THE CONSTRAINTS AND AFFORDANCES OF HOMEWORK REFLECTION FORMS IN COMMUNITY COLLEGE MATHEMATICS

AS LIMITAÇÕES E AS POSSIBILIDADES DAS FORMAS DE REFLEXÃO SOBRE DEVERES ESCOLARES NA MATEMÁTICA DA FACULDADE COMUNITÁRIA

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ABSTRACT
Reflection and self-assessment are key aspects of learning that should be part of the homework process, especially for college students. This article examines student participation in a homework reflection process in community college algebra. Data from two semester-long studies are compared in terms of how the format and content of reflection forms constrain and afford students' reflection and self-assessment of graded mathematics assignments. The first study revealed that the format of the self-assessment section of the forms constrained student work, as students did not understand how to complete the form, but that additional questions on the form did support reflection especially on the need to use resources and develop understanding of course learning outcomes. This study also revealed that students who participated in the reflection process during the entire semester gave more in-depth reflections and self- critiques than their peers who only participated for part of the semester. The results of the first study were used to redesign reflection forms used in the second study. The redesigned form better supported self-assessment. However, the differences in how students used the form remained. Possibilities for further redesign of the reflection forms are discussed, as well as implications for teaching practice and research.

Key words: mathematics homework, self-assessment, community college.

RESUMO
Reflexão e auto avaliação são aspectos fundamentais do aprendizado que devem ser parte do processo dos deveres escolares, especialmente para estudantes universitários. Este artigo examina a participação dos alunos em um processo de reflexão sobre a lição de casa de álgebra na faculdade comunitária. Dados de dois estudos feitos ao longo do semestre são comparados em termos de como o formato e o conteúdo dos formulários de reflexão restringem e proporcionam a reflexão e auto avaliação dos alunos de deveres graduados de matemática. O primeiro estudo revelou que o formato da seção de auto avaliação dos formulários limitou o trabalho dos alunos, porque estes não entenderam como completar o formulário, mas que as questões adicionais no formulário ajudaram a refletir especialmente sobre a necessidade de usar recursos e desenvolver compreensão dos resultados da aprendizagem do curso. Este estudo também revelou que os alunos que participaram do processo de reflexão durante todo o semestre apresentaram mais

reflexões e autocríticas em profundidade do que os seus pares que só participaram em parte do semestre. Os resultados do primeiro estudo foram utilizados para redesenhar formas de reflexão usadas no segundo estudo. O formulário redesenhado melhorou a auto avaliação. No entanto, as diferenças em como os alunos usaram o formulário permaneceram. Possibilidades de redesenhar os formulários de reflexão são discutidas, bem como implicações para o ensino de práticas e pesquisas.

Palavras-chave: deveres de matemática, auto avaliação, faculdade comunitária.

1. Introduction

One of the greatest challenges for educators at all levels is how to engage students effectively with homework. Despite historical and current controversies, in mathematics, homework continues to be recommended for secondary and college students in the US (Blair, 2006; NCTM, 2000). To truly make homework a learning opportunity, students must receive feedback on their work; and for feedback to be effective, input on how to improve is essential (Hattie & Timperley, 2007). To be able to improve work, students must learn to judge their work as teachers do and to use the same standards for future work (Sadler, 1989). Thus, the challenge of engaging students with homework includes extending the process of completing homework tasks to include reflection, self-assessment, and revision.

This paper examines how community college students participated in a homework reflection process. The analysis compares results from two semester-long studies of Intermediate Algebra students' participation in a homework reflection process that involves the use of reflection forms (i.e., worksheets to record students' reflection work). The comparison focuses on how the format of the reflection forms constrains and affords students' participation in the reflection process. This analysis relies on the conceptualization of homework as a social practice (Landers, 2013), with specific attention to the reflection forms as cultural tools or artifacts that mediate students' actions (Wertsch, 1998). Ideally, the format and content of reflection forms should constrain and afford students' work in productive ways. This paper considers how different forms used in the two studies did and did not achieve this goal for different students in the classes. The results from the first study were used to revise the forms for use in the second study. Therefore, the findings of this comparison have practical implications for the continued development of the reflection forms as well as theoretical implications for the development of the notion of homework as a social practice.

The article is organized as follows. The next section details the theoretical framework for the research, including the concepts of constraints and affordances. Following, I describe the research methods and then the findings from both studies. Finally, implications for teaching practice and research are discussed.

2. Theoretical Perspective

This study is grounded in the conceptualization of homework as a social practice (Landers, 2013) rather than homework as a set of assigned tasks (Cooper, 1989). Defining homework as such entails a focus on how students participate with teachers and others in their lives (e.g., family

members or peers). Following Wenger, I define practice as engagement in work or activities in social contexts that "gives structure and meaning to what we do" (Wenger, 1998, p. 47). Researchers have long studied social practices as central to learning and development, examining how participation in a practice provides opportunities for learning, problem solving, and cognitive and identity development (e.g., Cole, 1996; Lave & Wenger, 1991; Rogoff, 2003). For several decades the field of mathematics education has seen a "social turn" or "the emergence…of theories that see meaning, thinking, and reasoning as products of social activity" (Lerman, 2000, p. 23). Often described as a sociocultural perspective, researchers in this tradition attend to the "socially and culturally situated nature of mathematical activity" (Cobb, 1994, p.13).

From this perspective it may be argued that the unit of analysis might be a "community of practice", like the world of the claims processors Wenger studied (Wenger, 1998), or the "figured world" of a school or classroom (Boaler & Greeno, 2000; Holland, Lachicotte, Skinner, & Cain, 1998). However, the nature of homework as a practice leads to a different analytical focus, as homework is different from other practices. Although students do homework with other people, students are positioned as the "owners" of homework (Varenne & McDermott, 1999). That is, they have a different role than other participants and they are held responsible for the artifacts produced in practice. Therefore I "zoom in" on students (Lerman, 2001) as they participate in the practice of homework.

Grounded in a Vygotskian perspective on learning and development (Vygotsky, 1978), a sociocultural perspective conceptualizes human activity as mediated by cultural tools or artifacts (c.f. Cole, 1996; Wertsch, 1998). The means by which human actions are mediated may in fact be a physical tool, such as a hammer or a wrench, but the concept of cultural tools or meditational means also includes language, symbolic systems, psychological schemas, and so on. The assumption is that to understand human actions, both internal (mental) and external, we must consider the agents (humans acting with goals) and the meditational means as a system. Thus, the analytical goal is to understand the relationship or interaction between an agent and the meditational means (Wertsch, 1998). Wertsch provides the example of pole vaulting: to understand this activity, one cannot analyze only the pole or the athlete. Further, Wertsch's example of using the standard algorithm for multi-digit multiplication illustrates how multiplication is not a direct action but one mediated by the structure and process of the algorithm. This conceptualization of cognitive activity is aligned with the notion of distributed cognition, where cognition is not defined as an aspect of a person's mind, but as distributed across a person and artifacts as a system (Hutchins, 1995).

In mathematics education many tools are used, such as rulers, calculators, and manipulatives. Individual students utilize such cultural tools in their work but these tools also mediate collaborative problem solving (Katic, 2009). In the practice of mathematics homework, students can employ many of these same tools. The paper artifacts they bring home are also meditational means, such as direction sheets, worksheets, or workbooks. With respect to engaging students in reflecting on work, teachers often employ rubrics to support students in learning to self-assess (cf. Andrade & Valtcheva, 2009). The current research examines how mathematics students use homework reflection forms. These forms scaffold students' review of graded assignments by providing a list of topics on which to self-assess and questions to guide reflection on their engagement with the assignment. The analysis focuses on the *constraints and affordances* of the

forms. The affordances of a cultural tool are the aspects that enable action, while the constraints limit possible actions (Brown, 2009; Wertsch, 1998). The notion of a constraint may seem negative, but a constraint may limit actions in useful ways, such as narrowing down options from a large set of possibilities (Brown, 2009). The current research considers both notions of constraints in the analysis of students' use of the reflection forms.

3. Methods

3.1 Setting and Participants

The current study was conducted at a community college in Northern California. The college's student body is diverse along several dimensions, including age, race/ethnicity, and socioeconomic status. In recent years the college has seen a growth in the number of students enrolling directly after high school, and many of these students assess into developmental courses. As is the case at many of California's community colleges, the majority of students must take developmental math courses before they can complete college-level courses needed to transfer to a four-year institution. Developmental math programs include courses from arithmetic to intermediate algebra, and progressing through this sequence has proven to be a challenge and often a barrier to educational advancement for an alarming number of students (Bonham & Boylan, 2011), especially students of color and first generation college students (Hern, 2010).

Given this context and a desire to support students in preparing for college level math, faculty in the math department at this college created a developmental program grounded in research-based best practices of developmental education, including the integration of learning and study strategies and opportunities for faculty professional development (Bonham & Boylan, 2011). The program is designed around five learning outcomes: (1) mathematical communication, (2) reasoning and problem solving, (3) multiple representations, (4) skills and applications, and (5) effective learning. This last outcome includes the expectation that students are able to self-assess strengths and weaknesses and use appropriate resources and strategies to improve learning. As the capstone course in the program, Intermediate Algebra provides students with opportunities to develop and use skills related to all of these outcomes. As an Intermediate Algebra instructor I continuously develop teaching strategies related to the effective learning outcome. The research described here is grounded in that effort. Therefore the participants of the study include students in two semesters of Intermediate Algebra, as well as the author, as both researcher and course instructor (cf. Magidson, 2005).

In both studies students were found to be evenly distributed in three categories or levels of participation in the reflection process: (1) frequent participants, or students who completed most or all of the reflection forms, (2) decreased participants, or students who started the semester completing the forms, but stopped during the semester, and (3) non-participants, or students who completed few or no forms. The current research focuses on students in categories (1) and (2).

Table 1. *Student participants from Study 1 and Study 2*

Category	N (Study 1)	N (Study 2)	Description
1. Frequent participation	10	10	These students completed greater than 70% of the reflection forms
2. Decreased participation	10	8	These students started out completing reflection forms, then decreased in frequency, or stopped turning them in. These students completed approximately half of the forms.
3. Non-participation	8	8	These students completed 0- 3 reflection forms. These students are not included in the current research.

3.2 Procedures

The research was conducted in two sections of Intermediate Algebra taught in successive semesters. Both classes were taught using highly similar curriculum materials, assignments, and assessments. Assignments included skill-development software, worksheets, journal writing, and more in-depth written assignments, which are designed to be completed in a math lab and are aligned with the learning outcomes described previously. These written assignments extended in-class activities and required students to develop and use skills such as explaining concepts and processes, and solving modeling problems using multiple representations (i.e., tables, graphs, and symbolic algebra.) Both sections met twice per week and were given an assignment at the end of each class session, due the next. All assignments were graded and returned the following class session. Students then completed written reflection forms for the in-depth written assignments (20 forms in Study 1 and 18 in Study 2).

In both studies the reflection forms included prompts for students to record their scores for the given assignment and to rate their satisfaction with their performance. The forms prompted students to self-assess on a list of topics that represented the skills and knowledge for the assignment. This list was therefore different on each form, tailored to the given assignment. The forms also included other questions to guide students in their reflections on their work, such as the resources they used or what they could have improved. The format and content of the forms used in both studies will be detailed as part of the analysis of constraints and affordances of the forms, including how the forms were revised between Study 1 and Study 2.

In order to give students ample opportunities to reflect over the course of the semester, but also to adjust to the nature and expectations of the course, the reflection forms were introduced two weeks into the semester in both studies. As the instructor, I introduced the forms by explaining that although some students may already review their graded work, this activity would provide all students with a structure for doing so, towards improving their ability to learn from homework feedback. The forms became part of the routine of the classes: students received a new form with returned assignments and they submitted forms with the next assignment. However, in order to help students view the forms as a learning opportunity rather than an assessment, the completed forms were not graded. In Study 1, students did not receive feedback on the forms, as they were kept for analysis. In Study 2, I reviewed the completed forms,

provided limited feedback, scanned the forms, and returned them to students.

3.3 Data Sources and Analyses

The data for both studies consists of the completed reflection forms for students in Category 1 (frequent participation) and Category 2 (decreased participation). This corpus includes 275 reflection forms in Study 1 and 219 forms in Study 2.

Analysis of the reflection forms was conducted in four phases, described below. For both semesters, the analysis focuses on the constraints and affordances of the forms for (1) student self-assessment on assignments and (2) students' reflections on the work they did for the assignment. Therefore, the analyses focused on selected questions on the reflection forms. As shown in Appendix 1, in Study 1, questions 3 and 4 on the reflection form were for self-assessment and question 5 was designed for students to reflect on their work. As shown in Appendix 2, in Study 2, questions 2 and 3 were for self-assessment and questions 4 and 5 were for reflection.

3.3.1 Phase 1 analysis

The first phase of analysis examined the assumed constraints and affordances of the form used in Study 1. As the designer of the reflection form and course instructor, I documented my assumptions about how the format and content of the form would afford or enable students' self-assessment for each assignment and their reflection on their homework process. This analysis focused on questions 3, 4, and 5 of the form. (See Appendix 1 for a sample form.)

3.3.2 Phase 2 analysis

The second phase of analysis examined the constraints and affordances of the forms as students used them in Study 1. The first goal of this analysis was to determine how the format and content of questions 3 and 4 of the reflection forms afforded students the opportunity to self assess, or if the format and content constrained or limited their work in potentially unproductive ways. Students' responses to these questions were reviewed to determine if they completed the self-assessment and if they did so correctly. Students' completion of these questions was compared across the participation categories described above to determine if there were differences between the two groups of students.

The second goal of this analysis was to determine what types of reflection were afforded by question 5 on the form and how the question may have potentially constrained reflection. This analysis combines etic and emic perspectives on the data. As described above, this work is grounded in the conceptualization of homework as a social practice. In this vein, a central issue is how students make meaning out of their homework participation (Landers, 2013). Thus, it is necessary to understand students' perspective on their experiences doing each assignment. A grounded approach (Glaser & Strauss, 1967; Strauss, 1987) was therefore used to develop a set of themes grounded in the perspectives of the students. Their responses to question 5 were used to develop categories or themes. An initial analysis of the Study 1 forms resulted in the broad categories of (1) accounting for success and (2) accounting for lack of success. Then each student's forms were reviewed to create a summary list of topics for that student. Following, all

of the students' lists were considered together to identify larger themes or patterns across cases, within the framework of accounting for success or lack thereof. For example, when students' summary lists included items that referenced the different types of resources they used on assignments, a larger category of "resources" was created. The themes identified were compared across the participation categories to determine if there were differences between the two groups of students, with a focus on how the question enabled or potentially limited reflection.

3.3.3 Phase 3 analysis.

After Study 1, the reflection form was redesigned with the goals of supporting students in understanding how to productively use the form and engaging them in participating in the reflection process through the entire semester. The analysis of assumptions conducted in Phase 1 was repeated for the new version of the form used in Study 2. See Appendix 2 for a sample form.

3.3.4 Phase 4 analysis

The analyses described above as part of Phase 2 were repeated with the student reflection forms in Study 2. The list of codes developed in Study 1 was used as a starting point for coding students' responses to questions 4 and 5, which replaced question 5 in the form used in Study 1. (The redesign is discussed below as part of the Phase 3 analysis.)

4. Findings

4.1 Phase 1

Appendix 1 shows a sample of the reflection form used in Study 1. Questions 3 and 4 were designed for students to be able to consider each item as something they believed they had demonstrated mastery of on the assignment, or something on which they had not done well. Repeating the list was meant to cue students to circle every item once, in one list or the other. Thus, the set of questions was designed to support students in assessing their own (graded) work on a given assignment with respect to a list of skills/knowledge aligned to the assignment. In a sense, the list of skills can be considered a constraint. Following Brown's (2009) notion of a constraint not as a hindrance but as a clear boundary, giving students the list of skills/knowledge was designed to mediate their self-assessment activity by narrowing their focus to aspects of their work identified by their teacher as the most important skills and knowledge to be practiced and demonstrated on each assignment.

The instructional goal of question 5 was for students to reflect on their own actions during their completion of the assignment and to connect what they had done to their performance on the assignment. The question was otherwise open ended, designed to give students flexibility to account for their performance in terms that were meaningful to them. However, in the introductory discussion of the forms in class, students *were* prompted to write about topics such as resources they had used or topics they needed to study further. Therefore, the question and its introduction in class were designed to mediate students' reflection activity by focusing their attention on how to account for their performance. The existence of the question on the form was designed to afford this type of reflection, while its broad wording was designed to not constrain students to specific types of responses.

4.2 Phase 2

The comparison of reflection participation for students in categories 1 and 2 (frequent participation versus decreased participation) has been presented previously as part of a study that compared students in sections of Intermediate Algebra that did and did not participate in the reflection process (Landers & Reinholz, 2015). Here the focus is how the format and content of the reflection forms mediated students' self-assessment and reflection work.

In terms of self-assessment, the format of questions 3 and 4 appeared to have constrained student work. Although the 10 Category 1 students generally submitted complete reflection forms, only 3 of these students consistently, fully completed the self-ratings in questions 3 and 4. The other 7 students worked inconsistently, often missing items (i.e., not selecting the items in either list). Only 1 of the 10 category 2 students consistently, correctly completed the self-assessment. The other 9 students consistently missed items, and 1 of these students circled items in both lists. Thus, while these questions were designed for students to select each item once in one of the two lists, towards assessing each item as something mastered or something missed, in reality the questions constrained students' ability to self-assess in this way.

In response to question 5, students in both categories accounted for their success mainly in terms of the use of resources, especially getting help in the math lab. However, 7 of the category 1 students also wrote about using their classwork as a homework resource, a strategy that the category 2 students did not discuss, despite the fact that this resource is encouraged. Category 1 students also referenced course learning outcomes, especially mathematical communication. In accounting for their lack of success, both groups also referenced resources and learning outcomes, but Category 1 students further referenced specific math content on which they needed to improve. Overall, the question afforded students the opportunity to connect their homework efforts to their performance on assignments, but the students in Category 1 provided more detailed reflections and self-critiques in response to this question. Thus, the open-ended nature of the question could be considered a constraint. The question did not scaffold students to address particular issues, such as resources or specific mathematical content. Several students in Category 1 further used the question as a space to address other issues, such as critiquing the help they received in the lab. However, as written, the question limited focus to students' own actions. Therefore, some Category 1 students were more attuned to the larger possibilities of how to reflect than their classmates who perhaps took the question more literally. Examples of students' responses are shown in table 2.

Table 2. *Sample responses to reflection sheet question 5 in Study 1.*

Participation Category	Sample responses to question 5 (accounting for success or lack)	Case note
Frequent participation	Assignment 7: Overall I did a great job on this assignment. I understand how to solve systems using y = mx + b. What I got a little confused on was the estimation. I did not know how to explain it well. Assignment 27: I did awesome on this assignment. I took a long time on a detailed explanation. 100%. Yes!	This student completed all 20 reflection forms. She routinely wrote about many different issues to account for success and lack of it when relevant. She often focused on communication and used question 5 on the form to track development towards excellent communication, which she celebrated at the end of the semester when she felt she had mastered it. This student earned an A in the course.
Decreased participation	Assignment 7: I worked on this assignment in the math lab. When I got stuck on something I asked for help. I just forgot to check my work on the paper. I checked my work on the calculator. Assignment 24: I did not explain my work enough. I was confused on what to find on 1b.	This student completed the first 5 reflection forms and then only 5 more out of the 20 total during the semester. Her responses to question 5 focused mainly on utilizing the lab as a resource and working with classmates. This student earned a B in the course.

4.3 Phase 3

Given the analysis of student work in Study 1, it was essential to redesign the self-assessment portion of the reflection form. The grid format, as shown in question 2 of Appendix 2, was designed to afford students the opportunity to correctly complete the self-assessment. Three levels of performance were included to provide students with more and specific possibilities for labeling their work. The brief rubric at the top of question 2 was designed to remind students of how student work was assessed in the class discussion that introduced the forms in the second week of the semester. Finally, question 3 was included to work against the potential constraint of the skills/knowledge list in question 2. As an instructor, I wanted to develop a strategy for teaching students to generate for themselves the list of items presented in question 2. However, given the limits of class time for such activities, I chose to add question 3 to cue students to the fact that the list in question 2 might not be exhaustive, and that they could identify other skills or knowledge they had demonstrated on the assignment. Overall, the redesign was an attempt to create a format that would afford students the opportunity to self-assess on every item listed as

well as the chance to write about what was meaningful to them in their work. At the same time, I assumed that continuing to use a list in question 2 would appropriately constrain or bound students' work by focusing their attention on important skills and knowledge on each assignment.

Given the ways in which the Category 1 students in Study 1 had used the reflection question, I included question 4 (things to improve) and question 5 (resources) in the new form. The goal was to create a new form that appropriately mediated students' self-assessment and reflection work.

4.4 Phase 4

Although students in Category 2 were more likely than students in Category 1 to submit incomplete reflection forms, overall, students in both groups were able to complete correctly the self-assessment in question 2 of the redesigned form by checking off one rating for every skill listed. However, question 3 did not afford meaningful reflection in either group. Six of the 9 Category 1 students tended to address the question, though their responses were mainly redundant with what they wrote elsewhere on the forms. Only 3 of the 8 students in Category 2 answered this question, while the other 5 students generally left the question blank.

Similar to the results in Study 1, Category 1 students responded to question 4 (things to improve) with reflections about mathematical communication (8 of 9 students) and specific math content (5 of 9). Fewer students in Category 2 addressed specific math content (3 of 8), but most did write about communication (5 of 8). Students in both groups also wrote about the need to check their work. Thus, overall, students' responses to question 4 of the redesigned form were similar to how students in Study 1 accounted for their lack of success in question 5. However, by focusing question 4 only on areas to be improved, students were not afforded the same opportunity to write about how they accounted for their success on an assignment. The use of the words "skills/knowledge" in question 3 likely prompted students to consider adding topics to the list in question 2, rather than writing more generally about their success. Question 5 (resources) did afford students with some opportunity to account for their success. All of the students in Category 1 routinely completed this question and listed multiple resources for each assignment. Six of the 8 students in category 2 completed this question on the forms they submitted, but were less likely to list multiple resources, instead focusing on use of the math lab. Again, similar to Study 1, students in Category 1 tended to submit more complete forms and to use the reflection questions to provide more in depth and specific responses. Examples of students' responses are shown in table 3.

Table 3. *Sample responses to reflection sheet questions 3, 4 and 5 in Study 2.*

Participation Category	Sample responses	Case note
Frequent participation	Question 3: Usually all of the skills are listed on the grid above. The only thing is setting up a window on a graphing calculator, I still need help with that. Question 4: For my next assignment I need to make sure I do everything the directions ask so I can get a perfect score again. Question 5: class notes/examples, calculator, math lab	This student completed all 18 reflection forms. She used the forms to document the multiple resources she used on each assignment as well as her need to improve on communication and specific math content. This student earned a C in the course.
Decreased participation	Question 3: (blank) Question 4: checking my work for any simple errors. Question 5: graphing calculator, lab, old assignments	This student completed 9 of the 18 reflection forms and then stopped participating when she learned that the forms were not graded. This student tended to leave question 3 blank. In question 4 she focused on her need to make an effort and to check. In question 5, she focused on using her calculator and classwork as resources. This student earned an A in the course.

5. Discussion and Conclusions

The four phases of analysis presented seek to combine an investigation of the artifact itself (the reflection form) and how this artifact mediated students' self-assessment and reflection work. In both studies, the format and content of the reflection forms had constraints and affordances. The format of the self-assessment question in Study 1 constrained students' work in that many students did not appear to understand what to do with the repeated lists in questions 3 and 4. Thus, they were unable to complete successfully the self-assessment. Question 5 did afford students with the opportunity to reflect on their actions that led them to be successful or not as successful as they wanted on the assignment. However, students in Category 1 (frequent participation) were more likely to use this question to give a detailed self-critique than their classmates in Category 2 (those who decreased participation in this process during the semester). The fact that Category 2 students were more likely to misunderstand the self-assessment format and less likely to provide detailed, specific responses to question 5 was previously identified as a possible explanation for why these students stopped reflecting during the semester (Landers & Reinholz, 2015). Thus, redesigning the forms was a high priority for Study 2.

Students' use of the forms in Study 2 did demonstrate better understanding of the self-assessment format in question 2. The new grid format provided students with a better visual cue to self-assess every item listed. However, the inclusion of question 3 (additional skills/knowledge demonstrated) was not clearly meaningful to students, as they tended to repeat what they had written elsewhere, acknowledge the question with a comment such as "none", or leave the question blank. Students in both categories used questions 4 and 5 to reflect on where to improve their work and what resources they were using, with similar results to Study 1 in that Category 1 students tended to provide more detailed responses. However, these questions did not explicitly prompt students to account for their success as the form used in Study 1 had done. This was an unintended constraint that limited students' opportunities to reflect on what they had done to be successful, beyond listing resources. Overall, the redesigned form created a more equitable meditational tool for students with respect to self-assessment, but perhaps less so in terms of reflection.

As an instructor, one of my goals in continuing to develop the reflection process was to keep students engaged during the entire semester. In Study 1, after introducing the reflection forms I did not routinely remind students to submit the forms or confront them when they did not, as I would do with homework assignments. It was only at the end of the semester that I saw that only one third of the students had completed forms during the entire semester. However, this result seemed appropriate given that the forms did not earn students points and that I had not reminded students to complete them. For Study 2, I aimed to increase participation by redesigning the forms and engaging students in several class discussions about how to use the forms, including an activity in which we rated anonymous student work. Yet, the same distribution of participation remained, with only one third of students participating throughout the entire semester. One explanation might be that students with higher grades would participate more, as these students tend to have better study skills or may want to please a teacher. In Study 1, Category 1 students' courses grades were slightly higher than Category 2 students: A-C range versus B-C range. However, in Study 2, Category 1 students had course grades in the B-C range and Category 2 students had grades in the A-C range. (In both studies, the students in Category 3 (non participation) tended to have lower course grades, as these students routinely did not complete assignments in the first place.) Another explanation might be that the reflection forms created work for students to complete outside of class in addition to their regular assignments. Students in Category 2 may have discontinued their participation at points during the semester when other assignments took priority. Unfortunately, surveys given at the end of the semester in both studies did not provide much insight into the decreased participation. However, what is clear is that the new form did not function as a meditational tool to support sustained participation for students who would otherwise stop participating.

The results of both studies point to several possibilities for further redesign of the reflection forms and process. In terms of the forms, the reflection questions (3, 4, and 5) could be revised to (1) better provide students with cues to account for their success and (2) support all students in learning to write specific, in-depth self-critiques. In terms of process, additional in-class activities might motivate students to complete reflection forms, as in-class activities and discussions would provide opportunities to negotiate how to use the forms and to create buy-in to the value of reflection. The reflection process could also be expanded to include peer-review and revision, strategies that have been identified as productive for self-assessment (Reinholz, 2015) and for learning through self-assessment (Andrade, 2008).

Future research could investigate the results of the continued development of the forms and reflection process. Additionally, to continue to build understanding of the constraints and affordances of the reflection forms, alternative research methods should be considered. For example, observations of students engaged in peer review could provide significant details of how the forms mediate reflection and revision, including constraints and affordances of the forms, as well as how the forms become reifications of reflection work and hence a source of meaning (Wenger, 1998).

Further, the concepts of constraints and affordances broaden the conceptualization of homework as a social practice by considering not just the interactions among people, but the interactions between people and cultural tools as well. This perspective points to the potential for analyzing the constraints and affordances of other tools or meditational means used in the practice of homework. Do students differentially interact with tools such as workbooks, calculators, or online resources? How do these tools constrain or afford productive homework practices?

Such questions are grounded in a commitment to understanding how homework can be a productive practice for students rather than a burden. The call to expand the practice of homework to include reflection, self-assessment, and revision, is grounded in this same commitment to promoting homework as a learning opportunity for all students.

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Appendix 1
Sample Reflection form from Study 1. (Student forms contain space after question 5.)

Assignment 4 reflection log sheet (turn in with assignment 6) Name: _____

Directions: read over your work and feedback you received on assignment 4 (Unit 1 activity 4 lab.) Then complete this form.

1. The score I received on this assignment was ___, which is ___ percent.

2. How satisfied are you with your work on this assignment? Circle or highlight one:
Very satisfied Satisfied Somewhat satisfied Somewhat dissatisfied Very Dissatisfied I don't care

3. What did you do well on this assignment? Circle or highlight all that apply.

- Demonstrating knowledge of the definition of function
- Completing all problems
- Using function notation to find an output, given an input
- Using function notation to find an input, given an output
- Generally documenting and communicating work
- Defining variables
- Estimating values from the graph in #5
- Finding and using an equation in #5
- Communicating understanding of the context in #5 by explaining what values mean

4. What did you miss or not do well on this assignment? Circle or highlight all that apply.

- Demonstrating knowledge of the definition of function
- Completing all problems
- Using function notation to find an output, given an input
- Using function notation to find an input, given an output
- Generally documenting and communicating work
- Defining variables
- Estimating values from the graph in #5
- Finding and using an equation in #5
- Communicating understanding of the context in #5 by explaining what values mean

5. Explain what you did that led you to be successful on this assignment, or what led you to not be as successful as you may have wanted.

Appendix 2
Sample Reflection form from Study 2.
(Student forms contain space after questions 3, 4, , and 7.)

Assignment 4 reflection log sheet (turn in with assignment 6) NAME: _____

Directions: review your work and the feedback you received on **assignment 4** (**unit 1 activity 4 lab**.) Then complete this form.

1. The score I received on this assignment was _____/_____, which is _____ percent.

2. Rate yourself on each skill/concept listed.

Excellent: my work on this assignment shows I have achieved this skill, with the exception of minor errors.
Satisfactory: my work shows that I have a basic understanding, but there is room for improvement.
Not there yet: my work shows that I have a lot of work to do to mastery this skill or understand a concept.

Skill/knowledge	Excellent	Satisfactory	Not there yet
Demonstrating knowledge of the definition of function			
Using function notation to find an output, given an input			
Using function notation to find an input, given an output			
Estimating values from a graph			
Finding points on a line			
Using the graph of a line to write an equation			
Explaining the meaning of function values in context			
Documenting/communicating my work			
Defining variables			
Completing all problems			
Following directions			

3. What other skills/knowledge not listed do you think you demonstrated on this assignment?

4. Describe one thing you could improve upon for your next assignment and how you will do it.

5. What resources did you use to help you complete this assignment?

6. How satisfied are you with your work on this assignment? Circle or highlight <u>one</u>:

Very satisfied | Satisfied | Somewhat satisfied | Somewhat dissatisfied | Very dissatisfied | I don't care

7. Write a sentence to explain why you rated yourself this way in #6.