

## Impact of a Portfolio Program on Self-Assessment Skills Involving General Longitudinal Outcomes

Thomas Scartabello, Marie Abate,  
and Louis Slimak  
*West Virginia University*

Self-assessment is important in student and professional development. This study evaluated the impact of a structured electronic portfolio program that provided primarily global feedback on pharmacy students' self-assessment skills related to five general outcomes over a two-year period. The self-assessed outcomes, common to many academic programs, were communication/cultural competence, critical thinking/problem solving, evidence-based practice, professionalism/leadership, and teamwork/inter-professional collaboration. The primary outcome measure was a change in scores for each outcome from the students' earliest gradable submission to their latest over a two-year period, using a scoring rubric (maximum = 21 points) to evaluate self-assessment quality. Mean scores improved significantly for all outcomes. From the earliest to latest portfolio submissions across all longitudinal outcomes, rubric scores improved in 61% of submissions, remained the same in 16%, and decreased in 23%. A total of 141 submissions (41%) had a score increase of two or more points, with 45 entries (13%) increasing by > four points. Only 37 (11%) had a decrease in score of two or more points, with just nine entries (3%) showing a decrease of > four points. This article describes a unique portfolio program to develop students' self-assessment skills, including improvements that can be extrapolated to students across many academic disciplines.

Self-assessment involves analyzing one's actions, strengths, and areas for improvement, taking into account performance benchmarks and feedback. Self-assessment emphasizes the identification of strengths and weaknesses, generally based on comparisons with specific performance criteria, as well as strategies for further improvement and continued development (Desjarlais & Smith, 2011; McMillan & Hearn, 2008; Motycka, Rose, Ried, & Brazeau, 2010). It is a key component and important initial step in personal and professional development (Boud, Lawson, & Thompson, 2013; Boud, Lawson, & Thompson, 2015; Franco, Franco, Pestana, Severo, & Ferreira, 2017; Kalata & Abate, 2013). Engaging in frequent reflection—reviewing previous knowledge and experiences to gain better insight into situations or actions—and developing self-assessment skills are thought to positively impact education as well as promote lifelong learning (Briceland & Hamilton, 2010; Haldane, 2014; Lew & Schmidt, 2011; Motycka et al., 2010; Wetmore, Boyd, Bowen, & Pattillo, 2010).

Opportunities for self-assessment and reflection should be offered to all students and developing professionals (Wetmore et al., 2010). One method for accomplishing this is through portfolios. Although student portfolios vary in format and content across programs and institutions, they are generally compilations of work that can serve as the basis for reflection and self-assessment, demonstrate accomplishments, and illustrate areas for improvement (Briceland & Hamilton, 2010; Haldane, 2014; Plaza, Draugalis, Slack, Skrepnek, & Sauer, 2007; Wetmore et al., 2010). Portfolios can greatly assist students in developing and refining their skills (Briceland &

Hamilton, 2010; Kalata & Abate, 2013; Klenowski, Askew, & Carnell, 2006; Wetmore et al., 2010). The incorporation of opportunities to develop skills such as self-assessment, innovation, critical thinking, problem solving, leadership, and professionalism are meaningful in pharmacy, additional health sciences curricula, and other disciplines (Accreditation Council for Pharmacy Education, 2017; Ramia, Salameh, Btaiche, & Saad, 2016). The Accreditation Council for Pharmacy Education (ACPE), responsible for accrediting U.S. schools/colleges of pharmacy, supports the use of student portfolios in pharmacy curricula to document student progression in achieving program objectives and to develop self-assessment skills (ACPE, 2017).

Educators should facilitate the development of self-assessment in student learning (Kalata & Abate, 2013; Tsingos, Bosnic-Anticevich, Lonie, & Smith, 2015). Faculty members, tutors, and mentors can evaluate students' self-assessments, providing advice for improvement, thereby promoting informed self-analyses and decision-making (Tsingos, Bosnic-Anticevich, & Smith, 2014). The use of a standardized method, such as a rubric, to evaluate self-assessments also serves as an important student learning tool, with findings used to guide future curricular development (Tsingos et al., 2015).

Frequent self-assessment assignments throughout a program might be expected to develop self-assessment skills, particularly if the self-assessments focus on actual program work such as assignments. However, the best approaches for enhancing self-assessment skills have not been adequately studied (Boud et al., 2013, 2015). One study found that design and business students' voluntary scoring of their individual performance on tasks with defined criteria tended to converge with tutors' scores

Table 1  
*Questions for Longitudinal Outcome Portfolio Submissions*

Question no.	Question
Q1	State the name of the item you are writing about; for example, diabetes case study, pharmaceuticals quiz, patient counselling paper, etc.
Q2	List the course number and course name this assignment was in.
Q3	Briefly describe how this work helped you improve your (insert longitudinal outcome here) knowledge or skills.
Q4*	If you entered item(s) last semester/year for (insert longitudinal outcome here), what did you say that you could continue to improve, and what have you done to improve in those areas?
Q5	Briefly provide AT LEAST two examples of specific (insert longitudinal outcome here) knowledge or skills you can continue to improve.

\*Q4 not applicable for first submissions; it is only applicable for subsequent submissions.

over time, but it required the completion of most of a degree program before this convergence occurred (Boud et al., 2015). When consistent tasks were involved (e.g., written communication, verbal communication, critical thinking), convergence occurred more rapidly. Faculty often struggle with how to best enhance students' self-assessment skills throughout a curriculum in an efficient, yet effective manner. A portfolio program with frequent, repeated self-assessments might be an effective way to improve, document, and analyze student self-assessment skills while also tying these skills to specific program learning outcomes, thereby enhancing assessment (albeit indirectly) of student learning as well.

Providing students with clear expectations for high-quality self-assessments, using completed, graded assignments as the focus for their self-assessments, linking these assignments to consistent, longitudinal program outcomes, and asking students to answer focused questions for their self-assessments might help them improve as self-assessors, especially if they are asked to provide specific ways to improve and report subsequent actions taken. Thus, the objective of this study was to determine if students' self-assessment skills improved through the use of repeated portfolio self-assessment assignments with guided questions linked to broad-based educational outcomes.

## Methods

### Study Sample

Pharmacy students at our institution are required to complete self-assessments each semester as part of their portfolio curriculum requirement. Our curriculum is a full-time, four-year professional program that admits students who have completed at least two years of prerequisite coursework. A revised curriculum, initiated

with the entering first-year students, began in the fall 2015 semester (graduating class of 2019).

### Portfolio Requirements

RxOutcome (CORE Higher Education Group, West Warwick, RI) is used for the electronic portfolio system. As part of the pharmacy portfolio in this study, students assessed their skills in five skills-related longitudinal outcomes: (1) communication/cultural competence, (2) critical thinking/problem solving, (3) evidence-based practice (use of best available evidence and professional judgment in decision-making), (4) professionalism/leadership, and (5) teamwork/inter-professional collaboration. Identified by the pharmacy faculty as skills that cross subject matter, these outcomes are important general abilities that pharmacy practitioners should possess and are reinforced across the professional curriculum. Some outcomes were grouped together under the same heading in the portfolio to help focus the outcomes, since aspects of one overlapped with and complemented another. These included communication (including written and verbal) and cultural competence; critical thinking and problem-solving; professionalism and leadership; and teamwork and inter-professional collaboration.

Each semester, students were required to select completed, graded assignments/exercises from their portfolio coursework involving knowledge or skills encompassed by the longitudinal outcomes and to answer focused questions (see Table 1) about their learning and aspects for improvement. For outcomes involving two components, such as critical thinking and problem-solving, students were asked to describe how the portfolio work submitted specifically improved their skills, and how they could continue to improve those skills, in one and/or both areas. Students were also given definitions and examples of each individual component of an outcome, such as the differences between critical

thinking and problem-solving, and the definition and components of cultural competence so they would recognize the characteristics of each individual skill.

During their first three professional program semesters, incoming fall 2015 students were required to add at least one graded assignment or exercise from each required pharmacy course and the answered self-assessment questions to their portfolios. Thus, each outcome had at least one entry by the end of the academic year, with a minimum of five or six portfolio entries during that time period. During their fourth semester (spring 2017), students could select one or more relevant assignments from *any* required or elective professional course, so that each outcome during a semester had at least one entry accompanied by the answered self-assessment questions. This resulted in the same number of entries per semester and guaranteed that each outcome had at least one entry per semester. The portfolio component was pass/fail based upon students' completion of the requirements each semester instead of letter graded. Thus, a student's self-assessment, whether or positive or negative, did not factor into an actual grade.

At the start of the fall 2015 semester, students were required to attend an hour-long orientation about portfolios, their purpose, the portfolio requirements for that semester, and general expectations for the self-assessments. Students were also required to attend another hour-long portfolio session at the beginning of each subsequent semester, during which examples of model self-assessments were shared with students along with the features that constituted an excellent self-assessment.

### Outcome Measures

This study reviewed portfolio self-assessments from pharmacy students who completed their second year of the professional program in spring 2017 to ensure the availability of two years of data for this

study. Student entries were submitted to the portfolio over three semesters: spring 2016, fall 2016, and spring 2017. Portfolio entries from the first semester, fall 2015, were not included because Q4 (see Table 1) was not yet applicable for scoring.

A specially designed rubric was developed to determine the quality of the students' self-assessments. The investigators searched the published literature for rubrics previously created for similar purpose and adapted the rubric's performance criteria from previously published reflective and self-assessment rubrics to ensure content validity (Tsingos et al., 2015; Wetmore et al., 2010). The investigators incorporated elements that highlighted key components of a high-quality self-assessment such as descriptiveness, specificity, relevance, etc. Inter-rater reliability (Intraclass correlation coefficient [ICC]) on a draft rubric was determined by comparing results from two of the investigators who used the rubric independently to grade the same sample of 36 random submissions (student names removed; a mix of earliest and latest gradable submissions). The investigators obtained an ICC score of 0.72, indicating good inter-rater reliability. Next, the investigators discussed score discrepancies and made minor wording changes to the final version of the rubric used for scoring (see Appendix). Finally, one investigator used the completed rubric to score the quality of each student self-assessment for consistency.

Student entries for all five longitudinal outcomes were analyzed. Randomly assigned numbers replaced student names prior to the review and scoring of the self-assessments and for grade point average (GPA) analyses. For each portfolio outcome, the rubric score for the students' earliest gradable submission was compared with their score on their latest (i.e., most recent) gradable submission.

Table 2  
*Differences Between Mean Scores from Earliest to Latest Entries*

Longitudinal outcome	<i>n</i>	<i>M</i> score (range): <i>M</i> score (range):		<i>MD</i>	95% CI	<i>p</i> *
		First entry	Last entry			
Communication/cultural competence	68	17.40 (12-21)	18.16 (13-21)	0.76	0.21-1.32	0.0075, 0.012
Critical thinking/problem solving	74	16.26 (11-21)	17.03 (12-21)	0.77	0.26-1.30	0.0048
Evidence-based practice	73	15.96 (11-20)	17.79 (12-21)	1.84	1.32-2.36	< 0.0001
Professionalism/leadership	55	16.45 (10-21)	17.67 (13-20)	1.22	0.73-1.71	< 0.0001
Teamwork/inter-professional collaboration	73	16.92 (13-21)	17.49 (14-21)	0.57	0.10-1.05	0.017, 0.0031
Mean (all outcomes combined)	74	16.58	17.59	1.01	0.73-1.29	< 0.0001

*Note.* \*Values from paired *t* test and Wilcoxon signed-rank tests, respectively; both identical if only one value listed.

The change in rubric score from the baseline (i.e., earliest gradable entry) to the end (i.e., latest gradable entry) provided the primary measure for each outcome. Scores ranged from a minimum of seven points to a maximum of 21 points for each submission. If students entered multiple submissions for the same outcome in a semester, only the first was evaluated as their earliest gradable entry, and only the latest submission was evaluated for their second gradable entry. Secondary outcome measures included: (a) the relationship of the changes in rubric scores to the baseline (earliest) gradable submission scores, (b) the correlation between average earliest submission rubric scores (across all outcomes) and professional program GPA, and (c) the correlation between earliest submission rubric scores for each individual outcome and professional program GPA.

### Data Analysis

Rubric scores were analyzed as both continuous and ordinal data using a paired *t* test and Wilcoxon signed-rank test, respectively. Scores for each of the five longitudinal outcomes were analyzed separately. Pearson correlation was used to analyze the correlation between rubric scores and professional program GPAs. Statistical significance was determined if  $p \leq 0.05$ .

### Results

Portfolio data from all students ( $N = 74$ ) in the entering pharmacy class during fall 2015 were reviewed, with the following numbers of students analyzed for each longitudinal outcome: communication/cultural competence ( $n = 68$ ), critical thinking/problem solving ( $n = 74$ ), evidence-based practice ( $n = 73$ ), professionalism/leadership ( $n = 55$ ), and teamwork/inter-professional collaboration ( $n = 73$ ). The numbers analyzed varied depending on the complete submissions (earliest and latest) present for each outcome during the study period. A total of 343 paired entries were analyzed across the longitudinal outcomes. A total of 50 students had complete, gradable paired entries for all five outcomes.

The mean scores and differences between mean scores for the earliest and latest gradable entries are shown in Table 2 for each outcome, individually and combined. All scores improved from the first to last entries with statistically significant gains. Mean improvement was greatest in the evidence-based practice domain, with an increase of almost two points, and smallest in the teamwork/inter-professional collaboration domain.

To illustrate the type of improvement that was observed in portfolio entries, an example is provided of a student who showed a large increase (six points) in their rubric scores from their earliest to latest submissions. This student's responses to questions 3-5 on their first communication self-assessment follow. The student

referred to an uploaded assignment for the self-assessment and received a rubric score of 13 on this first submission due to a lack of clarity and descriptiveness. Q3: "It helped me learn to communicate my thoughts and opinions in a written manner." Q4: "Last semester was based on a PowerPoint presentation and included speech and transitions. I have slowed my speech in recent presentations as well as improve on transitions, both orally and written." Q5: "I can better communicate my ideas in a written manner as well as improve on the style of writing, to ensure understanding by patients, professors, and many more."

This same student's responses on their latest communication self-assessment are shown below. The rubric score increased to 19, and the responses clearly demonstrate greater thought and detail compared to the first entry. The student could have achieved a higher rubric score on this last entry by providing specific improvement strategies for communication skills and writing style. Q3:

This assignment helped me communicate information in a way that made it possible for people that are not used to scientific language to understand. I was able to write in a way that patients are able to understand.

Q4:

Better communicate my ideas in a written manner and also improve my writing style so people can understand what I am presenting better. I have improved the way I communicate my written ideas by spending more time developing my thoughts and ensuring that they sound correct before I write them down on paper. I also critiqued my writing style so that it comes across more professional and more understandable towards the readers. I did so by brushing up on my English skills and proof reading the papers that I write.

Response to Q5:

I can do a better job of communicating with others from other cultures in a way that makes them feel comfortable. I have been criticized for not seeing things from their side of the culture spectrum. I can also continue to improve my writing style so that I am more understandable when I write.

Overall, from the earliest to the latest submissions across all longitudinal outcomes, rubric scores improved in 61% of the submissions, remained the same in 16%, and decreased in 23%. The degree of change in the self-assessment scores is shown in Table 3. Larger changes in scores occurred for those with

Table 3  
*Degree of Rubric Score Changes From Earliest to Latest Submissions*

Longitudinal outcome (Total <i>n</i> )	No. of entries with indicated change						
	Increase			No change	Decrease		
	≥ 4 points	2 to 3 points	1 point	0 points	1 point	2 to 3 points	≥ 4 points
Communication/cultural competence (68)	9	14	11	16	7	10	1
Critical thinking/problem solving (74)	11	17	14	11	9	9	3
Evidence-based practice (73)	17	18	18	8	11	1	0
Professionalism/leadership (55)	5	23	7	10	6	4	0
Teamwork/inter-professional collaboration (73)	3	24	16	11	10	4	5
Total (343)	45	96	66	56	43	28	9

Table 4  
*Changes in Latest Submission Scores Based on Earliest Submission Scores*

Earliest submission score	Entries with indicated change <i>n</i> (%)		
	Increase	No change	Decrease
18 or less	197 (73%)	37 (14%)	34 (13%)
19 or greater	10 (13%)	19 (25%)	46 (62%)

Table 5  
*Correlations Between Portfolio Submission Scores and Grade Point Average*

	<i>n</i>	<i>r</i>	<i>p</i>
Average earliest submission score across all outcomes and professional program GPA (end of second year)	74	.467	< .001
Average earliest submission score for communication/cultural competence and professional program GPA (end of second year)	74	.250	.032
Average earliest submission score for critical thinking/problem solving and professional program GPA (end of second year)	74	.394	.001
Average earliest submission score for evidence-based practice and professional program GPA (end of second year)	74	.504	< .001
Average earliest submission score for professionalism/leadership and professional program GPA (end of second year)	74	.265	.051
Average earliest submission score for teamwork/inter-professional collaboration and professional program GPA (end of second year)	74	.332	.004
Average earliest submission score of 16 or less across all outcomes and professional program GPA (end of second year)	28	.553	.002
Average earliest submission score of 16 to 18 across all outcomes and professional program GPA (end of second year)	29	.112	.562
Average earliest submission score across all outcomes of 18 and above and professional program GPA (end of second year)	17	.258	.318

*Note.* GPA = grade point average.

improvement in their submissions compared to those with worsening skills. Across all outcomes, 141 (41%) had an increase in rubric scores of two or more points, with 45 entries (13%) showing an increase of at least four points or more. In contrast, only 37 (11%) had a decrease in score of two or more points, with just nine

entries (3%) showing a decrease of at least four points or more.

Further analyses of each pair of portfolio entries broken down by the earliest submission score are seen in Table 4. Low- to mid-range scorers (i.e., rubric score ≤ 18) on the earliest submissions were more likely to

improve in later submissions and were less likely to show score decreases compared to initial high-range scorers (i.e., rubric score  $\geq 19$ ).

Figures 1-5 show a further breakdown of the change in rubric scores from the initial to the latest score for each longitudinal outcome. Overall, most students improved their rubric scores. For each outcome, the mid-range scorers, with an initial rubric score of 13 to 15 or 16 to 18, most frequently improved. The greatest actual number of improved scores occurred for students with earliest submission scores in the 16 to 18 range, although proportionately more students with earliest scores in the 13 to 15 range improved compared to the 16 to 18 range (84.3% vs. 67.1%, respectively). Ten of the 12 students with an initial rubric score 12 or lower in any outcome improved their rubric scores on the last submission. High-range scorers, with an initial rubric score of 19 to 21, had a decrease in score more often than no change or an increase (see Table 4). Of the 46 high-range scorers with a decrease in rubric scores, 27 students (59%) had less than a two-point decrease. Of the remaining 19 students, the larger score decreases occurred for self-assessments in two domains: teamwork/inter-professional collaboration and critical thinking/problem solving.

Statistically significant correlations existed between the students' professional program GPAs and their rubric scores both overall and for each longitudinal outcome, with the exception of professionalism/leadership (see Table 5). A moderately strong, statistically significant positive correlation was found between the professional program GPA and students' mean rubric scores for the earliest submissions across outcomes for students whose initial scores were 16 or below.

### Discussion

The ability of students to self-assess their knowledge and skills is important for personal and professional development as well as the educational process (Franco et al., 2017; Haldane, 2014; Lew & Schmidt, 2011; Motycka et al., 2010; Wetmore et al., 2010). However, students are often unfamiliar or inexperienced with self-assessment practices. They may be unsure about the purpose or value of a portfolio and how it will be evaluated. In addition, although faculty in disciplines such as pharmacy might be required by accreditation or other standards to promote students' self-assessment skills (ACPE, 2017), accomplishing this can be unclear and confusing. The majority of our students demonstrated an overall improvement over time in self-assessment skills related to five general longitudinal program outcomes, with minimal intervention on the part of faculty members.

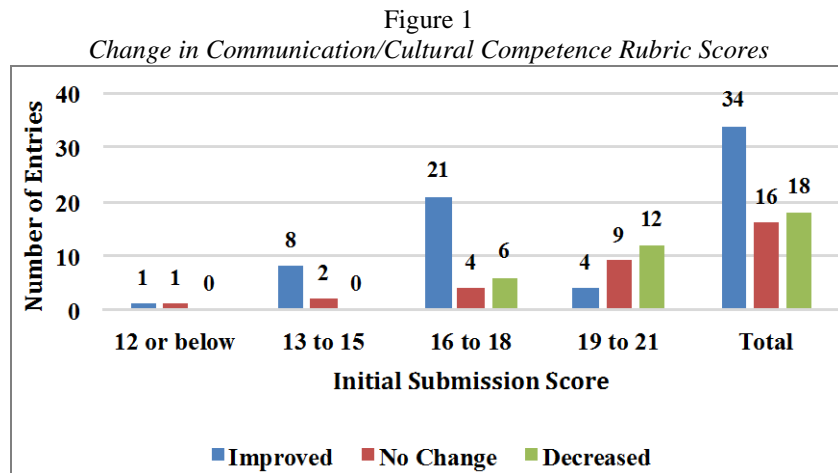
Instructions and examples of appropriate self-assessments were posted online for students, which likely helped them improve over time. Direct feedback was also provided to a relatively small number of students with missing or unacceptable submissions each semester to indicate needed changes. Overall, the portfolio itself provided students with the opportunity to individually hone their self-assessment skills with time and experience. The specific outcomes, including communication/cultural competence, critical thinking/problem solving, evidence-based practice, professionalism/leadership, and teamwork/inter-professionalism, are important skills in most academic disciplines. Thus, the findings from this study are applicable to a variety of subject areas and programs.

Adding more structure and guidance might clarify portfolio expectations for students, but our program believes in a balance between freedom of thought and "expected" writing (Franco et al., 2017). Our portfolio structure was designed to help achieve this balance. In this study, as we have shown, students selected the completed, graded exercises or assignments from their coursework each semester. They chose to enter and place them in the longitudinal outcome folder(s) they felt were most relevant. They were given some guidance for their self-assessments in the form of a small number of focused, specific questions to address, but they could answer the questions as they wished.

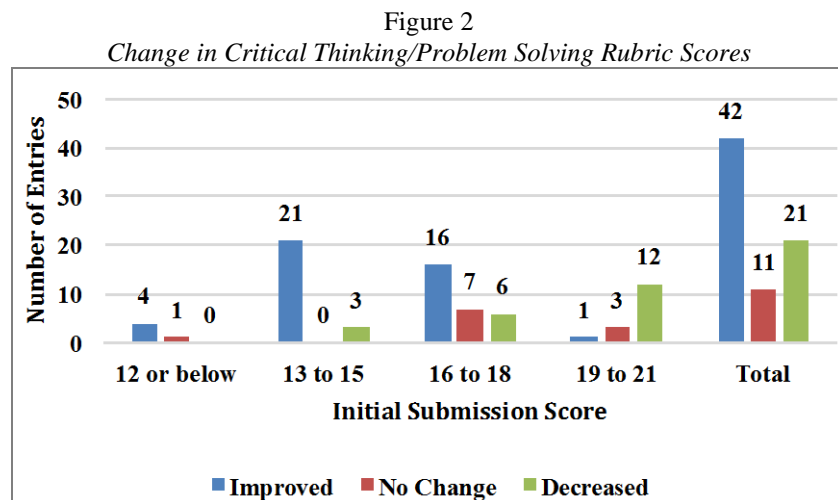
This structure and balance served our students well. At the beginning of each semester, students received instructions for portfolio access/use and were given a few examples of thoughtful, well-written answers to questions completed by previous students to illustrate desired features in a self-assessment. A staff member used a checklist at the end of each semester to ensure that students met the requirements for the number of portfolio entries and that all questions were answered for each entry.

Any checklist item scored as "not completed" resulted in the system (RxOutcome) automatically generating a response to the student that their portfolio was not satisfactory and needed to be corrected; students could view the checklist and comments provided to determine the changes needed. The staff member shared the names of students with unacceptable or missing portfolio entries with the portfolio director, who followed up with students as needed to ensure the work was done.

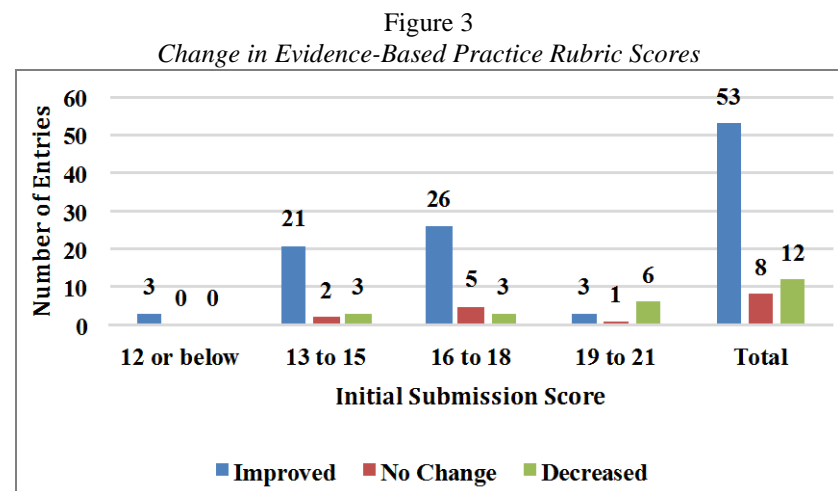
Consistent with previous research (Boud et al., 2013, 2015), our mid-range scorers had the largest number of improved self-assessment rubric scores from their earliest to latest portfolio submissions and high-range scorers (i.e.,  $\geq 19$ ) were more likely to have a decrease or no change in scores. An explanation for the pattern with high-range scorers is that they may have already had well-developed self-assessment skills at



Note. Number of entries with the indicated change in communication/cultural competence rubric score from the initial to the latest submission, based upon initial submission score.

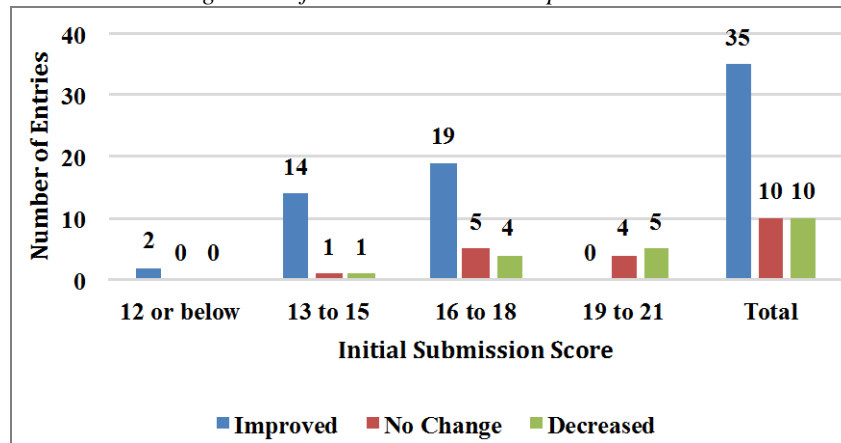


Note. Number of entries with the indicated change in critical thinking/problem solving rubric score from the initial to the latest submission, based upon initial submission score.



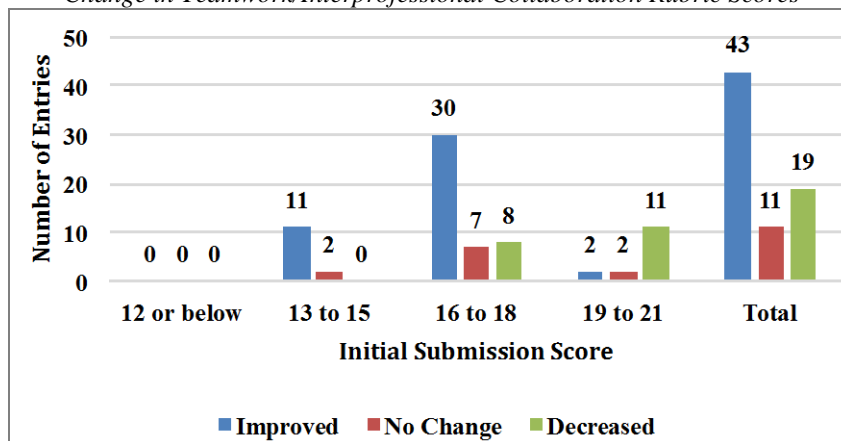
Note. Number of entries with the indicated change in evidence-based practice rubric score from the initial to the latest submission, based upon initial submission score.

Figure 4  
*Change in Professionalism/Leadership Rubric Scores*



Note. Number of entries with the indicated change in professionalism/leadership rubric score from the initial to the latest submission, based upon initial submission score.

Figure 5  
*Change in Teamwork/Interprofessional Collaboration Rubric Scores*



Note. Number of entries with the indicated change in teamwork/interprofessional collaboration rubric score from the initial to the latest submission, based upon initial submission score.

baseline, and therefore had less room for improvement (Boud et al., 2015). For over half of the high-range scorers with a decrease in their scores for any of the outcomes, the decrease was small (one or two points). In most of these cases, their latest scores were still fairly high, demonstrating acceptable self-assessment skills. A possible explanation for the pattern among low- to mid-range scorers is that those students may have had less developed self-assessment and judgmental skills at baseline, or they might not have put forth sufficient effort, especially if they did not understand or appreciate the purpose and benefits of self-assessment. Most of these individuals showed improvement in their last self-assessment rubric scores after subsequent practice and experience.

Of the five longitudinal outcomes that were the focus of the self-assessments, the greatest improvement in rubric scores occurred in the evidence-based practice domain ( $MD = 1.84$  points). This could be explained by the fact that students had little evidence-based practice exposure in the curriculum until after their first gradable portfolio entry was due. For future portfolio improvements, more explanation regarding evidence-based practice could be provided to first-year students, or students could be required to address this outcome only after they have completed a required evidence-based practice course during their second year of the curriculum. In contrast, students demonstrated the least improvement in the teamwork/inter-professional collaboration domain ( $MD = 0.57$ ). The mean score for the earliest submission was relatively higher for this outcome compared to the others,



which may have contributed to a smaller number of improved scores for this outcome. Alternatively, students might have had more difficulty self-assessing this particular area. This is also consistent with the finding that teamwork/inter-professional collaboration was one of the outcomes in which a small number of higher scorers on their initial submission experienced larger decreases in subsequent scores.

An interesting finding in this study is that moderate to weak statistically significant positive correlations were observed between students' initial rubric scores and their GPAs. The stronger of these correlations ( $r = 0.55$ ) was found for students with lower initial scores of 16 or more. It might be beneficial to provide focused self-assessment guidance and tailored advice to students with relatively low GPAs, especially when a first self-assessment is observed to have substantial deficiencies.

Portfolio programs vary across institutions and are often evolving in an effort to improve students' reflective and self-assessment skills. For our current portfolio requirement, a tutor or mentor was not assigned to each individual student due to increased faculty workloads with the implementation of a new curriculum. Personnel limitations might also be common to other institutions, especially during times of budgetary cutbacks or concerns. We found significant improvement in most students' self-assessment skills across longitudinal outcomes through the use of many practice opportunities but with minimal individual faculty-student interactions. Perhaps students' self-assessment skills could be improved to a greater extent by providing them with more exemplary portfolio self-assessment examples. Additionally, as students progress through each semester, a number of interested faculty could review most, or a broad sampling of, self-assessment entries and provide formative feedback to individuals or to the student body as a whole.

This study had several strengths, including the relatively large number of portfolio entries analyzed over a two-year period. Self-assessments focused on five general longitudinal outcomes, which provided insight into possible differences in self-assessment proficiency involving specific domains. A rubric for evaluating the quality of student portfolio entries was created and validated to quantify changes in self-assessment skills. Finally, student GPAs might be used to identify individuals who could benefit from greater assistance or intervention to improve self-assessment skills.

Although the study involved a two-year period, one limitation is that it is unknown whether students' self-assessment skills would improve with additional semesters of portfolio use. Future studies should evaluate students with prolonged portfolio experience to determine if further improvements occur with ongoing practice. Another limitation is that only one class year of students was analyzed in this study.

Additional research can determine whether consistent results are found among various student classes within and outside of an academic program. It is also possible that improvements found in our students' self-assessment skills resulted from other curricular experiences and not the portfolio assignments themselves. However, the assignments reinforced these skills, and they proved to be a good tool for evaluating the quality of the self-assessments. In addition, it should be noted that the pharmacy students in this study as a group may be both high-performing and highly motivated given the focused nature of the program and admission requirements. The broad applicability of this portfolio approach for use in general education programs or programs with less stringent admission requirements needs further study.

The portfolio program described in this study involved longitudinal outcomes applicable to many other disciplines. The Association of American Colleges and University's (AAC&U) LEAP Essential Outcomes and Valid Assessment of Learning in Undergraduate Education (VALUE) rubrics encompass most of the longitudinal outcomes, or important components of these outcomes, that were analyzed (AAC&U, 2017). A marriage of AAC&U LEAP outcomes assessment with a portfolio program such as this could support and enhance the self-assessment skills of students in any discipline, while simultaneously tying these skills to other program learning outcomes. This approach could be of particular value when assessing common general education or institutional outcomes such as critical thinking, cultural competence, and the ability to work on teams, which are often only tangentially related to course content and a program's curriculum and can be difficult to teach and assess in their own right.

## Conclusion

Self-assessment skills are important for student and professional development, and the portfolio is a useful tool to promote this development. Overall, this study found that students' self-assessment skills related to specific longitudinal outcomes significantly improved through the use of repeated self-assessment entries in a portfolio. Initial self-assessments by students that received a mid-range rubric score showed the largest extent of improvement. This type of portfolio can help improve students' self-assessment skills while allowing faculty to analyze self-assessment performance, thereby providing another powerful indirect measure of student learning within a program. Greater guidance and specific formative feedback might be needed for students who experience problems with initial self-assessments, especially for those who might be struggling to a

greater extent academically, as evidenced by lower GPAs. Institutions should consider implementing a portfolio program to improve students' self-assessment skills.

### References

- Accreditation Council for Pharmacy Education (ACPE). (2015). *Accreditation standards and guidelines for the professional program in pharmacy leading to the doctor of pharmacy degree*. Retrieved from <https://www.acpe-accredit.org/pdf/Standards2016FINAL.pdf>
- Association of American Colleges & Universities (AAC&U). (2017). *VALUE rubric development project*. Retrieved from <https://www.aacu.org/value/rubrics>
- Boud, D., Lawson, R., & Thompson, D. G. (2013). Does student engagement in self-assessment calibrate their judgement over time? *Assessment & Evaluation in Higher Education*, 38(8), 941-956. doi:10.1080/02602938.2013.769198
- Boud, D., Lawson, R., & Thompson, D. G. (2015). The calibration of student judgement through self-assessment: disruptive effects of assessment patterns. *Higher Education Research and Development*, 34(1), 45-59. doi:10.1080/07294360.2014.934328
- Briceland, L. L., & Hamilton, R. A. (2010). Electronic reflective student portfolios to demonstrate achievement of ability-based outcomes during advanced pharmacy practice experiences. *American Journal of Pharmaceutical Education*, 74(5), Article 79. doi:10.5688/aj740579
- Desjarlais, M., & Smith, P. (2011). A comparative analysis of reflection and self-assessment. *International Journal of Process Education*, 3(1), 3-18.
- Franco, R. S., Franco, C., Pestana, O., Severo, M., & Ferreira, M. A. (2017). The use of portfolios to foster professionalism: attributes, outcomes, and recommendations. *Assessment & Evaluation in Higher Education*, 42(5), 737-755. doi:10.1080/02602938.2016.1186149
- Haldane, T. (2014). "Portfolios" as a method of assessment in medical education. *Gastroenterology and Hepatology From Bed to Bench*, 7(2), 89-93.
- Kalata, L. R., & Abate, M. A. (2013). A mentor-based portfolio program to evaluate pharmacy students' self-assessment skills. *American Journal of Pharmaceutical Education*, 77(4), Article 81. doi:10.5688/ajpe77481
- Klenowski, V., Askew, S., & Carnell, E. (2006). Portfolios for learning, assessment and professional development in higher education. *Assessment & Evaluation in Higher Education*, 31(3), 267-86. doi:10.1080/02602930500352816
- Lew, M. D. N., & Schmidt, H. G. (2011). Self-reflection and academic performance: Is there a relationship? *Advances in Health Sciences Education: Theory and Practice*, 16(4), 529-545. doi:10.1007/s10459-011-9298-z
- McMillan, J. H., & Hearn, J. (2008). Student self-assessment: The key to stronger student motivation and higher achievement. *Educational Horizons*, 87(1), 40-49.
- Motycka, C. A., Rose, R. L., Ried, L. D., & Brazeau, G. (2010). Self-assessment in pharmacy and health science education and professional practice. *American Journal of Pharmaceutical Education*, 74(5), Article 85. doi:10.5688/aj740585
- Plaza, C. M., Draugalis, J. R., Slack, M. K., Skrepnek, G. H., & Sauer, K. A. (2007). Use of reflective portfolios in health sciences education. *American Journal of Pharmaceutical Education*, 71(2), Article 34. doi:10.5688/aj710234
- Ramia, E., Salameh, P., Btaiche, I. F., & Saad, A. H. (2016). Mapping and assessment of personal and professional development skills in a pharmacy curriculum. *BMC Medical Education*, 16(19), 1-13. doi:10.1186/s12909-016-0533-4
- Tsingos, C., Bosnic-Anticevich, S., Lonie, J. M., & Smith, L. (2015). A model for assessing reflective practices in pharmacy education. *American Journal of Pharmaceutical Education*, 79(8), Article 124. doi:10.5688/ajpe798124
- Tsingos, C., Bosnic-Anticevich, S., & Smith, L. (2014). Reflective practice and its implications for pharmacy education. *American Journal of Pharmaceutical Education*, 78(1), Article 18. doi:10.5688/ajpe78118
- Wetmore, A.O., Boyd, L. D., Bowen, D. M., & Pattillo, R. E. (2010). Reflective blogs in clinical education to promote critical thinking in dental hygiene students. *Journal of Dental Education*, 74(12), 1337-1350.

---

THOMAS SCARTABELLO, at the time of writing, was a resident in the West Virginia University-Mylan Pharmaceuticals, Inc., joint drug information residency program. His responsibilities consisted of assisting in the operation of the academic drug information center as well as the evidence-based practice curriculum. He was present as a professional resource and mentor for students in the professional pharmacy program. After gaining experience in the pharmaceutical industry, he is now a Manager of Global Medical Information and Medical Review at Alexion Pharmaceuticals.

MARIE ABATE is Professor of Clinical Pharmacy at West Virginia University School of Pharmacy. She serves as Director of Programmatic Assessment and Director of the WV Center for Drug and Health Information. She chairs the school's Educational

Outcomes Assessment Committee that collects/analyzes assessment data and manages the portfolio program in the four-year professional Doctor of Pharmacy degree program. She teaches the evidence-based practice course and precepts senior students during drug information rotations. Her research and publications currently focus on evaluating the success of educational methods including portfolios and analyzing the characteristics of drug-related deaths in West Virginia.

LOUIS SLIMAK is the Director of Academic Excellence and Assessment for West Virginia University. He chairs the University Assessment Council and serves on the West Virginia State Assessment Council, which brings together assessment professionals across all of West Virginia's public higher education institutions to collaborate on the assessment of West Virginia students. His current position does not require teaching responsibilities, but he was full-time English faculty and department chair previously.

Appendix  
Portfolio Self-Assessment Evaluation Rubric

	<b>Poor 1</b>	<b>Fair 2</b>	<b>Excellent 3</b>	<b>Score</b>
<b>Describes the experience</b>	Description either missing or unable to determine what the experience involved.	Provides an incomplete or vague description of the experience.	Provides a complete, specific description of the experience.	
<b>Relates the experience to the desired outcome</b>	Provides no association between the experience and the outcome.	Provides a vague or incomplete association between the experience and the outcome.	Provides a complete and clear association between the experience and the outcome.	
<b>Implementation of previously stated ways to improve*</b>				
<b>Includes previously stated ways to improve</b>	No previous ways to improve are included.	Some, but not all, previous ways to improve are included.	All previous ways to improve are included.	
<b>Describes previous ways to improve and specific strategies for improvement</b>	Description is not detailed or explicit for any previous ways to improve, and strategies for improvement are missing.	Description lacks detail or explicitness for some previous ways to improve, or some strategies for improvement are missing or vague/unclear.	Description is both detailed and explicit for all previous ways to improve and specific strategies for improvement.	
<b>Indicates change in behavior</b>	Provides no mention of a change in behavior for any previous ways to improve.	Provides mention of a change in behavior but includes little to no explanation or evidence (if applicable) for one or more of the previous ways to improve.	Completely/clearly explains a change in behavior, with evidence (if applicable) for all previous ways to improve.	
<b>Provision of new ways to improve</b>				
<b>Describes new ways to improve and specific strategies for future improvement</b>	Description is not detailed or explicit for any new ways to improve, and strategies for improvement are missing.	Description lacks detail or explicitness for some new ways to improve, or some strategies for improvement are missing or vague/unclear.	Description is both detailed and explicit for all new ways to improve and specific strategies for improvement.	
<b>Provides new ways to improve that are relevant and distinct</b>	No new ways to improve are relevant to the outcome.	Only some new ways to improve are relevant to the outcome, while others are partly or vaguely relevant; <b>OR</b> all ways to improve are relevant but are vaguely distinct and partly overlap.	All new ways to improve are clearly relevant to the outcome and are clearly distinct.	
			<b>TOTAL SCORE:</b> (Maximum score = 21)	

\*This section is not applicable for first submissions; it is only applicable for subsequent submissions