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Table of Contents

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Metacognition and Music: An Investigative Study Among Collegiate Piano Majors

by Steven Brundage

Successful learners rely on habits of self-awareness and self-evaluation; they are independent, capable of assessing task-difficulty, strategizing towards task-completion, and appraising outcomes (Pogonowiski, 1989). They have mastered rudimentary skills of planning, organizing, and monitoring progress; they do not exclusively rely on teacher-input (Byo and Cassidy, 2008).

They independently manage their own emotional states when faced with challenges and setbacks, they are less prone to discouragement, and they are self-motivated, aware of their own limitations and potential (Cross and Paris, 1988). They possess a diverse set of domain-transcendent and domain-specific skills—among them, overarching and fundamental, are skills of metacognition (Miklaszewski, 1989).

And so, this article presents the results from research that sought to measure self-reported metacognitive habits among collegiate piano majors. It examines the degree to which participants comprehend and employ practice strategies, recognize their own strengths and weaknesses in learning and performing, accurately predict a performance outcome, and self-evaluate following a performance.

It explores domain-general and -specific definitions of metacognition, advocates for further metacognitive study, and lists the methodology, results, and conclusions from the study. Here, understanding and applying metacognitive theory to piano pedagogy may hold the potential to provide piano teachers with strategies for developing more capable and self-sufficient learners and performers. To that end, this research aims to promote further discussion and investigation into metacognition and its relationship to piano learning, teaching, and performing.

Towards Defining Metacognition

Introduced in 1979, American developmental psychologist John H. Flavell defined metacognition as "one's own knowledge concerning one's cognitive processes and products or anything related to them" (Flavell, 1979, p. 906). Flavell offered the following: "I am engaging in metacognition … if I notice that I am having more trouble learning A than B, if it strikes me that I should double-check C before accepting it as a fact, if it occurs to me that I had better scrutinize each and every alternative in any multiple-choice-type task situation before deciding which is the best one."

Flavell continued, "if I become aware that I am not sure what the experimenter really wants me to do, if I sense that I had better make a note of D because I may forget it, if I think to ask someone about E to see if I have it right. Such examples could be multiplied endlessly" (p. 232). Flavell believed that metacognition referred, among other things, to the active monitoring and consequent regulation of cognitive processes, usually in the service of some objective.

Others have described metacognition as "our ability to know what we know and what we don't know. . . . our ability to plan a strategy for producing what information is needed, to be conscious of our own steps and strategies during the act of problem solving, and to reflect on and evaluate the productivity of our own thinking" (Costa, 1984, p. 57). Cross and Paris defined metacognition

as “the knowledge and control [individuals] have over their own thinking and learning activities” (Cross and Paris, 1988, p. 131).

More recently, Taylor described metacognition as “an appreciation of what one already knows, together with a correct apprehension of the learning task and what knowledge and skills it requires, combined with the agility to make correct inferences about how to apply one’s strategic knowledge to a particular situation, and to do so efficiently and reliably” (Taylor, 1999, p. 34).

In its simplest form, metacognition refers to “cognition about cognition,” the root word “meta” meaning “beyond” and “cognition” being defined as “the act or process of knowing in the broadest sense” (Merriam-Webster, 2016). So, a transliteration of the word may be understood as “beyond cognition” or “beyond thinking.”

The genesis of metacognition may be traced to the late 1970s during a time when educators determined that content-only driven instruction did not produce independent, effective thinkers (Presseisen, 1986). Thus began an emphasis on teaching students thinking skills, such as critical, creative, and higher-order thinking.

Presseisen believed metacognition to be the most striking aspect of training students in higher-order thinking, describing it as encompassing “the learning to learn skills aimed at making thinking more conscious and the student more aware of the ways one can go about problem solving or decision making” (Presseisen, 1986).

In this context, some researchers categorize metacognition as a “boss” function that enables individuals to properly plan, monitor, and evaluate cognitive actions (Halpern, 1998). Similarly, others view metacognition as the “central processor” of thinking (Brown, 1978, p. 81).

Metacognition in Two-Parts: Cognitive Knowledge and Cognitive Regulation

Just as Flavell defined it, researchers believe metacognition to comprise two parts: (1) cognitive knowledge and (2) cognitive regulation (Schraw, 1998; Cross and Paris, 1988; Flavell, 1979).

Cognitive knowledge refers to what an individual knows about cognition and can be classified in three ways: (1) person variables; (2) task variables; and (3) strategy variables. “Person” variables represent the knowledge about an individual’s own strengths and weaknesses as they pertain to learning and processing information.

“Task” variables denote the awareness one has for evaluating the complexities of a task as well as the demands required to complete the task. Lastly, “strategy” variables signify the active methods one employs when encountering a learning or problem-solving situation.

Livingston offers the example, “I know that I (person variable) have difficulty with word problems (task variable), so I will answer the computational problems first and save the word problems for last (strategy variable)” (Livingston, 1997).

The second part of metacognition (cognitive regulation) includes elements of planning, monitoring, and evaluating (Paris and Winograd, 1990). Planning is multifaceted, involving goal

setting, allocation of resources, time management, as well as awareness and selection of learning strategies.

Monitoring, which can be understood as regulating, includes attending to and being aware of comprehension and task performance. Effective monitoring often involves self-testing. Lastly, evaluation is described as the appraisal of one's learning in regards to measuring its products against goals.

Naturally, researchers have identified connections between cognitive knowledge and cognitive regulation. Both Schraw (1998) and Flavell (1979) assert that one enables the other, though each describes the experience somewhat differently. Schraw contends that cognitive knowledge facilitates cognitive regulation and quite similarly, Flavell (1979) reasons that cognitive regulation begets cognitive regulation.

Metacognition in Music Research

In theory, metacognition can be domain transcendent, but in application, it is domain-specific. Music educator and author Carol Benton writes in her landmark book, *Thinking about Thinking: Metacognition for Music Learning*, "Learners do not practice metacognitive skills in isolation from the content of their studies" (Benton, 2014, p. 4).

Benton explains, "Music students learn how to count rhythm patterns within specific meters. With practice, they develop the ability to monitor their rhythmic accuracy, recognize rhythm mistakes, and apply strategies to correct those mistakes."

She continues, "when music learners become aware that they have made rhythm mistakes—and they take action to make corrections—they are applying metacognition. Specifically, the learners are using the metacognitive skills of self-awareness, self-monitoring, and strategy use to accomplish the goal of rhythmic accuracy" (Benton, 2014, p. 5). And so, researchers note the positive applications of metacognition to music learning, music teaching, and independent practice (Benton, 2014).

In *Dimensions of Musical Thinking* (1989), a Music Educators National Conference (MENC) publication, contributing author Lenore Pogonowski affirmed metacognitive theory as representative of 1 of 4 dimensions in musical thinking, asserting that metacognitive skills might assist music learners in controlling their own learning processes, help them become more aware of their own skills, and free them from exclusively rote-based learning (Pogonowski, 1989).

In a revised version of Bloom's taxonomy from 2001, editors expanded the original 4 learning objectives to 6, including (1) remembering, (2) understanding, (3) applying, (4) analyzing, (5) evaluating, and (6) creating. Wendell Hanna, an editor on the project, explained, "Developing metacognition can help music learners to become more objective about their overall musicianship. He concluded that if learners lack metacognition—that is, if learners are not able to 'think about musical thinking—then their musicianship will plateau and fail to progress" (Hanna, 2007, p. 14).

Need for Metacognitive Study

Since Flavell first introduced the idea of metacognition, a majority of metacognitive research has been domain-transcendent, offering general principles of theory or application to fields of study unrelated to music. Often there has emerged relevant data for the music teacher, such as notions of self-knowledge, self-evaluation, planning, and monitoring.

But there can exist problems in translating conclusions about metacognition in the general sense into meaningful conclusions for the music teacher. Music learning involves more than cognitive knowledge, it also comprises skill development in psychomotor and affective domains. These complexities can result in challenges when transferring general information about metacognition into specific application for the piano teacher. So, there exists a need for further study into metacognitive theory as it applies to the field of piano pedagogy.

And so, as researchers have examined specific aspects of music practice through questionnaires (McPherson, 2000), interviews (Nielsen, 2004), and videotaped practice (Barry, 1992; Hallam, 1997), metacognitive habits of self-regulation and self-evaluation have proven to be most determining of effective learning and successful performing.

Moreover, research offers empirical evidence that metacognitive skills are "teachable" (Kramarski and Mevarech, 2003). Kuhn and Dean (2004) make claims for the necessity of providing teachers with mechanisms for fostering metacognition among their students. Similarly, Martinez and Schneider describe the problem of teachers lacking an awareness of the multitudinous dimensions of metacognition and their significance in cultivating higher-level thinking (Martinez, 2006, p. 696; Schneider, 2008).

So, understanding and applying metacognitive theory to piano pedagogy may hold the potential to provide piano teachers with strategies for developing more capable and self-sufficient learners and performers. Cognitive knowledge may relate to the piano performer's experience of measuring his or her own comprehension of musical and technical detail within repertoire, evaluation of repertoire-difficulty, identification of factors that may impact successful learning, and implementation of strategies for effective problem-solving when practicing.

Cognitive knowledge may also hold application to the piano teacher's awareness of personal strengths and weaknesses in learning and teaching, as well as his or her own capabilities in choosing appropriate repertoire for students, and means of understanding and communicating effective practice methods and strategies to students.

And cognitive regulation may concern the performer's abilities to set goals and monitor progress, evaluate practice effectiveness, and appraise performance-quality. For the piano teacher, cognitive regulation relates to the experiences of evaluating students' practice effectiveness, implementing and monitoring instructional strategies for error detection and correction in lessons, evaluating student-performance quality, and instructing students in use of metacognitive skills during practice.

Methodology

Procedures

The design of this study began with pretest questionnaires, which were completed by participants prior to their piano jury performance. Next, evaluation forms were delivered to piano faculty for use during each participant's jury performance. Faculty evaluators were not the participant's applied piano teacher. Upon the completion of each participant's jury performance, the researcher collected evaluation forms from faculty and then distributed a self-evaluation form to each participant.

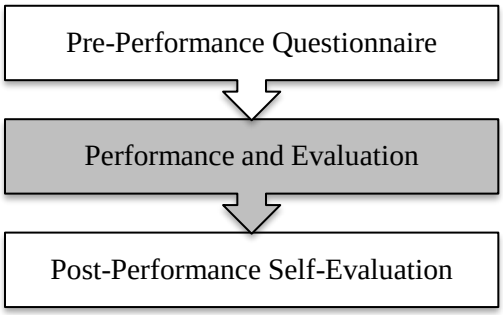


Figure 1.1. Study Design.

Participants

Eligible participants for this study included piano majors performing piano juries at the conclusion of the semester. With permission, the researcher contacted twenty-one eligible students by email, informing them of the study and inviting them to participate. Twelve (N = 12) students agreed to participate in this study: 6 undergraduates and 6 graduate.

Participants were enrolled in a variety of degree programs at the School of Music, including the Bachelor of Music-Education (n = 2), Bachelor of Music-Performance (n = 1), Bachelor of Arts in Music (n = 3), Master of Music-Performance (n = 3), and Master of Music-Pedagogy (n = 3).

Materials

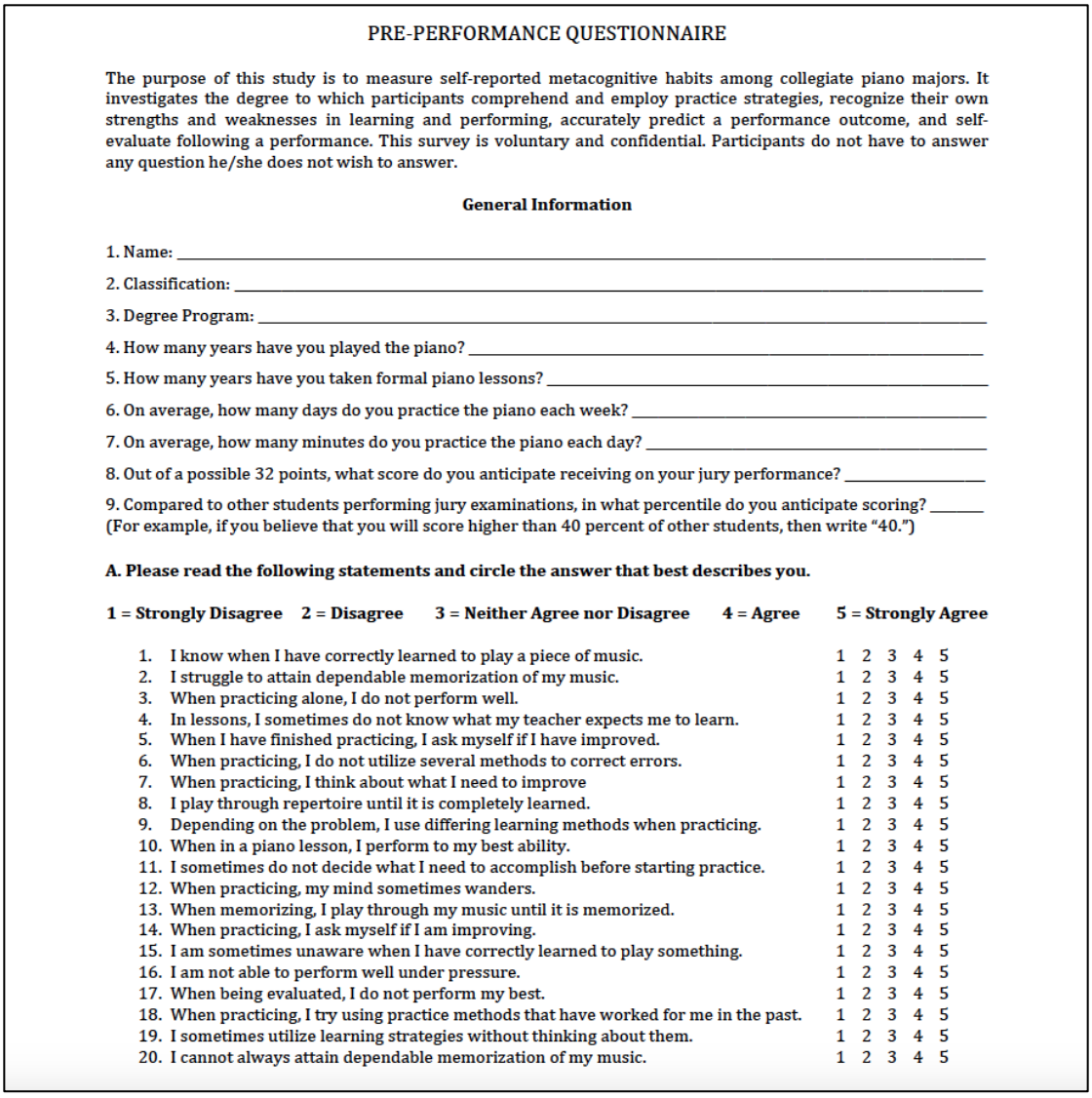
Two forms of data collection were used in this study: (1) a researcher-constructed pretest questionnaire (Figure 1.2), and (2) a researcher-constructed evaluation form (Figure 1.3).

The pretest questionnaire was administered before participants' jury performances and the evaluation form was used on two occasions: first by a piano faculty member during jury performances and secondly by participants following their own jury performance.

The pretest questionnaire was divided into three parts: (1) general information, (2) metacognition, and (3) practice methods. The first part—general information—gathered information about participant's degree program and classification, years having played the piano, years having taken formal piano lessons, average days of weekly practice, and average hours of daily practice. The general information section also asked participants to predict their evaluation score out of a

possible 32 points and to compare their predictive score with other participants' scores via percentile.

The second part of the pretest questionnaire—metacognition—contained 20 statements designed to measure participants' views of their own practice and performance skills. Using a 5-point Likert scale along a continuum from "Strongly Disagree" to "Strongly Agree," statements comprised equal-parts positive and negative positions. The third part—practice methods—included space for participants to describe three methods of learning used during practice.



PRE-PERFORMANCE QUESTIONNAIRE

The purpose of this study is to measure self-reported metacognitive habits among collegiate piano majors. It investigates the degree to which participants comprehend and employ practice strategies, recognize their own strengths and weaknesses in learning and performing, accurately predict a performance outcome, and self-evaluate following a performance. This survey is voluntary and confidential. Participants do not have to answer any question he/she does not wish to answer.

General Information

1. Name: _____
2. Classification: _____
3. Degree Program: _____
4. How many years have you played the piano? _____
5. How many years have you taken formal piano lessons? _____
6. On average, how many days do you practice the piano each week? _____
7. On average, how many minutes do you practice the piano each day? _____
8. Out of a possible 32 points, what score do you anticipate receiving on your jury performance? _____
9. Compared to other students performing jury examinations, in what percentile do you anticipate scoring? _____
(For example, if you believe that you will score higher than 40 percent of other students, then write "40.")

A. Please read the following statements and circle the answer that best describes you.

1 = Strongly Disagree 2 = Disagree 3 = Neither Agree nor Disagree 4 = Agree 5 = Strongly Agree

1.	I know when I have correctly learned to play a piece of music.	1 2 3 4 5
2.	I struggle to attain dependable memorization of my music.	1 2 3 4 5
3.	When practicing alone, I do not perform well.	1 2 3 4 5
4.	In lessons, I sometimes do not know what my teacher expects me to learn.	1 2 3 4 5
5.	When I have finished practicing, I ask myself if I have improved.	1 2 3 4 5
6.	When practicing, I do not utilize several methods to correct errors.	1 2 3 4 5
7.	When practicing, I think about what I need to improve	1 2 3 4 5
8.	I play through repertoire until it is completely learned.	1 2 3 4 5
9.	Depending on the problem, I use differing learning methods when practicing.	1 2 3 4 5
10.	When in a piano lesson, I perform to my best ability.	1 2 3 4 5
11.	I sometimes do not decide what I need to accomplish before starting practice.	1 2 3 4 5
12.	When practicing, my mind sometimes wanders.	1 2 3 4 5
13.	When memorizing, I play through my music until it is memorized.	1 2 3 4 5
14.	When practicing, I ask myself if I am improving.	1 2 3 4 5
15.	I am sometimes unaware when I have correctly learned to play something.	1 2 3 4 5
16.	I am not able to perform well under pressure.	1 2 3 4 5
17.	When being evaluated, I do not perform my best.	1 2 3 4 5
18.	When practicing, I try using practice methods that have worked for me in the past.	1 2 3 4 5
19.	I sometimes utilize learning strategies without thinking about them.	1 2 3 4 5
20.	I cannot always attain dependable memorization of my music.	1 2 3 4 5

Figure 1.2. Pre-Test Questionnaire.

The evaluation and self-evaluation forms were identical. They contained eight areas of critique: (1) Memory Control, (2) Note Accuracy, (3) Tempo Control, (4) Rhythmic Accuracy, (5) Articulation Accuracy, (6) Dynamic Accuracy, (7) Tone Quality, and (8) Expressivity. Participants

responded using a 4-point scale in which 1=Poor, 2=Fair, 3=Good, and 4=Excellent. The maximum points possible was 32.

SELF-EVALUATION and EVALUATION FORM

This self-evaluation form is being used as part of a dissertation study titled, "An Investigative Study Measuring Self-Reported Metacognitive Habits Among Collegiate Pianists."

Name of Student: _____

Please select the rating that best describes your performance in the following areas:

	1 = Poor	**2 = Fair**	**3 = Good**	**4 = Excellent**
1. Memory Control	1	2	3	4
2. Note Accuracy	1	2	3	4
3. Tempo Control	1	2	3	4
4. Rhythmic Accuracy	1	2	3	4
5. Articulation Accuracy	1	2	3	4
6. Dynamic Accuracy	1	2	3	4
7. Tone Quality	1	2	3	4
8. Expressivity	1	2	3	4

Figure 1.3. Self-Evaluation and Evaluation Form.

Results

To assess the relationships among the pretest questionnaire composite score, the predictive, actual, and self-evaluation scores, the researcher computed a Pearson product-moment correlation coefficient for pairs of variables. Results are shown in Figures 1.4 and 1.5.

A very weak negative correlation ($r = -.104$, $n = 11$, $p = .762$) was identified between the pretest questionnaire composite and the predictive evaluation scores, meaning that these two variables do not vary together. A strong positive correlation ($r = .710$, $n = 12$, $p = .010$) was identified between the pretest questionnaire composite and actual evaluation scores. This can be interpreted as indicating that increases in pretest questionnaire composite scores correlate with increases in actual evaluation scores.

Results showed a weak positive correlation ($r = .417$, $n = 12$, $p = .178$) between the pretest questionnaire composite and self-evaluation scores. For the actual and self-evaluation scores, results indicated a positive correlation ($r = .623$, $n = 12$, $p = .031$). For this pair of variables, increases in actual evaluation scores correlated with increases in self-evaluation scores.

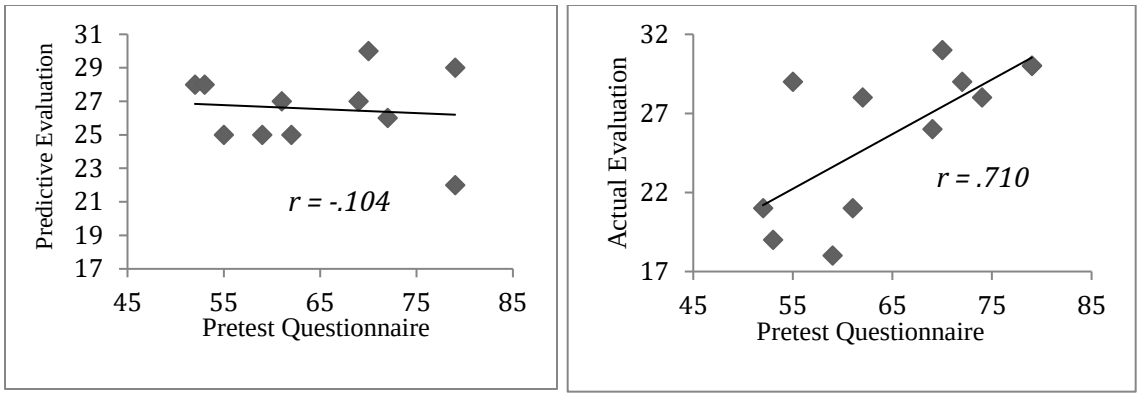


Figure 1.4. Scatterplots Showing Pretest Questionnaire Composite Scores with Predictive Evaluation Scores (left panel) and Pretest Questionnaire Composite Scores with Actual Evaluation Scores (right panel).

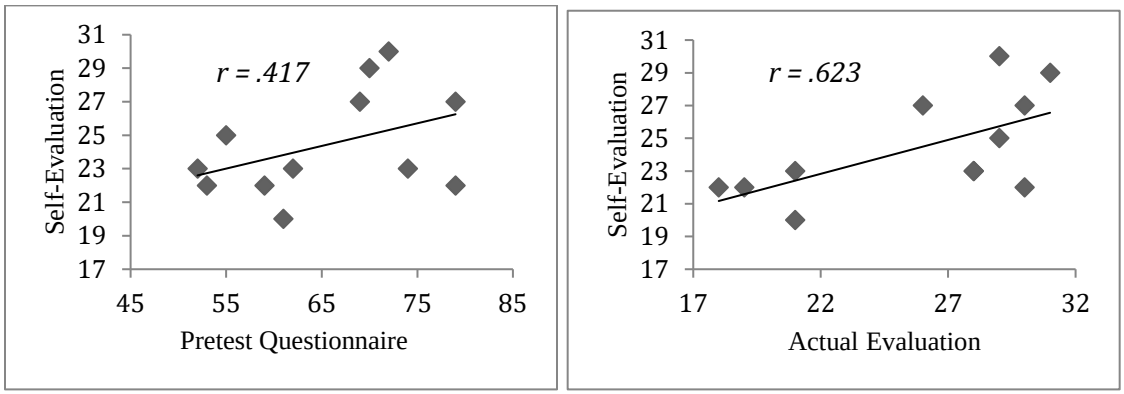


Figure 1.5. Scatterplots Showing Pretest Questionnaire Composite Scores with Self-Evaluation Scores (left panel) and Actual Evaluation with Self-Evaluation Scores (right panel).

Answering Research Questions

The following research questions guided this study:

1. What metacognitive habits do collegiate piano majors possess?
2. How do collegiate piano majors measure their own abilities against those of their peers?
3. How accurately do collegiate piano majors predict their own performance outcome? And how does this predictive accuracy correlate with self-reported metacognitive skills?
4. How accurately do collegiate piano majors self-evaluate following a performance? And how does this self-evaluation correlate with their actual performance evaluation?
5. In what ways do specific metacognitive habits correlate with performance ability?

Research Question #1

To answer research question #1, "What metacognitive habits do collegiate piano majors possess?" the researcher administered a pretest questionnaire and self-evaluation form aimed at identifying participants' own self-regulative and self–evaluative skills. The pretest questionnaire gathered data in three parts: (1) general information, (2) metacognition, and (3) practice methods. Part one collected information about participants' classification and degree program, number of years

having played the piano, number of years having taken formal piano lessons, average number of weekly practice days, average number of daily practice minutes, predictive evaluation scores, and predictive percentile ranking. Using a 5-point Likert scale, part two of the pretest questionnaire presented 20 statements concerning participants'' own self-regulative and -evaluative skills. Part three of the pretest questionnaire invited participants to describe three learning methods used when practicing.

Part two of the pretest questionnaire contained 20 Likert statements with responses ranging on a 5-point continuum from "strongly disagree" to "strongly agree." These statements were intended to probe into the metacognitive habits of participants—particularly self-regulative and evaluative habits. The researcher calculated aggregated results for each statement as well as composite scores for each participant. Composite scores, which were calculated out of a maximum 100 points possible, were intended to indicate a measure of metacognitive strength. Composite scores from this study ranged from 52 to 79, with a mean of 65.41.

Participants' responses to 8 statements from the pre-test questionnaire were notable. In statement #1, 33% of participants reported "disagree" or "neither disagree nor agree" with "I know when I have correctly learned to play a piece of music." Participants' disagreement or neutrality with this statement may relate to underdeveloped metacognitive habits in areas of self-regulation and self-evaluation. Among collegiate piano majors, one might have presumed near unanimous agreement with this statement. 75% of participants reported agreement with statement #4, which read, "In lessons, I sometimes do not know what my teacher expects me to learn."

In statement #6, 84% of participants agreed with the statement, "When practicing, I do not utilize several methods to correct errors." It is unclear whether the majority of participants confirmed this statement because they (1) implicitly utilize several methods to correct errors in practice, (2) utilize only a few, highly effective methods to correct errors, or (3) truly do not utilize several methods to correct errors. Participants responded 25% of the time in disagreement or "neither agree nor disagree" to the statement, "When practicing, I ask myself if I am improving." Participants' disagreement or non-affirmation to this statement may suggest that judgments of improvement occur without conscious recognition; another possibility may be that these participants do not measure their own progress in practice.

To the statement #15, "I am sometimes unaware when I have correctly learned to play something," participants responded 25% of the time in agreement and 33% of the time with neither agree nor disagree. This statement is similar to statement #1, which also addressed self-regulation—recognizing when learning has occurred. Statement #16 aimed at understanding participants' self-view of performance anxiety, stating, "I am not able to perform well under pressure." To this statement, participants agreed 41% of the time and disagreed 42% of the time. 17% were indifferent, reporting neither agreement nor disagreement. Related to statement #16, statement #17 read, "When being evaluated, I do not perform my best," with which participants agreed 42% of the time. Only 25% of participants strongly disagreed with this statement. Lastly, with statement #20, which read, "I cannot always attain dependable memorization of my music," 58% of participants agreed and 8% indicated neither agreement nor disagreement. Indicating that only 33% of participants believe they can consistently attain dependable memorization of repertoire.

4 of the 12 participants in this study abstained from completing part three of the pretest questionnaire, which asked participants to describe in short-answer form three learning methods used when practicing. Among the responses from 8 participants who completed the practice methods portion of the pretest questionnaire, descriptions relating to "sectional practice" were mentioned with the greatest frequency at 6 times, followed by "slow practice" with 5 mentions, and "harmonic analysis" reported by 4 participants. Other learning methods reported by participants include using varied rhythmic accents, listening to the music with score away from the piano, playing through repertoire while taking notes, and hands separate practice.

Research Question #2

Concerning research question #2, "How do collegiate piano majors measure their own abilities against that of their peers?" participants were asked to answer the following question on part one of the pretest questionnaire: "Compared to other students performing jury examinations, in what percentile do you anticipate scoring?" For clarification, this question was followed by a parenthetical explanation that read, "For example, if you believe that you will score higher than 40% of other students, then write 40." Among 11 of the 12 participants, the mean percentile ranking was 51.2%; 1 of the participants did not provide a predictive percentile ranking. Undergraduate participants reported a mean percentile ranking of 41% and graduate participants indicated a 63.3% percentile ranking. The maximum for the total sample 90% and the minimum was 10%. Interestingly, the highest percentile ranking (90%) was reported by a graduate student who received an evaluation score of 21 out of 32 total points possible, in actuality, placing him or her in the 33rd percentile. Conversely, the participant who indicated the lowest percentile ranking (10%) scored 28 out of 32 possible points on his or her evaluation, placing him or her in the 50th percentile. 6 of the 11 participants predicted a percentile ranking equivalent or lower than their actual percentile ranking; they underestimated their own abilities against the abilities of their peers.

Research Question #3

Regarding research question #3, "How accurately do collegiate piano majors predict their own performance outcome? And how does this predictive accuracy correlate with self-reported metacognitive skills?" among the total sample, participants' average predicted evaluation score was 26.55 out of a possible 32 points; their average evaluation score was 25.83—an overestimation of 2.7%. Among undergraduate participants, the average predicted evaluation score was 27.3—an overestimation of 7.8%. Among graduate participants, the average predictive evaluation score was 25.6— an underestimation of 2.8%.

The minimum and maximum predicted evaluation scores among undergraduate participants were 25 and 30, respectively; for graduate participants they were 22 and 28. This data shows that undergraduate participants overestimated their performance evaluation, whereas graduate participants underestimated theirs. In view of their predictive accuracy in relation to self-reported metacognitive skills, the Pearson product-moment correlation coefficient revealed no significant positive or negative relationship. Among the groups of undergraduate and graduate participants, the average composite score for part two of the pretest questionnaire, which sought to provide a measure of metacognitive strength, was nearly identical—65.3 out of a possible 100 points for undergraduates and 65.5 for graduates.

Research Question #4

Research question #4 stated, "How accurately do collegiate piano majors self-evaluate following a performance? And how does this self-evaluation correlate with their actual performance evaluation?" To answer this question, the researcher designed the study to include an evaluated performance and self-evaluation from each participant. Following the completion of the pretest questionnaire, each participant performed for a jury of piano faculty in the Recital Hall of the University of South Carolina. Participants received evaluation from a faculty juror who was not the their own applied lesson teacher. The evaluation and self-evaluation forms included 8 areas of critique: (1) Memory control, (2) Note accuracy, (3) Tempo control, (4) Rhythmic accuracy, (5) Articulation accuracy, (6) Dynamic Accuracy, (7) Tone Quality, and (8) Expressivity. Evaluation was made on a 4-point scale in which 1=poor, 2=fair, 3=good, and 4=excellent.

Among the total sample, the average evaluation score was 25.83 out of a possible 32 points; for self-evaluations the average score was 24.42. Among undergraduate participants, the average evaluation score was 25.33 and for self-evaluations it was 25. In contrast, among graduate participants, the average evaluation score was 26.33, while the average self-evaluation score was 23.83. The data indicates that among the total sample, participants underestimated their evaluation scores by a margin of 5.8%, however among undergraduate participants, the margin was 1.3% and among graduate participants it was 10.4%. This data suggests that undergraduate participants more accurately self-evaluated than did graduate participants.

The researcher used the Pearson product-moment correlation coefficient to test for any relationship between participants' evaluation and self-evaluation scores. Among the total sample, tests indicated a positive correlation ($r = .634$) with a p-value of .031, indicating that high evaluation scores generally varied with high self-evaluation scores. Among undergraduate participants, tests indicated a positive correlation ($r = .843$) a p-value of .035, meaning that high evaluation scores went together with high self-evaluation scores. Among graduate participants, there was a negative correlation between evaluation and self-evaluation scores ($r = -.447$, $p = .374$). This indicates that where graduate participants received high evaluation scores, they tended to self-evaluate a lower score.

Research Question #5

To answer research question #5, "In what ways do specific metacognitive habits correlate with performance ability?" the researcher used the Pearson product-moment correlation coefficient test to investigate relationships between individual statements from part two of the pretest questionnaire and evaluation scores. Tests revealed significant positive relationships between evaluation scores and three statements from part two of the pretest questionnaire. Statement #14, which reads, "When practicing, I ask myself if I am improving," held a positive correlation ($r = .590$, $p = .043$), suggesting that high evaluation scores vary together with participants' agreement with statement #14. Also holding a positive correlation ($r = .663$, $p = .019$) with evaluation scores, statement #19 reads, "I sometimes utilize learning strategies without thinking about them." And lastly, statement #20, "I cannot always attain dependable memorization of my music," held the strongest positive correlation of the statements from part two of the pretest questionnaire ($r = .836$, $p = .001$).

Regarding any relationship between specific practice methods mentioned by participants on part three of the pretest questionnaire and evaluation scores, the researcher found that 4 of the 5 participants who indicated "slow practice" received an evaluation score of 29 or better out of 32 points possible. Regarding any significant correlation between predictive evaluation and evaluation scores, there was only a very weak negative correlation ($r = -.071$, $p = .836$). Between self-evaluation and evaluation scores, there was a positive correlation ($r = .623$, $p = .031$). And between predictive percentile ranking and evaluation scores, there was a very weak negative correlation ($r = -.118$, $p = .729$).

Comparisons between undergraduate and graduate participants' responses were not defined in the scope of this study; however, interesting patterns emerged and bear mentioning. Descriptive statistics for part one of the pretest questionnaire indicated that the average number of years participants had played the piano was 14.16; incidentally, this average was identical among undergraduate ($N = 6$) and graduate ($N = 6$) participants, though the standard deviation differed somewhat among the two groups—3.12 and 3.54, respectively. This may indicate that some graduate students began playing the piano later in life than average undergraduate participants. Similarly, the average number of years participants had reported taking formal piano lessons was again nearly identical between undergraduate and graduate participants—13 and 13.16, respectively.

Remarkably, the minimum number of years participants reported having taken formal piano lessons among undergraduate participants was 5 years and the minimum for graduates was 8 years. This may indicate that at least one undergraduate participant began taking formal piano lessons during his or her teens. Interestingly, the minimum (4) and maximum (7) number of days of weekly practice among undergraduate and graduate participants was equivalent. Where undergraduates and graduates differed was in average minutes of daily practice, for which undergraduates reported 162.5 minutes and graduates indicated 205 minutes. Between undergraduate and graduate participants, the minimum and maximum average minutes of daily practice were reported with more similarity—75 and 330 minutes for undergraduates and 90 and 360 minutes for graduates.

Conclusions

In this study, the researcher investigated metacognitive habits among collegiate piano majors. Results of the Pearson product-moment correlation coefficient revealed a positive correlation ($r = .710$, $p = .010$) between pretest questionnaire composite scores and evaluation scores. This indicates that an increase in pretest questionnaire composite scores varied with an increase in evaluation scores among participants. As the pretest questionnaire measured participants' metacognitive habits, results from this study may suggest that collegiate piano majors who possess a greater measure of metacognitive skills may also achieve higher performance evaluation scores than collegiate piano majors who possess a lower measure of metacognitive skill.

In particular, piano teachers may consider instructional techniques that address participant responses to 5 statements from the pretest questionnaire. 75% of participants agreed with statement #4, "In lessons, I sometimes do not know what my teacher expects me to learn." It is important to note the wording of this statement includes, "sometimes"; data collected in response to this statement does not indicate that 75% students in this study claimed they did not know what their teachers expected of them during lessons. However, in the cases in which this statement is

sometimes true, teachers may use literal, not subjectively descriptive, language when expressing learning objectives or expectations in applied lessons. Specificity will mitigate misunderstandings and didacticism will provide effective pathways to problem solving.

25% of participants agreed with statement #15, "I am sometimes unaware when I have correctly learned to play something." This statement addresses self-evaluation. For a pianist to accurately self-evaluate, he or she must comprehend the musical concepts presented in repertoire, possess the physical technique necessary to play the repertoire, and listen critically to the resultant sounds from playing repertoire. Teachers may first consider providing instruction in musical concepts and requisite technique found in student repertoire (e.g., teaching distinctions among articulations such as non-legato, legato, staccato, and tenuto; and using technical exercises or repertoire to reinforce the concepts). Next, teachers may have students practice critical listening skills during applied lessons (e.g., using play-back exercises during lessons in which the teacher plays an improvised short phrase of music that includes specific articulations, rhythms, notes, and dynamics; or the teacher may play short passages of repertoire and ask the student to identify any intentional mistakes).

41% of participants agreed with statement #16, "I am not able to perform well under pressure" and 42% agreed with statement #17, "When being evaluated, I do not perform my best." Related to these, 58% of participants agreed with statement #20, which reads, "I cannot always attain dependable memorization of music." Preparing students to perform well and not simply learn well is a significant challenge for all applied music lesson teachers.

Principally, among collegiate applied lesson teachers, the demand to memorize music places an additional layer of burden upon the student preparing to perform as well as the teacher guiding the student. Finding solutions to the performing problems many students face is not impossible; certainly, many collegiate applied lesson teachers are adequately preparing students for successful performing and for others, despite their strategies, students may feel incapable of performing well under pressure. For those teachers seeking solutions, directing students to learn repertoire that realistically fits their reading, technical, and expressive capabilities seems an appropriate place to begin.

The researcher hopes that that the findings of this study will promote further discussion and investigation of metacognition among topics of piano learning, teaching, and performing.

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