BRIEF

An Online, Self-directed Pharmacy Bridging Course for Incoming First-Year Students

Melinda Verdone, EdD, MS,^a Medha D. Joshi, PhD, MPharm,^b Thomas M. Bodenshtein, PhD,^c Jacalyn M. Green, PhD,^c Sean M. Lynch, PhD,^c Jacob P. Gettig, PharmD, MPH, MEd,^b Nancy Fjortoft, PhD^b

^a University of Wisconsin Extended Campus, Madison, Wisconsin

^b Northwestern University, Chicago College of Pharmacy, Downers Grove, Illinois

^c Northwestern University, College of Graduate Studies, Downers Grove, Illinois

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Objective. To evaluate the short-term effectiveness of an online bridging course to increase the knowledge of struggling incoming students' in crucial content areas within the Doctor of Pharmacy (PharmD) curriculum.

Methods. An assessment was administered to all incoming first-year pharmacy students (N=180) during orientation to determine their foundational knowledge in key areas. Students who scored <70% on the assessment (N=137) were instructed to complete a 10-module, online, self-directed bridging course focusing on physiology, biochemistry, math, and medical terminology during the first two weeks of the quarter to prepare them for first-quarter coursework. After completing the bridging course, participants completed the same assessment to determine content knowledge acquisition and retention. At the end of the quarter, the assessment was again administered to all first-year students, regardless of whether they had completed the bridging course.

Results. The average assessment score of students who completed the bridging course modules improved significantly (53% vs 76%). All students demonstrated significant improvement in assessment scores between orientation and the end of the quarter; however, bridging course participants achieved a greater increase in assessment scores (53% vs 73%) than nonparticipants (76% vs 81%). Significant relationships were found between assessment scores following completion of the bridging course and pass rates in first-quarter courses.

Conclusion. The online, self-directed bridging course offered at Northwestern University, Chicago College of Pharmacy proved successful as a method of knowledge acquisition and as a system for early identification (within the first two weeks of the quarter) of students in need of additional academic support.

Keywords: bridging course, early intervention, online

INTRODUCTION

Most colleges of pharmacy in the United States require incoming students to have completed a minimum of two years of prerequisite coursework and developed a foundational knowledge of the sciences prior to beginning their pharmacy coursework.¹ Coursework requirements typically include chemistry, organic chemistry, biology, calculus, English, and general education.² Students may take these courses at any accredited college or university, ranging from competitive research-oriented universities to community colleges. Because of this flexibility, the

academic rigor of these pre-pharmacy courses varies widely, resulting in incoming students having different levels of academic preparedness for starting the Doctor of Pharmacy (PharmD) curriculum.

Some pharmacy students struggle in their academic studies especially during the first professional (P1) year, and often in basic science courses.³ This is not surprising considering that the undergraduate preparation of the entering students varied. Also, when students transition to professional school they tend to encounter a sharp escalation in academic rigor compared with what they had previously experienced.⁴ As a result, some students may not possess the knowledge base needed to excel in the PharmD program. Pharmacy educators play a crucial role in connecting P1 students with the faculty members and

Corresponding Author: Melinda Verdone, University of Wisconsin Extended Campus, 5602 Research Park Blvd., Ste. 300, Madison, WI 53719. Tel: 608-263-0599. Email: melinda.verdone@uwex.edu

resources they need. A key factor in this process is identifying struggling students and determining which interventions would best support their learning throughout the PharmD program, with the ultimate goal of producing self-regulated learners.

Administering a bridging course at the beginning of a pharmacy program has several benefits. First, it gives incoming students a chance to refresh their foundational knowledge just prior to starting the PharmD curriculum as a significant amount of time may have passed since the students learned some of the prerequisite material. Second, a bridging course is a low-stakes avenue for students to transition into the pharmacy curriculum. Third, a bridging course allows faculty members to identify students who may struggle in their subsequent PharmD coursework, even prior to taking their first examination. Early intervention is crucial to providing support to these students in a timely manner to promote academic success and retention.⁵

At Midwestern University, faculty members within the Chicago College of Pharmacy and the College of Graduate Studies developed an online 10-module bridging course to assist all students with the transition from undergraduate to professional pharmacy coursework. The objectives of this study were to evaluate the short-term effectiveness of an online 10-module bridging course on students' knowledge acquisition and retention and to identify struggling students who may need supportive interventions early in the academic term.

METHODS

The 10 modules for the course were developed and recorded over a three-month period prior to the study. Senior pharmacy faculty members selected module content based on their previous experience with teaching P1

students and review of past students' course assessments. Members of appropriate academic departments approved the module content and assessments prior to use. A schematic of the bridging course and assessments is presented in Figure 1.

The study was reviewed and approved by Midwestern University's Institutional Review Board. The study was conducted during the 2017-2018 academic year and involved all 180 incoming P1 pharmacy students. The assessments described in this study were not a component of the P1 students' course grades and participants were informed of this prior to participation. All 180 students (100%) provided informed consent prior to participation.

A 30-question, paper-based assessment was administered to all incoming P1 students (N=180) as part of their orientation, which was held before courses began. The multiple-choice items on the assessment were constructed by the faculty members who designed the modules for the bridging course. Students were told the initial assessment would be used to gauge their knowledge and guide the college in providing additional learning resources to them if needed, but students were not informed about the bridging course at that time. The college used a 70% standard for determining students' achievement of learning objectives. Also, because of the limited number of questions per section on the preliminary assessment, only an overall score could be used to assess performance. Thus, those students who passed the assessment at 70% or higher (n=43) were exempted from completing the bridging course modules. Students who failed the assessment (ie, scored <70%, n=137) were required to complete all of the bridging course modules within two weeks.

The curriculum for the bridging course consisted of 10 modules focusing on physiology, biochemistry, math, and

Figure 1. Assessment Scheme for a Bridging Course into a Doctor of Pharmacy Program for Incoming Students

medical terminology. Module content consisted of foundational material that would not necessarily be covered in first-quarter PharmD courses. The modules were online and self-directed, but had to be completed within the two-week period at the beginning of the quarter. Each module consisted of approximately 15 to 30 minutes of instructional video and included an optional formative quiz at the end.

Total time to complete all 10 modules was approximately three hours. Students had a lighter course load during this two-week period ensuring they had enough time to complete the bridging course. If students did not meet the deadline, a follow-up email was sent, allowing the student a one-week extension to complete the modules.

At the conclusion of the bridging course, participants completed the assessment a second time. Students were not provided with the questions and answers after the first assessment so that the same assessment could be used. Students who scored <70% on the post-course assessment were contacted for follow-up intervention consisting of a one-on-one meeting with the college's senior education specialist. During these meetings, students were connected with supplementary resources and additional support was provided to them throughout the quarter.

At the beginning of the following quarter (ie, 12 weeks after completion of the initial assessment), all first-year students in attendance at a required in-person information session were given the same assessment. In addition, an anonymous survey developed by the investigators was administered to determine students' perceptions of the content, quality, and helpfulness of the modules in the bridging course. The survey consisted of 30 questions regarding the depth and helpfulness of the information provided in each module and the quality of the module activities on a four-point Likert scale (strongly disagree, disagree, agree, strongly agree). One open-ended question allowed for collection of general comments.

Descriptive statistics were used to show the data's central tendency and dispersion. Repeated measures ANOVA or paired *t* tests, as appropriate, were used to examine differences in learning assessment scores between students who completed the modules and those who did not. Chi-square tests were used to compare scores on the post-course assessment with students' pass/fail grades in biochemistry, calculations, and physiology courses completed in the first quarter. Alpha was set a priori at .05. Students' perceptions regarding the modules were summarized descriptively.

RESULTS

The 2017-2018 incoming class consisted of 180 students with an average age of 23 years, and represented a wide range of ethnic groups; 65% of the students were

female. The demographic data of just those students who completed the bridging course were not collected separately so no demographic comparisons between students who did and did not have to complete the course could be made.

Of the 180 incoming students, 100% completed the initial assessment. Of these, 137 students scored less than 70% and were required to complete the bridging course.

The 10 module videos were viewed by 82% to 99% of the 138 students who completed the bridging course, with an average of 89% of students who viewed the videos across all modules. Formative quizzes for each module were completed by 80% to 93% of the students, with an average of 86% completion across all modules. Six students did not complete the bridging course during the two-week period, but did complete it during the one-week extension.

All 138 students who completed the bridging course completed the post-course assessment. Scores of the participants significantly improved from the initial assessment to the second assessment (53% vs 76%, $p < .001$).

Overall, all of the first-year students demonstrated a significant improvement in assessment scores between the initial assessment and the follow-up assessment administered at the beginning of the second quarter. However, there was a greater proportional increase in the scores of the bridging course participants (53% vs 73% [$p < .001$] compared with 76% vs 81% [$p = .004$]).

Significant relationships were found between post-course assessment scores and course pass rates in biochemistry ($\chi^2 = 13.0$, $p < .001$), calculations ($\chi^2 = 4.0$, $p = .045$), and physiology ($\chi^2 = 13.0$, $p < .001$), the three courses targeted by the bridging course content. Forty-one (29.9%) of the 138 students who completed the bridging course scored <70% on the post-course assessment and met with the college's senior education specialist for additional help. Of the 41, 11 went on to fail a first-quarter biochemistry, calculations, and/or physiology course. The post-course assessment was unsuccessful in identifying four students (2.9%) who passed the post-course assessment but subsequently failed a first-quarter course.

Of the 138 students participating in the bridging course, 137 completed the survey (99% response rate). Survey results are summarized in Table 1. The majority of participants felt that the concepts were covered with sufficient depth (83%), the modules provided information that helped them in their courses (73%), and that the activities included in the modules helped reinforce the concepts (75%).

DISCUSSION

Although the knowledge gap between participants and nonparticipants was not eliminated completely, incoming PharmD students who participated in a 10-module

Table 1. Incoming Doctor of Pharmacy Students' Perceptions of Modules Included in a Bridging Course (N=138)

Module and Topics	The concepts were covered in sufficient depth (Agree or Strongly Agree)	This module provided information that helped me in my courses (Agree or Strongly Agree)	The activities included in the modules helped reinforce the concepts (Agree or Strongly Agree)
	No. (%) ^a	No. (%) ^a	No. (%) ^a
Medical terminology	107 (82)	90 (69)	92 (70)
Physiology			
Homeostasis and membrane transport	116 (85)	102 (75)	104 (76)
Autonomic nervous system	113 (82)	104 (76)	106 (77)
Pressure and flow	107 (81)	96 (73)	99 (75)
Biochemistry			
Introduction to metabolism	105 (78)	92 (69)	95 (71)
Cell signaling	105 (80)	90 (68)	94 (71)
Cell cycle	107 (80)	93 (69)	99 (74)
Pharmacy			
Basic math	117 (88)	108 (81)	109 (82)
Basic chemistry concepts	118 (89)	103 (78)	108 (82)
Introduction to dosage forms	105 (80)	95 (73)	93 (71)

^a Percent calculations based on total responses for each item rather than on the total number of students who completed the bridging course

bridging course showed significant improvement in their post-course and follow-up assessment scores. These improvements indicated an increase in students' content knowledge as a result of course participation and retention of content knowledge over the course of the first quarter. Increase in scores on the follow-up assessment scores among non-participants was attributed to learning in first-quarter pharmacy courses that was related to that covered in the bridging course content or independent research on the assessment topics. Additionally, failure of the post-course assessment identified students who would require additional assistance in their coursework. These results indicate that the pass/fail grade on the post-course assessment was an effective means of identifying struggling students early in the academic term.

These findings are in alignment with those of other studies that evaluated the effectiveness of students participating in a pharmacy bridging course.^{6,7} However, the online format of this bridging course allowed for flexibility in participation and administration compared to that required for classroom-based bridging courses reported in the literature.⁸ With this online format, students can increase their foundational knowledge at their own convenience,⁹ and students can use the bridging course modules throughout the academic term to review concepts. In addition, the inclusion of math and medical terminology in the bridging course, along with biochemistry and physiology, helped to prime students for first-year coursework at our institution. Overall, students found the bridging course to be the right length and difficulty level, while providing adequate reinforcement of foundational knowledge.

The findings from this study are limited because the study was conducted at only one institution and with only one class of incoming students, which may prevent generalization of our findings to other PharmD students. In addition, the assessment was used three times over the course of the study. Thus, some students' performance may have increased because of familiarity with the assessment questions. Also, it was not possible to determine whether students watched the video modules in their entirety, which would have limited the full benefit of participation in the bridging course. Additionally, the elapsed time between students completing the bridging course modules and the post-study survey was 10 weeks. During this time, students may have forgotten or misrepresented their perceptions of the modules. Also, the bridging course and assessments were developed to identify struggling students early and to provide additional academic support to them rather than to inform or use in making decisions regarding admissions criteria.

Going forward, improvements to the bridging course will be made. A few students expressed anxiety and stress over having to complete the modules during the first two weeks of the quarter. To address this concern, the bridging course could be made available earlier, prior to the start of the quarter. Additionally, assessment questions must be updated regularly to maintain the integrity of the evaluation and early identification process, as overseen by the senior education specialist. Because the modules in the bridging course are introductory in scope, the needed content knowledge does not change from year to year. Therefore, the modules do not need to be substantially

modified each year. Instead, new questions are constructed that align with module content, which limits the amount of time needed for the revision process. Expanding the number of topics and depth of content of the bridging course modules in alignment with first-year course content will be investigated in response to the participant survey results from this study.

CONCLUSION

The online, self-directed bridging course offered at Midwestern University, Chicago College of Pharmacy proved successful as a system of early identification and intervention for students who need additional academic support. Participants in the bridging course demonstrated increased understanding of the concepts presented in the modules, and this knowledge was retained throughout the academic quarter. Student perceptions of the bridging course modules indicated they were informative and helped them to understand concepts in their courses.

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