, 1992; Arendale, 2002; Center for Academic Development University of Missouri-Kansas City, 2006). The founder of SI, Dr Deanna Martin, relied on both educational and psychological theories to develop SI. Some notable theories include Bandura's cognitivist theory, Dale's Cone of Experience, Keimeg's Hierarchy of Learning Improvement Programs, Piaget's constructivism theory, Skinner's behaviourism theory, and Tinto's Model of Retention (Martin & Arendale, 1992; Zerger, 2008). A key difference between SI and other tutoring programmes are the intentional focus on identifying difficult courses rather than identifying struggling students. As such, SI is inclusive of all students. Another unique aspect of SI is the peer-leader model, where students who did exceptionally well in the course develop and facilitate the SI sessions. Additional characteristics of SI include an emphasis on active learning rather than passive learning, the inclusion of content review along with study strategies, and scheduled, recurring sessions (Martin & Arendale, 1994).

SI is an easily adoptable model, and many pharmacy schools offer SI; however, few pharmacy-specific studies exist in the literature. Of the existing research, several schools focused on peer-to-peer tutoring or peer-assisted learning as forms of SI (Donohoe & VanDervort, 2014; Aburahma & Mohamed, 2017; Cole *et al.*, 2018;), while one review of remediation programmes included SI as a form of remediation

assistance (Maize *et al.*, 2010). To date, only one published study examines students' perceptions of a modified SI programme (Mosley, Maize, & LaGrange, 2013). Given the current landscape of pharmacy education (Brown, 2020), it is critical to provide the best resources possible to ensure student success. SI is useful to support students as they transition to professional coursework and learn to navigate the

increased rigour. Further, the current challenges facing higher education (Draugalis, Johnson, & Urice, 2020; Laplante, 2020; Lederman, 2020; Lyons, Christopoulos, & Brock, 2020; Maloney & Kim, 2020) today, such as remote learning, hybrid-flex modalities, and decreased enrollment necessitate an even greater need to engage students and ensure learning outcomes are met successfully.

Table I: Correlating department, curricular placement and format of courses offered in the Lipscomb College of Pharmacy

Course	Department	Year – term	Format
Physiological Basis of Therapeutics I	Pharmaceutical Sciences	P1 – Autumn	Virtual
Microbiology and Immunology	Pharmaceutical Sciences	P1 – Autumn	In person
Pharmaceutical and Medicinal Chemistry	Pharmaceutical Sciences	P1 – Autumn	In person
Biomedical Literature Analysis and Drug Information	Pharmacy Practice	P1 – Spring	In person
Physiological Basis of Therapeutics II	Pharmaceutical Sciences	P1 – Spring	Virtual
Pharmacological Basis of Therapeutics I	Pharmaceutical Sciences	P1 – Spring	In person
Pharmacological Basis of Therapeutics II	Pharmaceutical Sciences	P2 – Autumn	In person
Pharmacological Basis of Therapeutics III	Pharmaceutical Sciences	P2 – Spring	In person

P1 = first professional year; P2 = second professional year

The Lipscomb University College of Pharmacy, established in 2007, is a private institution with a four-year curriculum and an average class size of approximately seventy-five students. The college formally adopted SI in 2017 and has since grown the programme to include face-to-face and virtual sessions for multiple courses (Table I). A majority of SI sessions are offered during the first year, with only two sessions offered in the second year of the curriculum. In this context, SI offerings are predominantly offered to support pharmaceutical science courses, with the exception of Biomedical Literature Analysis and Drug Evaluation, led by the pharmacy practice department. All sessions prior to the 2019 COVID-19 pandemic were offered in an in-person format, with the exception of the Physiological Basis of Therapeutics I and II, which were offered in a virtual format establishing important infrastructure for later shifts to virtual SI sessions. Importantly, this SI model can be adopted and applied to any course tied to the Center for the Advancement of Pharmacy Education (CAPE) 2013 Education Outcomes Domain 1 - Foundational Knowledge (Develop, integrate, and apply knowledge from the foundational sciences to evaluate the scientific literature, explain drug action, solve therapeutic problems, and advance population health and patient-centred care) (Medina *et al.*, 2013). The Lipscomb University College of Pharmacy SI programme is coordinated by the Dean of Academic Affairs but is a truly collaborative effort with course coordinators and peer leaders. SI sessions are scheduled weekly for every course, which is a delicate balance with classroom,

laboratory, and experiential requirements. All sessions are placed on the master student calendars and are reinforced by the course coordinators with placement on the syllabi (dates and times), along with written and verbal reminders.

One peer leader (Table I) is selected per course by the course coordinator and the Dean of Academic Affairs based on their past course performance, personality, potential career interest in academia, and willingness to prepare and lead the SI sessions. Once peer leaders are selected, the Dean of Academic Affairs, along with key academic support staff, provides training utilising the University of Missouri-Kansas City (UMKC) Leader Guide (Center for Academic Development University of Missouri-Kansas City, 2006) and encourages the use of active learning strategies in the sessions. Peer leaders receive "student" access to their assigned course in the learning management system to stay abreast of content pace and current materials. Peer leaders then work directly under faculty guidance to prepare for each session on a weekly basis. Peer leaders take attendance at each session and report back to the faculty primarily via email, or phone/text on how the session went, noting any challenges, outstanding questions, or areas needing further clarification. The qualitative peer leader's feedback is highly valuable and critical for the faculty member to take back to the classroom to clarify concepts and reinforce challenging material. Peer leaders receive financial compensation for their weekly session preparation, delivery, and

faculty feedback time comparable to pharmacy intern pay.

As previously mentioned, most of the SI offerings are in-person except for Physiology I and II. Due to scheduling constraints, Physiology SI sessions were moved to a virtual format as a pilot in January 2019. In order to increase student engagement in the virtual setting, a discussion board was created in the learning management system for each SI session, and students were required to post their questions or topics needing further clarification as their 'entry ticket' to the session. This requirement also allowed the peer leader adequate time to prepare for the session and increase efficiency. These virtual sessions also utilised audience response or 'gamification' platforms such as Kahoot! or Mentimeter to promote active participation. Of note, all SI sessions switched to a virtual format in March 2020 due to the COVID-19 pandemic. Due to the pilot implementation of Physiology I and II, the College SI programme was able to quickly transition formats due to prior experience and sharing of best practices between faculty and peer leaders.

Operating the SI programme requires a substantial programmatic commitment from institutional leadership via the Academic Affairs Office, faculty and peer leaders. This commitment, combined with the increased student attendance to the many SI session offerings, precipitated interest in gathering perspectives and viewpoints of the College SI programme from students, faculty, peer leaders, and key staff. It is hypothesised that perceptions of the programme are generally positive; however, disparate perspectives exist among teaching faculty and students who opt to attend SI. The aim of the study focuses on the perceived programmatic benefits, strengths, challenges, and opportunities for growth.

Methods

A survey was designed by the authors and deployed over a two-week period in March 2020 to collect perspectives and viewpoints on the SI programme at the Lipscomb University College of Pharmacy. The survey was built and managed through the REDCap Data Management tool hosted at Lipscomb University (Harris *et al*., 2009; Harris *et al*., 2019). The survey was approved by the Lipscomb University Institutional Review Board prior to administration. Participants reviewed a modified consent in the instruction bar of the REDCap survey. The anonymous survey included a mixture of perception-based prompts on a Likert-like scale and a selected number of free-response questions to capture qualitative narratives. Logic-based prompts enabled

separate questions to populate for each of the survey populations.

An invitation to participate in this study was sent by email to all four student pharmacist cohorts, full-time faculty, current and previous peer leaders, as well as key staff in the Spring of 2020. Key staff members were defined by their role in the recruitment and retention of pharmacy students in areas such as Academic Affairs, Admissions and Student Affairs. Part-time and adjunct faculty members were excluded from the study. Participation was voluntary and without compensation. Participant responses were analysed by their designated categories. Students and peer leaders self-identified by their current academic cohort (P1 - P4) and the term of entry into the programme, as well as self-reported attendance to SI sessions. Faculty responses were characterised by their proximity to SI as defined as course coordination or teaching in a course supported by SI.

Results

Over 300 individuals were invited to participate during the survey period resulting in a 31.3% response rate (Table II). Pharmacy students had a 27.1% cohort response rate and comprised the majority of survey respondents. Greater than 60% of student respondents self-identified as first or second-year students in the programme, and 87% of student respondents reported attending at least one SI session. Among the peer leader cohort, there was a 60% survey response rate, and despite serving in the peer leader role, 50% of peer leaders reported attending SI sessions to support their own academic success. The majority of peer leader respondents self-identified as second-year pharmacy students (66.7%), consistent with the SI model of peer leader selection of recently matriculated students who experienced success in a given course. Faculty and key staff had a 51.2% survey response rate. Faculty were further sub-categorised by proximity to SI, resulting in fewer than 30% of faculty respondents self-identifying as either coordinating or teaching in a course supported by SI.

**Table II: Survey respondents by cohort (n=98)**

Cohort	Survey response number (%)
Student	71 (27.1%)
SI peer leader	6 (60.0%)
Faculty and staff	21 (51.22%)

Over the past three academic iterations of the SI programme, there has been an increase in the number of SI-supported courses in the curriculum. To this end, pharmacy students can spend approximately 4.5 hours per week attending SI sessions in addition to the time spent in the classroom and engaging in other independent study activities. To begin to understand the degree to which pharmacy students engage in SI, student respondents were asked to self-report their attendance by indicating the number of courses for which they have ever attended SI (Table III) as well as the estimated number of sessions attended per semester (Figure 1).

**Table III: Self-reported student (N=71) attendance to SI sessions by number of courses**

Number of courses	Student pharmacist graduation class year			
	2023	**2022**	**2021**	**2020**
1 course	5	-	6	4
2 courses	4	5	2	4
3 courses	5	6	3	1
4 courses	8	2	-	-
5+ courses	4	3	-	-
Do not attend	3	-	3	3
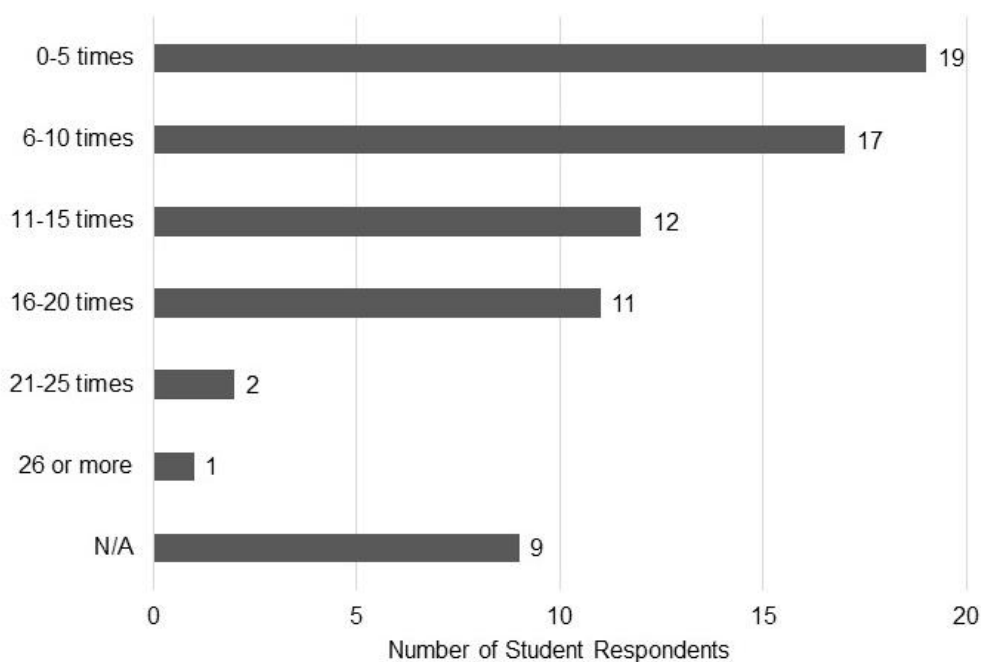
Figure 1: Pharmacy students (N=71) self-reported average session attendance per term

Consistent with the increased number of SI offerings, the student-reported data indicated an increasing trend for students seeking additional course support through SI. A selected number of student respondents appeared to have attended all possible sessions for all courses; however, this is not the norm, as the majority attended SI sessions once or twice per week on average. Pharmacy students may consume multiple SI sessions per week, and some faculty concern around 'best use of time' exists. SI is not unique to pharmacy programmes, but experiences in prior educational settings may influence student attendance patterns. To this end, pharmacy students were asked to indicate their familiarity with SI prior to entering pharmacy school. Fifty per cent of pharmacy students reported being 'not at all familiar' with SI prior to entering pharmacy school (Figure 2). Together, these data support students' interest in receiving SI support in their course work and indicate their willingness to devote additional hours per week to this effort.
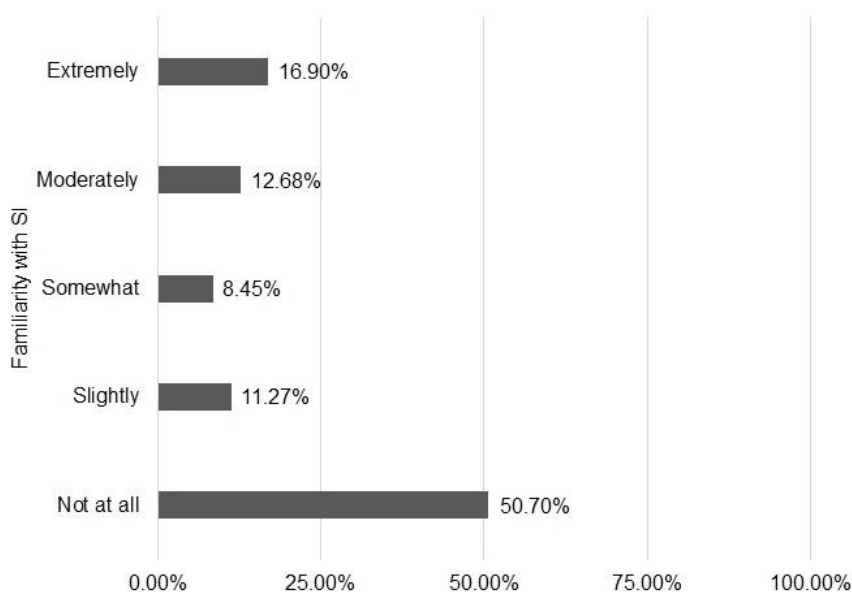
Figure 2: Pharmacy students' (n=71) familiarity with SI prior to entering pharmacy school

Academic support offerings like SI require a significant investment of time and resources at the institutional level, but whether SI contributes to potential programmatic benefits in addition to the primary goal of supporting students remains unexplored. Faculty and key staff perceptions were collected in key programmatic interest areas, including recruitment and marketing, and student experience, performance and confidence. While 70% of faculty and staff agree that academic support programmes, such as SI, are perceived to be useful in programmatic recruitment and marketing, 95% of agreement is observed in relation to the statement that SI is perceived to improve the overall student experience (Table IV). Additionally, faculty and staff tend to agree that these programme offerings improve student performance (70% agreement) and student confidence (80% agreement). The positive perception among faculty indicates favourable SI programme advocacy for those interfacing with pharmacy students but also identifies a potential role for SI in programmatic areas like recruitment, marketing, and the overall student experience.

Table IV: Faculty and key staff (n=21) perceptions of the role of SI in programmatic recruitment and marketing and student experience, performance and confidence

	Strongly agree N (%)	Agree N (%)	Neutral N (%)	Disagree N (%)	Strongly disagree N (%)	N/A N (%)
Academic support offerings like SI…						
…are useful tools in recruitment and marketing.	9 (42.9)	5 (23.8)	6 (28.6)	0 (0.0)	0 (0.0)	1 (4.8)
… improve the student experience.	7 (33.3)	12 (57.1)	1 (4.8)	0 (0.0)	0 (0.0)	1 (4.8)
… improve student performance.	5 (23.8)	10 (47.6)	4 (19.0)	1 (4.8)	0 (0.0)	1 (4.8)
… improve student confidence.	6 (28.6)	10 (47.6)	4 (19.0)	0 (0.0)	0 (0.0)	1 (4.8)

One challenge from the faculty perspective regarding SI is the impact on student-faculty interactions. In many cases, the SI peer leader and the session environment are sufficient to address outstanding student questions or concept misconceptions, thereby reducing the amount of contact time students have during instructor office hours or communicating with faculty. To explore this further, students and faculty were asked to evaluate whether SI had a positive impact on student-faculty interactions (Figure 3). While the majority of

faculty responses trended toward neutral or disagree/strongly disagree (40% of faculty respondents), student and peer leader responses to this statement were more positive, shifting more towards strongly agree/agree (39.5% of student respondents and 66.7% of peer leaders) illustrating that

SI is perceived to benefit student-faculty interactions. How SI contributes to student-faculty interactions remains unclear, but perhaps the student perceptions highlight a new avenue to enrich student-faculty interactions.
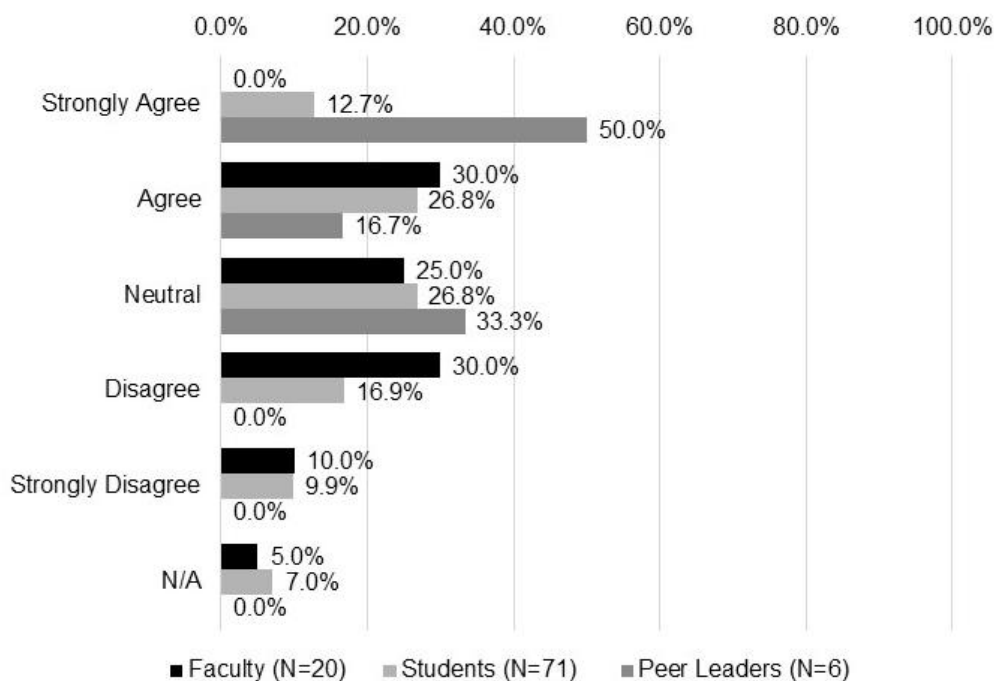

Figure 3: Participant perceptions of SI improving student-faculty interactions

One primary goal of this study was to evaluate the perception of SI benefits. Survey items were expressed as statements to which respondents were asked to indicate their degree of 'agreement' or 'disagreement'. One aspect of the perceived benefit was to explore the impact of SI on students' comprehension of the course content. Responses to this query are shown in (Table V). Both students (87% in agreement) and faculty (80% in agreement) indicated that attendance at (and participation in) SI sessions affords a positive impact on student comprehension. Additionally, student and faculty perceptions regarding the impact of SI on exam performance were collected. Both students and faculty expressed agreement (83% and 70%, respectively) that SI benefited student exam performance (Table V). This study did not correlate attendance at SI sessions with exam performance. Therefore, any attribution of benefit should be regarded as the subjective conception of the individual respondent.

Acknowledging that there are numerous study and learning strategies that vie for students' time, survey respondents were asked to consider the value of time with respect to its allocation toward SI. Students (79%

in agreement) and faculty (75% in agreement) both regard attending SI sessions as a worthwhile utilisation of time. These results are congruent with the preceding two survey items (i.e. benefit on comprehension and benefit on exam performance), and the composite responses of these three items would appear to substantiate the perception that SI offers a creditable 'return on investment'. Both students and faculty were also directed toward assessing the comparative benefit of two learning methodologies: participation in SI and watching recorded lecture content. Student and faculty responses indicate that both groups regard SI as offering a better learning value as compared to viewing recorded lectures. It is also observed, in contrast to the previous inquiries regarding perceived benefit, that faculty expressed a higher level of agreement with this statement (75%) than did students (63%) (Table V). Almost 20% of student respondents indicated their disagreement that SI was more profitable than watching recorded lecture videos. These results support that attending SI sessions is a useful method of study and perhaps may be more beneficial than re-watching recorded lecture content.

Table V: Respondent perceptions (n=98) of SI benefits to students

	Strongly agree N (%)	Agree N (%)	Neutral N (%)	Disagree N (%)	Strongly disagree N (%)	N/A N (%)
SI sessions have…						
…a beneficial impact on students' comprehension of the material.	38 (38.8)	47 (48.0)	8 (8.2)	1 (1.0)	0 (0.0)	4 (4.1)
… a beneficial impact on student exam performance.	32 (32.7)	48 (49.0)	11 (11.2)	3 (3.1)	0 (0.0)	4 (4.1)
Attending SI sessions is…						
…a worthwhile/beneficial investment of students' time.	31 (31.6)	47 (48.0)	11 (11.2)	4 (4.1)	1 (1.0)	4 (4.1)
… more beneficial/valuable to students than watching the recorded lecture videos (Panopto/Tegrity).	35 (35.7)	30 (30.6)	13 (13.3)	11 (11.2)	5 (5.1)	4 (4.1)

During SI sessions, peer leaders employ a variety of modalities due to personality, content demands, or even the needs of session attendees. Due to the multiple approaches that SI peer leaders employ, several survey items were designed to specifically address student attendee viewpoints on the modality used for engagement and their corresponding perception of efficacy. Students who indicated previous SI attendance were prompted to evaluate the degree to which students are engaged in the SI sessions, the role of SI attendance on motivation to self-study, and four items affiliated with active learning (Table VI). Among the student respondents who self-identified as SI session attendees, 89.1% evaluated SI sessions as being active and engaging, consistent with the intention of the peer leader training and faculty-peer leader coaching. However, while a high degree of agreement was observed with regard to session presentation and design, only 67% of students tended to agree that the majority of SI attendees were actively participating, with 12.5% of respondents shifting to disagree with this statement. Interestingly and independently, 82.8% of students who attended SI tended to agree that SI attendance creates motivation to increase independent study and review of the material. Whether SI serves as a self-assessment checkpoint or the role of the peer environment cultivates a 'positive pressure' is not known. The delivery modalities under the umbrella of active learning were also assessed through the survey. Among the engagement modalities, students indicated that the most helpful active learning methodology is self-assessment (with its attendant audience response, gamification, and immediate feedback components). Similarly, students responded that peer-led explanations of lecture material conferred a high level of utility. In stark contrast, however, working in small groups was regarded as the least beneficial SI methodology.

Table VI. Students who attend SI (N=64) evaluate general session engagement and active learning strategies

	Strongly agree N (%)	Agree N (%)	Neutral N (%)	Disagree N (%)	Strongly disagree N (%)	N/A N (%)
SI sessions are interactive and engaging.	19 (29.7)	38 (59.4)	7 (10.9)	0 (0.0)	0 (0.0)	0 (0.0)
Attending SI creates motivation to increase independent study and review of the material.	14 (21.9)	39 (60.9)	9 (14.1)	2 (3.1)	0 (0.0)	0 (0.0)
During SI Sessions…						
… the majority of students are actively participating.	11 (17.0)	32 (50.0)	12 (18.8)	8 (12.5)	0 (0.0)	1 (1.6)
… the most helpful methodology is having the leader (re)explain content/material that was presented by the professor during the lecture.	21 (32.8)	33 (51.6)	6 (9.4)	4 (6.3)	0 (0.0)	0 (0.0)
… the most helpful methodology is doing self-assessments (e.g., Kahoot quiz; Menti.com; etc.)	28 (43.8)	28 (43.8)	4 (6.3)	2 (3.1)	2 (3.1)	0 (0.0)
… the most helpful methodology is working in small groups (e.g., discussions, worksheets).	10 (15.6)	13 (20.3)	12 (18.8)	18 (28.1)	10 (15.6)	1 (1.6)

Discussion

The study survey aimed to capture various aspects of the SI programme in the Lipscomb University College of Pharmacy from students, peer leaders, faculty, and key staff in areas of perceived programmatic benefits, strengths, challenges, and opportunities for growth. The data suggest that students are indeed taking advantage of the SI sessions offered throughout the academic year, though they are not attending all possible SI session offerings. However, the extent to which attending SI directly correlates to student performance was not evaluated in the present study. Given the number of offerings, faculty can guide students to critically evaluate how individual resources, like SI, may be helping or hindering their success. Though well-intentioned, pharmacy students have to navigate all the potential resources offered to them, and such skills may require additional development. Several key observations can be made from the present work. First, SI in the present context carries a positive perception and buy-in among students and faculty, as a worthwhile investment of students' time and as a frequently utilised programmatic resource. Second, the initial SI peer leader training and ongoing coaching that occurs between faculty and the course peer leader has promoted an engaging and interactive session atmosphere. While some pharmacy students attend SI sessions and remain unengaged, the perception of benefit and return on the time investment relative to re-watching recorded lectures remains high.

Moreover, pharmacy students who attend SI reveal a positive trend of attending SI with increasing self-motivation to study independently, which is a worthwhile outcome for a programme promoting academic success. So while some pharmacy students may be disconnected in the actual session, perhaps an impact on motivating self-study is achieved. Third, students and faculty view the impact of SI on student-faculty relationships differently. Faculty have a more sceptical perception of SI in improving interactions with pharmacy students, but pharmacy students view SI as a way to better connect with faculty and improve existing interactions. Finally, depending on the types of previous educational experiences, pharmacy schools may be the first encounter that pharmacy students have with SI providing yet another resource as students acclimate to the rigour of a professional programme.

There is a significant faculty and institutional investment to ensure SI peer leaders and their respective weekly sessions are beneficial to pharmacy students. The weekly coaching undertaken by faculty and peer leaders promotes consistent content delivery in and outside of the classroom but also provides a forum for faculty and their peer leaders to develop a mentoring relationship. Beyond SI session planning, peer leaders who have career aspirations to teach or join the Academy begin to pull back the curtain as they design SI sessions and active learning assessments. While conjecture, the peer leader may also contribute to the observation made herein that students perceive that SI positively impacts student-faculty interactions. Just as faculty serve in mentoring capacities, peer leaders also serve as intercessors and mentors to other pharmacy students. Peer leader feedback to faculty provides insight into areas of confusion that students may be hesitant to independently articulate.

SI supports students in difficult courses utilising a peer leader model. The Lipscomb University College of Pharmacy SI programme provides support for eight courses in the first and second years of the professional curriculum. Overall, survey respondents had a positive response regarding the College SI programme. Students perceived that SI had a beneficial impact on material comprehension, and exam performance and was a worthwhile investment of their time. Students perceived the most helpful methodologies employed during SI were self-assessments via gamification. Interestingly, peer leaders and students who attend SI perceive the programme as having a positive impact on student-faculty interactions, whereas faculty responded in disagreement to neutrality. This finding highlights the importance of the faculty-peer leader relationship to provide guidance on SI session preparation while weaving SI session feedback into the classroom experience.

Conflict of interest

The authors declare no conflict of interest.

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