Form for submitting extended proposals
for consideration for the
**2018 ROBERT J. MENGES AWARD FOR OUTSTANDING RESEARCH IN EDUCATIONAL DEVELOPMENT**

**Instructions:**

- Boxes will expand to accommodate text.
- Total **word count must not exceed 2000 words** for the body of the proposal, excluding references and appendices.
- Supporting information (e.g. tables, figures, images, references, instruments, details of experimental design) may be placed in appendices. Though not limited, the strongest proposals are typically supported by no more than 10 pages of appendices. To conserve space, for example, you can place multiple figures on one page, single-space survey instruments, etc. Keep in mind, the selection committee is not required to read beyond this general limit.
- Be sure to include the word counts in each section, as well as the total for all sections (see below). Proposals without the word counts noted will not be read.
- Incomplete proposals will not be read.
- As a final step, **"blind" your proposal** by removing any direct references to you, your co-authors, institution, and supporting publications. Be sure to blind all parts of your proposal, including appendices.
- Send your proposal to the committee chair in **MS Word format**. For consistency, it is helpful if you use calibri, 11 pt font.

| RESEARCHERS NAMES (please indicate primary contact with a *): | INSTITUTION(s): | EMAIL ADDRESS(ES): |
|---|---|---|
| Eric Kaldor* | University of Rhode Island | ekaldor@uri.edu |
| Holly Swanson | University of Rhode Island | hswanson@uri.edu |
| | | |
| | | |
| | | |
| | | |
| Add lines as necessary. | | |

Please leave the rest of this page blank.

| SESSION TITLE: | A Campus-wide Strategy to Develop Metacognition in Gateway Science Courses |
|---|---|

## 1. RESEARCH QUESTION(S) & WHY THEY ARE IMPORTANT TO THE FIELD:

Can a campus-wide student workshop and four-week challenge designed to encourage the use of metacognitive learning strategies improve academic achievement in gateway science courses?

The keynote lecture and interactive workshop are commonplace techniques for disseminating innovative practices in higher education. Institutions devote resources each year to bring nationally or internationally renowned presenters and facilitators to campus and speak to large audiences. The best of these speakers not only explain innovations well, they develop a motivational message to convince their audience to change. Yet, these speakers leave and the initiative to change often leaves with them. Research on faculty development and our own practical experience has led us to question the impact of single events for organizational and personal change and seek mechanisms to increase the impact of well-designed workshops. Educational developers are charged routinely with bringing innovative practices to our institutions and must balance the demands to reach many with the need promote significant change with limited resources. In this paper, we describe our Workshop+Challenge model designed to extend participants' engagement with key ideas from the workshop and encourage personal growth. The Workshop+Challenge model combines an interactive workshop with four weeks of self-assessment surveys.

The Workshop+Challenge model developed at our institution around a faculty-driven initiative to increase students' metacognition, particularly in gateways science courses. Champions for equity among our faculty, staff, and administrators identified helping more students develop their metacognition as the most promising means to achieve more equitable outcomes in gateway science courses. After attending Saundra McGuire's workshops at a national conference, a faculty team recommended bringing her workshop to campus for students and faculty. These champions of organizational change had set an ambitious goal to produce a significant improvement in student learning with a single workshop. An educational development goal on this order cries out for collaborative solutions. We worked with colleagues from the Academic Enhancement Center, our student learning center, and the university's professional advisors to develop a strategy to extend student engagement with the metacognitive learning strategies presented in the workshop. The solution was a four-week challenge to extend student participants exploration of learning strategies and encourage reflection and self-assessment through weekly surveys. This kind of innovation is readily scalable and creates new opportunities for institutions to support metacognitive development. This research paper explores whether this innovation, combining a metacognitive workshop with four weeks of self-assessment surveys, has a measurable impact on student participants' academic achievement in their gateway science courses.

| WORD COUNT |
|---|
| 405 |

## 2. DESCRIPTION OF RESEARCH DESIGN:

This study was conducted at the University of Rhode Island with an undergraduate student enrollment of approximately 15,000 students. We investigate the association between the level of student participation in our Ace-Your-Course (AYC) Workshop+Challenge and their academic achievement in gateway science courses. The workshop was open to all students on campus. Students who attended the workshop were invited to participate in the challenge. Only students responding to the prior week's survey were contacted for the subsequent survey. An overview of the self-assessment surveys is presented in Appendix A. Instructors offered various levels of incentives to attend the workshop ranging from verbal encouragement during class to extra credit worth as much as 1.6% of the final course grade. At the workshop, we introduced the challenge and noted that all participants completing the fours surveys would be entered in a raffle for ten $100 gift cards to the campus store.

McGuire (2015) has documented the essential messages, strategies, and sample slides for a metacognitive learning strategies workshop. Her approach hinges on motivating students to try and self-assess small changes in their learning behaviors. She provides a roadmap of messages and activities to convince students to believe that seemingly little changes can produce dramatic improvements in their learning and academic achievement. McGuire recommends offering the workshop after students have results from their first exam because this is when many first recognize they are struggling academically.

In developing our self-assessment surveys, we attempted to promote her process – trying specific learning strategies, monitoring one's learning, assessing one's learning, and planning how to continue or make changes for improvement. With a workshop offered in the fourth week of the semester followed by four weeks of surveys, our AYC Workshop+Challenge was intended to cover the time between exam 1 and exam 2 in most introductory courses.

A pilot version of the AYC Workshop+Challenge was conducted in a previous semester with 243 students participating in a workshop based on McGuire's. Fifty-two students completed all four of the self-assessment surveys. Among challenge "completers", 83% reported an increase in their course grades and 96% reported an increase in their confidence for learning challenging material. This preliminary result provided the impetus to conduct the current study.

The implementation of this institution-wide intervention prevented traditional experimental design strategies. Students were not randomly assigned to groups and the timing of the workshop and challenge due dates could not be perfectly coordinated with the course exam schedules. Instead, we set out to statistically control for differences among students using OLS multiple regression. With informed consent from students, we collected admissions, exam and final grade data for each student from eight science course sections, including four chemistry, two nutrition and food science, one biology, and one human physiology. Only students who had grades for all exams were included in the analysis. This resulted in 979 student observations out of 1,110 possible across the five courses.

In preparing the data for OLS multiple regression analysis, we identified four different levels of

participation by students in the courses. The reference group of students for the analysis are students who did not attend the metacognitive workshop or participate in the AYC Challenge (n=632). The second group are students who only attended the metacognitive workshop presented by Dr. Saundra McGuire but did not complete any self-assessment surveys (n=229). The third group included students who attended the workshop and started the challenge, completing between one and three of the four self-assessment surveys (n=63). Among this group, 30 students only completed the first survey. The fourth group of students attended the workshop and completed all four of the self-assessment surveys (n=55). The distribution of student observations by courses and participation level is represented in Appendix B, Table 1.

OLS regression was performed on adjusted final grades after removing course-specific extra credit awarded for participants in the workshop. We controlled for a number of standard variables that predict academic achievement, including high school grade point average (converted to a common scale in university records), fraction of university maximum Pell grant awarded (from 0 to 1, a measure of family financial resources), credits passed at the institution prior to the semester, and credits failed at the institution prior to the semester. While we cannot determine whether Exam 1 preceded the workshop, we know the two events were closely timed. Exam 1 scores have been identified on our campus as highly predictive of student success in gateway science courses. Exam 1 grades were normalized to z-scores to use across different courses.

| WORD COUNT |
| --- |
| 747 |

## 3. LITERATURE REVIEW & THE RELATIONSHIP OF THE LITERATURE TO YOUR RESEARCH QUESTION(S):

A longstanding concern in the scholarship of teaching and learning has been how to increase the students use of “deep learning” strategies as opposed to “surface learning” strategies (Bain, 2012; Marton & Säljö, 1976). Students’ ability to effectively use deep learning strategies depends on their development of metacognition, which McGuire (2015) summarizes as the ability to think about one’s thinking, monitor one’s learning, and self-assess the level of one’s learning. Research has shown students commonly overestimate their abilities and exhibit high levels of self-confidence while inconsistently utilizing self-regulation and reflective practices in their learning processes (Iwamoto, Hargis, Bordner, & Chandler, 2017; Kruger & Dunning, 1999). Self-regulation and metacognition in particular is correlated to higher GPAs and test performance (Everson & Tobias, 1998; Sebesta & Bray Speth, 2017; Thiede, Anderson, & Therriault, 2003). According to Flavell (1979), metacognitive experiences are one of the prime mechanisms for the development of metacognitive knowledge, goals, and strategies for specific tasks. Systematically including metacognitive reflection on performance into a college remedial mathematics course resulted in significantly higher levels of academic success (Zimmerman, Moylan, Hudesman, White, & Flugman, 2011). This kind of systematic focus on metacognition across multiple course sections can be difficult to institute and McGuire (2015) has argued for the value of even a single workshop during class after Exam 1. Some early research on this approach suggests positive effects on academic achievement (Zhao, Wardeska, McGuire, & Cook, 2014). The AYC Workshop+Challenge combines McGuire’s single workshop with weekly metacognitive activities inspired by Zimmerman and colleagues.

| WORD COUNT |
| --- |
| 251 |

## 4. FINDINGS, INCLUDING THEIR SIGNIFICANCE & LIMITATIONS:

Attendance at Dr. McGuire's workshop was open to the campus and optional for students in these five classes. Among courses that offered extra credit, 22% to 48% of students attended compared to only 14 to 17% of students in the courses without extra-credit incentives (Appendix B, Table 1). Course-level incentives appear to have provided an important motivation for many students in attending the workshop.

Comparison of median values for control variables across levels of participation in the AYC Workshop+Challenge reveal significant differences (See Appendix B, Table 2). Differences in the median values for HS GPA between the reference group (3.50) and students attending the workshop and completing the challenge (3.90) are noteworthy. Students attending just the workshop and students who attended the workshop and started the challenge had identical median values (3.60). Given these differences, OLS regression is an appropriate means to compare student final grades across participation levels (See descriptive statistics in Appendix B, Table 3).

Due to the potential for overlap between the workshop and Exam 1, OLS regression was performed on adjusted final grades (100-point scale) with pre-semester variables and three dummy variables for participation levels (Model 1). In addition, Model 2 includes Exam 1 z-score (see Appendix B, Table 4). While both models are statistically significant ($p < 0.001$), the addition of the Exam 1 z-score variable increases the adjusted $R^2$ for the data from 0.283 to 0.573. This change dramatically reduces the regression coefficient for high school GPA dramatically from 9.58 to 2.82 and increases the constant in the model from 44.11 to 67.48.

The addition of Exam 1 z-score moderates the regression coefficients related to participation levels in the AYC Workshop+Challenge. Attending the workshop only is associated with a final grade 3.22 points higher ($p<0.01$) in Model 2 (See Appendix B, Table 4). Attending and completing the challenge is associated with a final grade 5.61 points higher ($p<0.01$) in Model 2. In stark contrast, attending the workshop and starting the challenge was not associated with statistically significantly differences from the reference group in either model.

These results offer important support for the Workshop+Challenge model, particularly as a mechanism to encourage metacognitive development of students. The significant academic achievement associated with attending the workshop and completing the challenge is promising. At the same time, the limited group of students who participated at this level gives us pause. Differences in high school GPA and exam 1 z-scores across participation levels suggests that the optional nature of the AYC Workshop+Challenge might have worked best for students who already possessed some critical habits and mindsets. The results offer us an excellent opportunity to propose to our faculty partners that we collaborate to bring the workshop and challenge into their classes to engage a wider group of students in participation.

Finally, the results for students who attended and started the challenge but did not complete the challenge raise important questions. Compared to the stronger results for students who attended the workshop, but did not start the challenge, we must ask what happened for these students. We have

identified three possibilities for further investigation. First, "starters" might have had an experience that negated the benefits of the workshop afterward. Second, they may have responded differently from the other students to the message of the workshop and self-assessment process of the challenge. Finally, starters might have had some important, but unmeasured differences in ability for self-regulated learning. We plan to follow up with a content analysis of student self-assessment survey responses during weeks one and two of the challenge to look for meaningful differences between "starters" and "completers".

| WORD COUNT |
| --- |
| 596 |

| TOTAL WORD COUNT FOR ALL 4 SECTIONS (MAX 2000 WORDS): 1999 | |
| --- | --- |

## REFERENCES


Bain, K. (2012). *What the best college students do*. Cambridge, MA: Belknap Press.

Everson, H. T., & Tobias, S. (1998). The ability to estimate knowledge and performance in college: A metacognitive analysis. *Instructional Science*, *26*(1/2,), 65–79.

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive developmental inquiry. *American Psychologist*, *34*(10), 906–911.

Iwamoto, D. H., Hargis, J., Bordner, R., & Chandler, P. (2017). Self-regulated learning as a critical attribute for successful teaching and learning. *International Journal for the Scholarship of Teaching and Learning*, *11*(2). https://doi.org/10.20429/ijsotl.2017.110207

Kruger, J., & Dunning, D. (1999). Unskilled and Unaware of It: How difficulties in recognizing one's own incompetence lead to inflated self-assessments. *Journal of Personality and Social Psychology*, *77*(6), 1121–1134.

Marton, F., & Säljö, R. (1976). On qualitative differences in learning I — Outcome and process. *British Journal of Educational Psychology*, *46*(1), 4–11. https://doi.org/10.1111/j.2044-8279.1976.tb02980.x

McGuire, S. Y., with McGuire, S. (2015). *Teach students how to learn: Strategies you can incorporate into any course to improve student metacognition, study skills, and motivation*. Sterling, VA: Stylus Publishing.

Sebesta, A. J., & Bray Speth, E. (n.d.). How should I study for the exam? Self-regulated learning strategies and achievement in introductory biology. *CBE-Life Sciences Education*, *16*(2), ar30, 1-12.

Thiede, K. W., Anderson, M. C. M., & Therriault, D. (2003). Accuracy of metacognitive monitoring affects learning of texts. *Journal of Educational Psychology*, *95*(1), 66–73. https://doi.org/10.1037/0022-0663.95.1.66

Zhao, N., Wardeska, J. G., McGuire, S. Y., & Cook, E. (2014). Metacognition: An effective tool to promote success in college science learning. *Journal of College Science Teaching*, *43*(4), 48–54. https://doi.org/10.2505/4/jcst14_043_04_48

Zimmerman, B. J., Moylan, A., Hudesman, J., White, N., & Flugman, B. (2011). Enhancing self-reflection and mathematics achievement of at-risk urban technical college students. *Psychological Test and Assessment Modeling*, *53*(1), 108–127.

Appendix A. META Challenge survey items and their presence on the weekly surveys.

| Survey Questions | Weekly Surveys | | |
|---|---|---|---|
| | 1 | 2/3 | 4 |
| Which strategy are you going to try?<br>a) Ask why, how and what if questions (Bloom's Taxonomy)<br>b) Implement the study cycle: preview, attend, review, study, and check<br>c) Spend time on your course every day<br>d) Complete homework like a test<br>e) Do more problems<br>f) Practice teaching the material<br>g) Other… | X | X | X |
| Describe how you used one or more learning strategies yesterday and today. | X | X | |
| Describe how you will use one or more learning strategies today and tomorrow. | X | X | |
| How do you feel about the learning strategy or strategies you are testing right now? | X | X | |
| How much more effort was required to use this strategy or strategies compared to your prior approach?<br>a) No additional effort<br>b) Some additional effort<br>c) Significant additional effort | X | X | |
| How much time have you used the strategy or strategies yesterday and today?<br>a) 10-30 minutes<br>b) 30-59 minutes<br>c) 1-3 hours<br>d) More than 3 hours | X | X | |
| Based on your own judgment, describe any improvement in your learning. | X | X | X |
| Considering feedback from your instructors (grades, comments conversations, etc), do you notice any changes in your learning and academic performance? | | X | X |
| How much has using one or more of the metacognitive learning strategies changed your confidence in your ability to learn the material in a challenging course?<br>a) Significantly increased<br>b) Increased<br>c) No change<br>d) Decreased<br>e) Significantly decreased | | | X |
| How much have your grades changed in relevant courses after adopting one or more of the metacognitive learning strategies?<br>a) Significantly increased<br>b) Increased<br>c) No change<br>d) Decreased<br>e) Significantly decreased | | | X |
| After experimenting with these learning strategies, what would you advise a new student arriving on campus next year? | | | X |
| How might the university convince more students to try these strategies? What is the best way to reach students like you and persuade them to try one or more of these strategies? | | | X |
| Dr. McGuire would like to hear from you. Do you have any thoughts, suggestions, or messages you would like to send her? Please write directly to her and we will share these messages with her without your name (unless you include it in the message). | | | X |
| Any additional comments/thoughts? | X | X | X |

**Appendix B. Statistical Tables**

**Table 1**

*Distribution of student observations by course incentives and participation level*

| Course | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | All |
|---|---|---|---|---|---|---|---|---|---|
| Incentive points to attend | 0 | 0 | 0.75 | 0.8 | 0.8 | 1.05 | 1.29 | 1.6 | |
| Participation Level | % | % | % | % | % | % | % | % | # |
| Course only reference group | 83% | 86% | 78%% | 52% | 57% | 65% | 54% | 52% | 632 |
| Attended workshop only | 11% | 9% | 15% | 28% | 28% | 21% | 31% | 36% | 229 |
| Attended + started challenge | 4% | 3% | 4% | 10% | 9% | 8% | 7% | 5% | 63 |
| Attended + completed challenge | 2% | 2% | 2% | 10% | 6% | 6% | 7% | 7% | 55 |
| Total student observations | 157 | 103 | 46 | 124 | 133 | 113 | 164 | 139 | 979 |

**Table 2**

*Median values for continuous variables by participation level*

| *Participation Level* | Adj. Final Grade | HS GPA | % of Pell max | Credits passed | Credits failed | Exam 1 z-score | n |
|---|---|---|---|---|---|---|---|
| Course only reference group | 78.8 | 3.5 | 0 | 8 | 0 | 0.08 | 632 |
| Attended workshop only | 83.0 | 3.6 | 0 | 3 | 0 | 0.30 | 229 |
| Attended + started challenge | 82.3 | 3.6 | 0 | 0 | 0 | 0.08 | 63 |
| Attended + completed challenge | 90.5 | 3.9 | 0 | 0 | 0 | 0.56 | 55 |
| All student observations | 81.0 | 3.6 | 0 | 4 | 0 | 0.18 | 979 |

**Table 3**

*Means, standard deviations, and correlations for continuous variables*

| | | | Correlation Matrix | | | | |
|---|---|---|---|---|---|---|---|
| Measures | M | SD | 1 | 2 | 3 | 4 | 5 |
| 1) Adjusted Final Grade | 79.37 | 12.88 | — | | | | |
| 2) High School GPA | 3.56 | 0.50 | 0.43 * | — | | | |
| 3) Percent of Pell max | 0.16 | 0.34 | -0.17 * | -0.14 * | — | | |
| 4) Credits passed prior to semester | 17.19 | 21.48 | -0.02 | -0.09 | 0.06 | — | |
| 5) Credits failed prior to semester | 0.83 | 2.82 | -0.22 * | -0.15 * | 0.12 * | 0.41 * | — |
| 6) Exam 1 z-score | 0.10 | 0.91 | 0.72 * | 0.43 * | -0.11 * | -0.01 | -0.13 * |

Notes: n=979 * $p < 0.01$

**Table 4**

*OLS regression on adjusted final course grades (100-point scale)*

| | *Model 1* | | | *Model 2* | | |
|---|---|---|---|---|---|---|
| Independent Variables | Coefficients | | SE | Coefficients | | SE |
| High School GPA | 9.58 | ** | 0.75 | 2.82 | ** | 0.61 |
| Percent of Pell max | -3.79 | ** | 1.06 | -2.62 | * | 0.80 |
| Credits passed prior to semester | 0.06 | ** | 0.02 | 0.04 | * | 0.01 |
| Credits failed prior to semester | -0.83 | ** | 0.14 | -0.59 | ** | 0.11 |
| Exam 1 z-score | | | | 9.02 | ** | 0.33 |
| Attended workshop only | 3.51 | ** | 0.87 | 3.22 | ** | 0.66 |
| Attended + started challenge | 0.21 | | 1.49 | 2.24 | | 1.12 |
| Attended + completed challenge | 7.08 | ** | 1.59 | 5.61 | ** | 1.20 |
| Constant | 44.11 | ** | 2.71 | 67.48 | ** | 2.21 |
| *Model Statistics* | | | | | | |
| Observations | 979 | | | 979 | | |
| F-statistic | 24.59 | ** | | 164.79 | ** | |
| Adjusted $R^2$ | 0.283 | | | 0.573 | | |

Notes: * p < 0.01 ** p < 0.001