

Background

Formative assessments are commonly used in undergraduate medical education to identify students' areas of weakness in preclinical curriculum. Studies¹ in undergraduate medical education point to information organization and integration as the most common student difficulties in the clinical years. Thus, it is reasonable to investigate the effectiveness of a supplemental resource focused on organizing pertinent information following formative assessment. At Western Michigan University Homer Stryker M.D. School of Medicine (WMed), formative assessments are offered weekly during preclinical courses. A multitude of supplemental resources are offered by WMed for preclinical study, but there are none that specifically target individual student weaknesses identified by formative assessments.

Purpose

The goal of this study is to determine whether a high-quality supplemental curricular resource, such as ScholarRx©, can improve the utility of formative assessments as a learning tool and improve student outcomes on summative assessment. We hypothesize that high-quality, supplemental curricular resource material will improve student satisfaction with the formative assessment process and improve summative assessment outcomes.

Methodology

ScholarRx© is a medical curriculum containing singular units of instruction, termed "bricks". During the Hematology and Oncology course at WMed in 2018, the course director released a total of 51 bricks for which there was an associated learning objective sampled on weekly formative assessments. Each brick was specifically recommended when students answered a formative exam question with a corresponding topic incorrectly. Students then completed surveys about supplemental learning resources used throughout the course. Performance on validated summative assessment items was normalized to historical student performance, and improvements were compared on the basis of whether a brick was made available with the associated with the sampled learning objective.

Results

Out of 40 students who completed the formative assessments, each brick was recommended to an average of 25 students based on incorrect answers. An average of 13 students actually downloaded each brick (Figure 1).

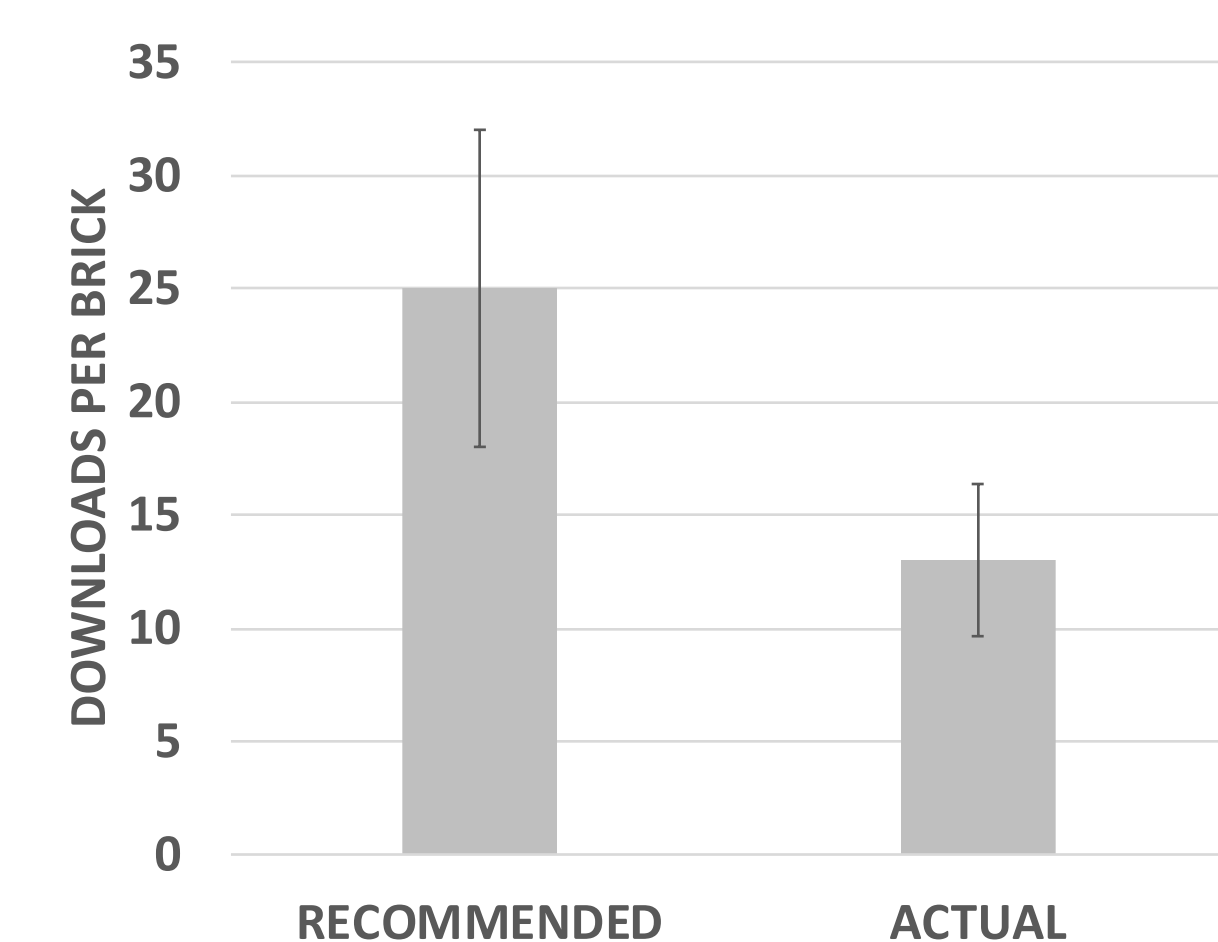


Figure 1. Average Downloads Per Brick. On reviewing the number of students who answered formative exam questions incorrectly, we were able to determine the number of students to whom each brick was "recommended", with an average (mean) across all bricks as 25±7 students. The number of students who downloaded each brick was 13±3 on average (mean).

When bricks were used, there was trend toward an increase in the number of students reporting that "WMed provided resources that are an efficient use of my time in studying weak areas identified by the formative exams" ($p = 0.05$, Figure 2). The use of bricks also led to a significant number of students stating that "supplemental resources provided by WMed aligned with the areas of weakness identified by the formative exams" ($p = 0.02$, Figure 3).

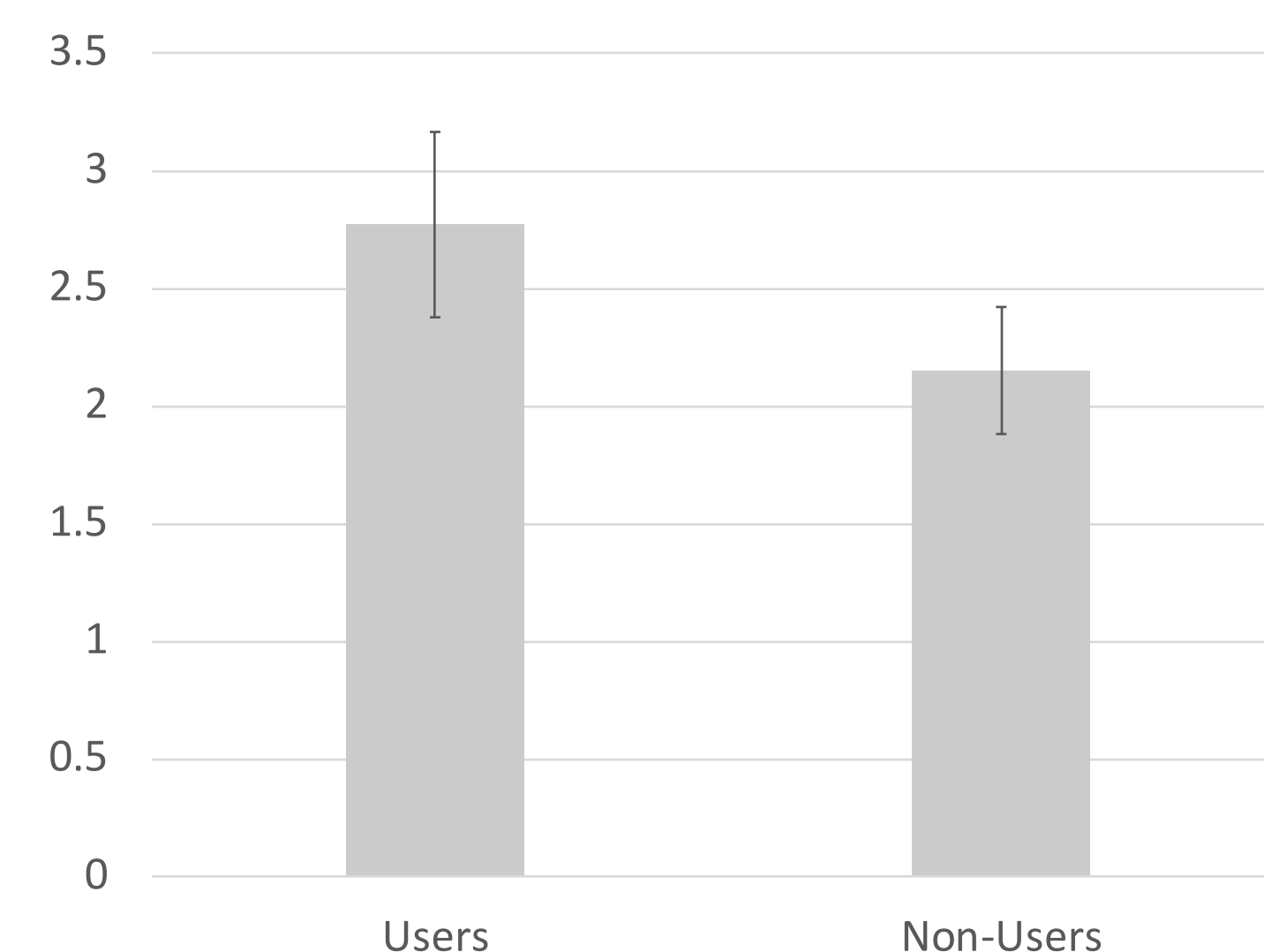


Figure 2. Comparison of users vs. non-users reporting bricks as an efficient use of their time (Scale: 1 = Strongly disagree, 2 = Disagree, 3 = Agree, 4 = Strongly agree).

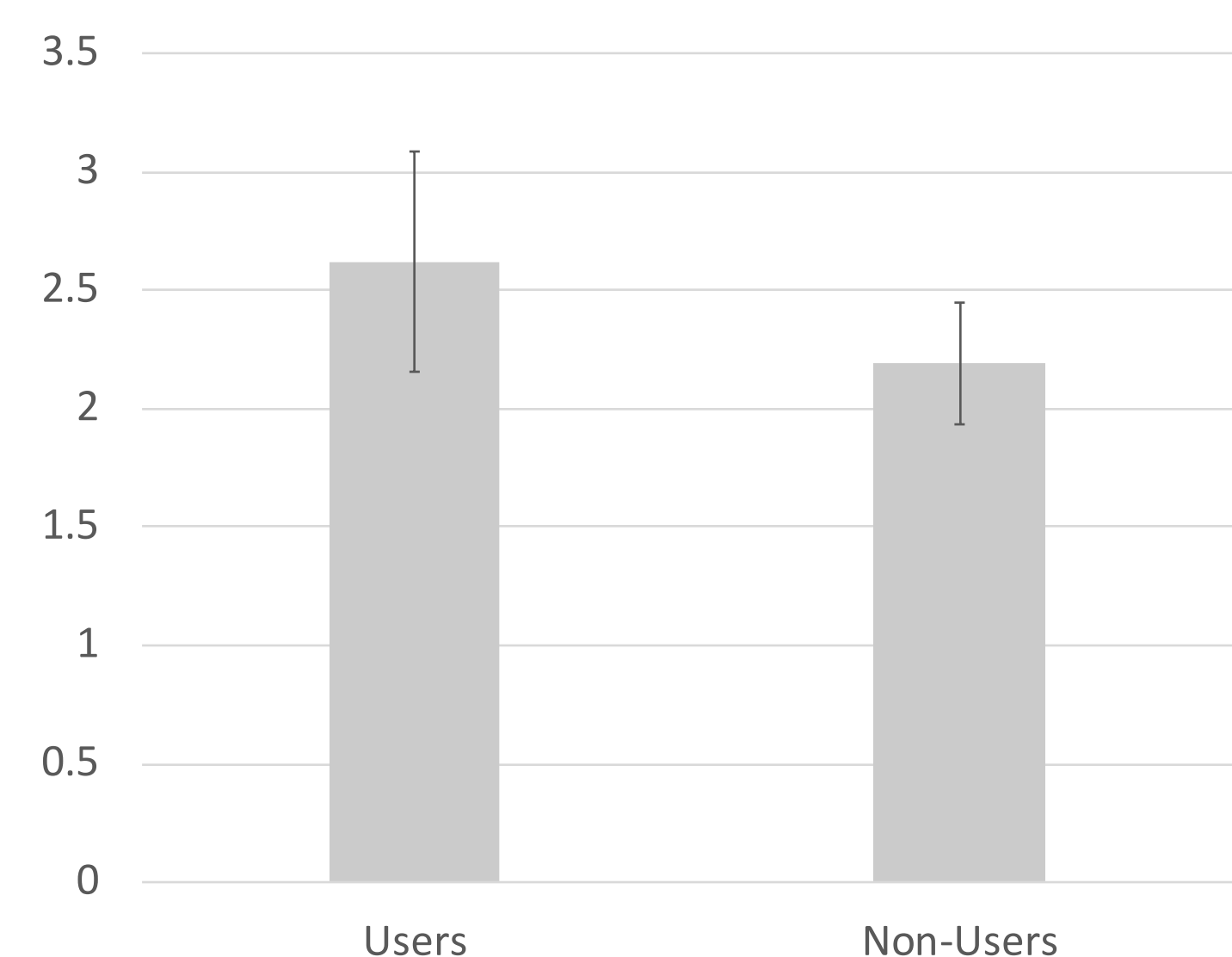


Figure 3. Comparison of users vs. non-users reporting that supplemental resources provided by WMed aligned with areas of weakness identified by formative exams (Scale: 1 = Strongly disagree, 2 = Disagree, 3 = Agree, 4 = Strongly agree).

When asked to rank various features of the bricks, users ranked practice questions as the most important/useful feature of the bricks (Figure 4).

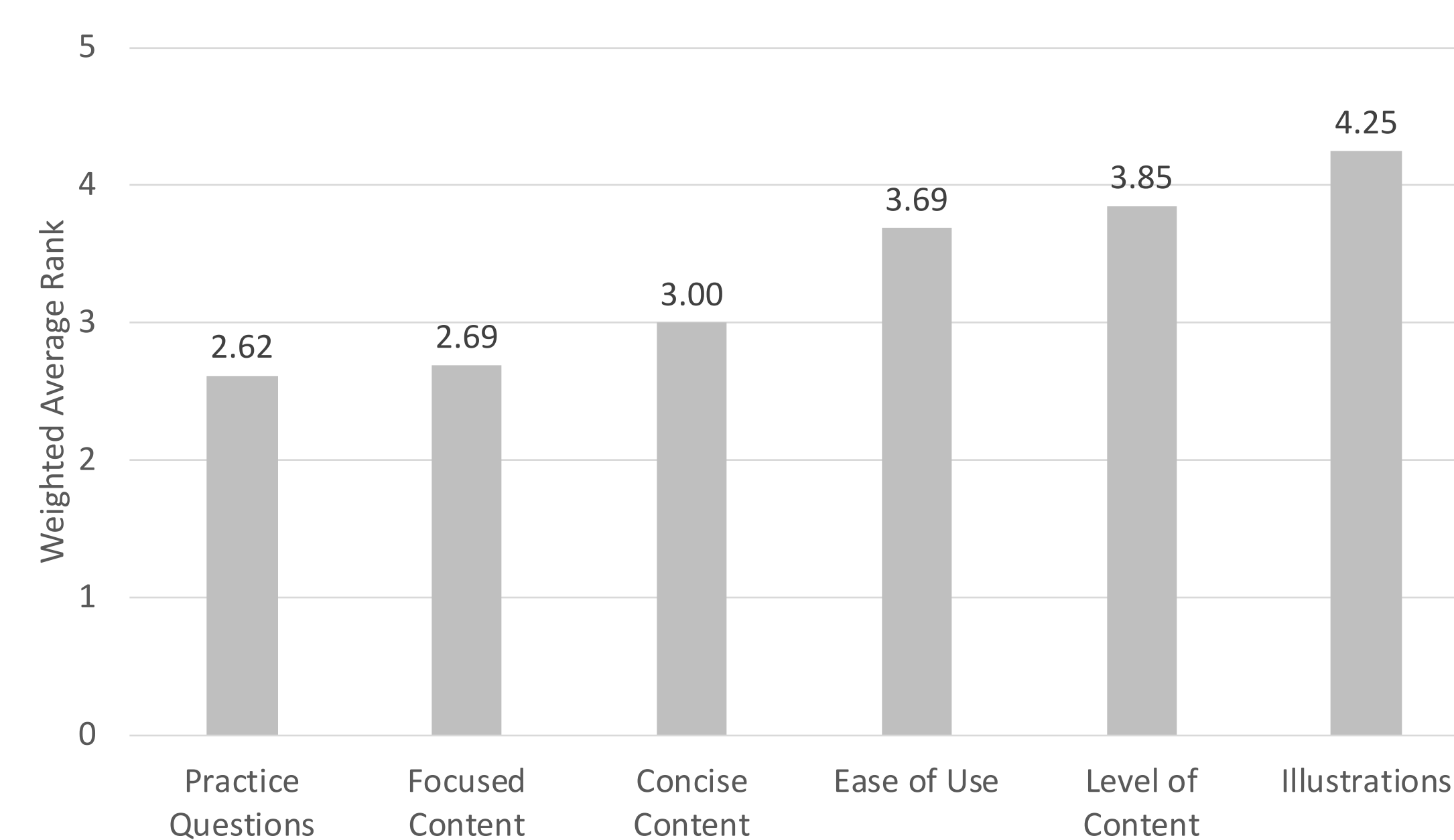


Figure 4. Ranked value of various features of the bricks. (Scale: 1 = the most important/useful feature of the brick, 2 = for the second most important/useful feature, etc.)

When asked to evaluate their agreement with statements regarding the bricks, users agreed with all positive statements but ranked positive statements on content, clarity, and readability as the statements with which they most strongly agree (Table 1).

Additionally, 86% of users agree that the bricks resemble study materials they or their peers would make for themselves.

Survey Question	Average Response
The content was clear (made sense to you after only one or two readings).	3.36
The style of presentation was written in a way that was easy to read or appealing to you.	3.36
The linkage to other content/topics was useful (integration with the bigger picture in the discipline or thread).	3.29
There was a large degree of alignment between the content in the brick and its stated objectives.	3.19
There was a large degree of connection between the basic science content in the brick and the use of that content for clinical application.	3.15
I found the questions and explanations posed at the end of the brick useful during remediation.	3.14
The bricks were engaging to use (kept your attention or interest).	3.07
There was an appropriate mix of text and illustrations.	3.07
The brick was aligned with the learning objectives in the course for which you were preparing to remediate.	3.07
The depth of content was appropriate for what I needed to learn.	3.00

Table 1. Students' evaluations of statements regarding bricks they used. (n = 13; Scale: 1 = Strongly disagree, 2 = Disagree, 3 = Agree, 4 = Strongly agree)

When asked about time spent in hours studying the areas of weakness identified by formative assessments, brick users reported an average of 2.83 hours while non-users reported an average of 6.57 hours ($p > 0.05$). For students who spent money exclusively on outside resources for use when studying areas of weakness identified by formative exams, users reported an average of \$123.75, while non-users reported an average of \$142.22 ($p > 0.05$).

Finally, we compared on summative assessment results between items for which a brick had been made available and items for which a brick was not made available. Normalizing the 2018 class to historical data, the class made a 7.4±10.3% improvement for items testing learning objectives for which bricks were available (n=23), and a 3.3±8.4% improvement on items testing learning objectives for which bricks were not made available (n=28, $p = 0.13$). Although we see a trend toward improved outcomes, this data may be limited in its significance by our relatively small sample size.

Conclusions

These results suggest that high-quality, supplemental curricular resource materials like ScholarRx© can help students efficiently study specific areas of weakness. Students agree that these resources are focused, clear, and easy to use with many practice questions. They overwhelmingly agree that they resemble study materials they would make for themselves or their peers. A larger sample size is required to demonstrate whether providing such a resource decreases time spent studying summative assessment results and total money spent on supplemental resources, as well as whether ScholarRx can improve student performance in the course.

References

¹Paul, G., Hinman, G., Dottl, S., & Passon, J. Academic development: a survey of academic difficulties experienced by medical students and support services provided. *Teaching and Learning in Medicine*, 21:3, 254-260