Annual Report for Assessment of Outcomes 2011-2012

Please address the questions below
send to *learningassessment@pcc.edu* by **June 22, 2012;** with Annual Report in the subject line

Note: Information provided in this report may be inserted into or summarized in Section 2C (LDC/DE)) or 6B (CTE) of the Program Review Outline.

This report is submitted by the Math Learning Assessment Standing Subcommittee (Math LAS) on behalf of the Mathematics SAC.

Members of the Math LAS and others who have been integral to this year's work (our one adjunct faculty member this year is bolded --- much appreciation for her time and work!):

Cascade (CA): Amy Cakebread, Carly Vollet
Rock Creek (RC): Ann Cary, Henry Mesa, Jeff Pettit, Jessica Bernards
Southeast (SE): Stephanie Yurasits
Sylvania (SY): Alex Jordan, Emiliano Vega, **Kelly Mercer**, Kim Neuburger, Michele Marden (chair)
Other Important Participants: Ann Sitomer (CA), Pete Haberman (SY), Steve Simonds (SY)

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Disclaimer:
The data included in this report is for PCC Math SAC use only. The survey was specifically designed for analysis of student learning for the college's core outcomes, as they are currently stated, under the guidance of PCC's Learning Assessment Council. The data is should not be used, nor is intended to be used, by any individual or group as an evaluation tool of individual mathematics faculty members, individual mathematics tutors, or individual students taking math courses. In addition, the data should not be used, nor is intended to be used, by non-PCC mathematics faculty as an evaluation of the mathematics department. PCC Math SAC permission is required before the data is used by any other individuals and/or groups for any purposes. Note: Use of this data in any means for research use and/or publication is strictly prohibited.

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1. Describe changes that have been implemented towards improving students' attainment of outcomes that resulted from outcome assessments carried out in 2010-2011. These may include but are not limited to changes to content, materials, instruction, pedagogy etc.

The Mathematics SAC is discovering how to make assessment of student learning meaningful and manageable. We have worked out many process-related kinks this year.

Assessment work for the past two years has been carried out by the Math Learning Assessment Standing Subcommittee (Math LAS). However, this year the Math SAC established another assessment group at the May SAC meeting, called the Action Subcommittee. This Action Subcommittee is charged with two things:

1. Determine how to best bring the potential actionable items collected by the Math LAS from this year's (and last year's) assessment data to the Math SAC. [As a group, the SAC will decide which action items to implement with guidance from the Action Subcommittee. This work will occur in the Fall SAC meetings.]

2. Oversee the implementation of the items chosen for action within the SAC.

The need for an Action Subcommittee emerged due to (1) the time required for the 12-member Math LAS subcommittee to genuinely consider how to best assess our students for the core outcomes and (2) the challenges with communicating the process and the results of the assessment work with a large number of faculty members (approximately 140 full-time and adjunct, where approximately 45 of whom regularly attend SAC meetings).

For the last two years, the focus for Math LAS has been on the following:

1. Considering what the core outcomes mean for mathematics and involving the SAC in the discussion
2. Creating the assessment activity for the core outcome(s) and involving the SAC as needed
3. Choosing the appropriate population of students, the appropriate sample size, and the appropriate data collection method for the activity and then logistically managing all of these while ensuring anonymity for both students and instructors.
4. Discussing what the data means and involving the SAC in this discussion by setting up analysis sessions outside of SAC time.

Members of the Math LAS will be working in collaboration with the Action Subcommittee to provide any needed support to their work.

As we look to the future, the SAC has decided to use more time during SAC Spring inservice for assessment. If there is enough time on SAC day, the hope is that the SAC will discuss the analysis of future assessment results and decide the course of action we wish to take at this meeting. This approach might change the role of the Action subcommittee or eliminate the need for it altogether.

In summary, the Math LAS will still manage the first three tasks listed above (as well as write the assessment report to the LAC), but the whole SAC will manage the interpretation of the assessment results to decide on actionable items with support from the Math LAS as needed. The members of the Action Committee or the SAC chair will lead the interpretation discussions and the implementation of the changes in the SAC.

Although the Math SAC has not implemented any discipline-level changes from last year's work some individual instructors who were members of the Math LAS did implement changes:

1. Concern from trend results: A large number of students felt that all data was linear. Change by individual faculty member: Instructor introduced "real" data that is both linear and nonlinear. As a part of the instruction, the class discussed why linear relationships are the simplest case. Complicated data sets were used and the students determined when the data sets were "linear enough" to use the techniques learned in the course content to find intersection points. Students

worked on projects of their own interest including the following: high school graduation rates compared to high school drop-out rates; Americans abusing welfare compared to Americans that are truly in need; divorce rates of veterans compared to non-veterans; and suicide rates of homeless compared to non-homeless.

2. Concern from trend results: A large number of students were not able to correctly use percents. Change by individual faculty member: Further investigation of student understanding of basic percent problems by sometimes giving one as an optional word problem on a test. Percents were considered pre-requisite material for the course taught and were not reviewed before the test.

For each outcome assessed this year:

2. Describe the assessment design (tool and processes) used. Include relevant information about:

-The nature of the assessment (e.g., written work, project, portfolio, exam, survey, performance etc.) and if it is direct (assesses evidence mastery of outcomes) or indirect (student's perception of mastery). Please give rationale for indirect assessments (direct assessments are preferable).

A survey was administered using PCC's professional Survey Monkey account for SAC-level assessment. The core outcomes of Self-Reflection and Professional Competence were measured. Please refer to page 10 for the **2012 Math Survey Data.**

The survey is an indirect measure of student's perceptions. For Self-Reflection, we focused on questions that we felt would fit the following three areas:

- Reflection – Core reflective thinking items (basically autonomy & relatedness aspects from self-determination theory (SDT; Deci & Ryan, 2009))
- Orientation – Mastery/performance, internal/external locus of control (hold self or others responsible)
- Competency – Belief about self-ability to perform in math and how achieve that performance (3rd aspect from SDT)

The Math LAS considered doing a direct assessment of Self-Reflection. There was considerable discussion about conducting a study where we compared pilot group to a control group for student's cognitive awareness of their mathematical knowledge (ie, can a student actually self-reflect accurately on their knowledge of particular math concepts/skills?) using a method based in research called Self-Regulated Learning. While there are methods of assessing self-reflection directly, we decided we should first attempt an indirect assessment for these reasons:

1. Without first investigating student perceptions we would not have a baseline measure of how SAC-level change might affect student perceptions.
2. Perhaps we would find evidence that our students had (or at least felt they had) high levels of self-reflective behavior which would affect our choice of direct assessment.
3. Many of the Math LAS members felt that the pilot class would require significantly more development than time permitted.

In addition to Self-Reflection, our primary focus, we also included some survey questions to assess Professional Competence. The Math LAS invited the feedback of the math department's assigned Learning Assessment Council (LAC) coach in our development and his guidance in developing survey questions for this Professional Competence was very helpful. Again, we opted for indirect assessment to create a benchmark and begin to understand our student's perceptions of math in terms of their future job/career goals.

-The student sample assessed (including sample size relative to the targeted student population for the assessment activity) process and rationale for selection of the student sample. Why was this group of students and/or courses chosen?

The survey was sent to *all* students enrolled in *all* math classes that began the first week of the Spring 2012 quarter during a 4-day window of the second week of Spring Quarter. Unfortunately, technical complications related to sending out mass emails in our new Google platform resulted in some students having less than 4 days to complete the survey. Institutional Effectiveness (IE) supported our work by sending out the email on our behalf and helped fix the Google mass-emailing issue. IE indicated that approximately 10,000 students were emailed.

We had approximately 2300 students respond to the survey. This is an acceptable response rate for an emailed survey to perform inference. Perhaps the students in the sample self-selected and this is not a random sample, however we are somewhat comforted that the student response rates for particular courses mirror student enrollment in particular courses and other demographic information. Please refer to page 26 for the **College Demographics.**

We considered asking faculty to encourage student participation by giving students credit or bonus for completing the survey. We decided against this for the following reasons:

1. Logistically finding a way that students could "prove" to instructors that they completed the survey while maintaining anonymity for students and faculty (and communicating this process to faculty) was surprisingly difficult.
2. Assessment is a new process for higher education and the math department is still experimenting with how to do discipline-level assessment effectively. We felt it was critical to not mandate, or even encourage, faculty to give points to students either as a part of their class or as a bonus while we are in this learning phase.
3. Department chairs were concerned about the possibility of a high volume of students complaining about class-to-class equity if individual instructors weighted the incentive differently.
4. Some of the Math LAS members were familiar with Human Subject Clearance for the Institutional Review Board (IRB). IRB regulations are required for human subject research for academic publication. Although this work does not require such stringent adherence to regulation (per Laura Massey in PCC's Institutional Effectiveness department), we decided we wished to err on the side of caution in regards to student coercion. Student coercion would happen if a student did not wish to complete the survey but would lose points in his/her class because the survey was mandatory for a portion of their grade.

To help increase response rate, we wrote an introductory statement to communicate to students the ways participation in the survey would be beneficial for them (ie, help us help you). Department chairs at each campus emailed the Spring Quarter instructors at their campus asking them to encourage their students to participate in the survey and to read the introductory statement to their class (or post it online in D2L for online classes).

Introductory statement for the students:

> "The PCC Mathematics department is evaluating our courses and requests your help. Early in the second week of the quarter you will be sent an email to your MyPCC email account that has a link to an anonymous and confidential survey. The survey takes approximately 10 minutes.
>
> The survey must be completed by midnight of Thursday, April 12. Look for an email that has a subject line of "Math Survey (Deadline: 4/12)"
>
> This is your opportunity to help us better understand the student's learning experience of mathematics which will guide the mathematics department in making decisions for your benefit."

-Any rubrics, checklists, surveys or other tools that were used to evaluate the student work. (Please include with your report). Where appropriate, identify benchmarks. How you analyzed results, including steps taken to ensure that results are reliable (consistent from one evaluator to another).

The Math LAS was awarded a Learning Assessment Council grant. We used these funds (in part) to hire a consultant, Una Chi, to help us refine the survey and evaluate the student responses to the survey. Please refer to page 29 for the **Consultant Analysis of the Survey Data.**

Una gave a presentation at a Data Analysis session. All math faculty members teaching during Spring Quarter were invited to attend. We had 23 attendees with the following breakdowns:

CA: 5	SE: 2	Part-time: 7
RC: 5	SY: 11	Full-time: 16

Two members of the Learning Assessment Council's (LAC) Program Assessment for Learning (PAL) facilitated the analysis of the results. The PAL members asked us to consider the following questions:

1. Identify questions for the consultant about her analysis of the student responses.
2. Identify relationships or results that jump out at you or are interesting (without interpreting or reading into them)
3. Discuss possible interpretations and/or questions to explore from the data.
4. Brainstorm possible actions that SAC might take regarding curriculum/instruction that could be presented to the SAC for consideration or as a jumping off point for further brainstorming.

3. Provide information about the results (i.e., what did you learn about how well students are meeting the outcomes)?

- If scored (e.g., if a rubric or other scaled tool is used), please report the data, and relate to any appropriate benchmarks.
- Results should be broken down in a way that is meaningful and useful for making improvements to teaching/learning. Please show those specific results.

The bulleted items below are from the third focus item of the PAL facilitation process (ie, #3: Discuss possible interpretations and/or questions to explore from the data) from our Data Analysis meeting. These items are the faculty interpretation of the results from the survey. These items are intended to guide us to our action for the next school year to drive improvement in student learning. The Action subcommittee may discuss these results with the SAC as a part of determining the best course forward.

For Self-Reflection (SR):

- Look at what we are doing right with MTH 112 and higher
- 20% of students didn't think about how to improve grades
- Students are not self-critical enough
- Are students checking solutions on tests?
- Students should be encouraged and prompted to check their work more often and more in-depth
- Implementing questions that are really good at assessing deeper understanding and easily graded (have test "pools" or guidelines on how to write good tests questions)
- Do students understand math processes (or are students relying on rote memorization and algorithms)?
- Technology for 20,60,65. Is this a terminology issue?
- Survey represents our age groups
- Anecdotally "fits" with instructors experiences with students in their classrooms.
- MTH 20 students displayed less SR behavior than all non-MTH 20 students.
- MTH 112/251/252 display more SR behavior than the non's
- MTH 253/254/256/261 students display more SR behavior than the non's
- Self-reflective thinkers make better math students (or is it vise-versa?)
- There was a significant group mean difference between self-reported grade and SR behavior on all grade levels differences.
- There is a clear difference in the reflective thinking ability of high level math course students versus low level math students (like math 20).

For Professional Competence (PC):

- Surprising that Engineering was 11%--may be from 112 > higher
- Biggest gaps: Critical Thinking, Problem Solving, Communicating Ideas, Self Disc, Interpreting graphs/charts
- Presentation skills ranked low (highlight what we do already or consider that we don't want to "force" student to present at lower course levels – they are already too nervous about their math ability). What do we mean by "presentation" anyway? It is difficult to make time for this in the classroom; is it that important?
- Communicating ideas: Being able to explain a process
- Nursing was a not a surprise.
- Problem solving is a key component to mathematics and it's encouraging to know that student recognize that in our classroom (88%).
- 77% of students feel that they need math knowledge for their career but only 38% feel that PCC Math courses are teaching them those skills.
- Career specific math skills: value in seeing the mathematical side of math independent of their purpose/career goal.
- Students rated the "work place skills" that are more teacher-centered higher than they did the ones that are more student-centered.
- Technology: respondents weighted in Math 60/65

Although the Math SAC may have been aware of some of the result items before, the data has provided the us with a focus point that encourages faculty members to address students' needs in a new way.

In addition, one of the most valuable results of this work has been the discussion among colleagues at SAC meetings. This outcome was difficult for us in part because the math department does not have

any course outcomes that fit nicely under Self-Reflection. However, it was interesting to discover that some math faculty members do incorporate self-reflection into their teaching. Because of this discussion, materials and ideas were shared within the SAC for how to encourage self-reflective behavior for pre-100 students to increase success rates.

4. Identify any changes that should, as a result of this assessment, be implemented to help improve students' attainment of outcomes. (These may include, but are not limited to, changes in curriculum, content, materials, instruction, pedagogy etc).

As mentioned in number one of this report, the Action Subcommittee will be responsible for bringing the possible changes from this year's assessment work (and last year's) to the Math SAC for discussion in Fall Quarter 2012.

Below is a list of possible discipline-level changes created from the participants of this year's data analysis session which was hosted by the Math LAS. The Math LAS shared these actionable items with the SAC at our last Spring SAC meeting.

Potential actionable items to improve student learning:

- Encourage pre-100 students to take a CG 111C course (math study skills) ideally taught by a math instructor
- Add reflection pieces to our CCOGs
- Address concerns with student advising
- Create 5-10 minute lessons on self-reflection and study skills that faculty could easily incorporate in their courses (e.g. activities, videos,...)
- Share at SAC meetings the successful ideas already used by our faculty for how to
    - encourage better study skills
    - incorporate student-centered learning techniques
- Seek out professional development opportunities for student-centered learning techniques
- Include questions that relate to student-centered learning as a part of faculty online evaluation to help instructors judge the effectiveness
- Communicate to students the importance of ideas/concepts rather than rote memorization of recipes
- Pilot Self-Regulated Learning in MTH 20. This method is being used at Seattle Central Community College (SCCC) and City University of New York (CUNY). Results below were given in a presentation by Lawrence Morales from SCCC at the 2011 ORMATYC/WAMATYC joint conference.

The CUNY Study: Results

Developmental Students	Self-Regulated Learning	Control
Completed Course	73%	67%
Passed final exam	54%	34%

Passed course	50%	33%
Passed COMPASS post-test	47%	27%

Intro Math Students	Self-Regulated Learning	Control
Passed final exam	73%	50%
Passed course	68%	49%
Passed COMPASS post-test	64%	39%

Participants in the Data Analysis Session (adjuncts are bolded – with much appreciation for their time and work):
Cascade: Amy Cakebread, **Carl Keller, Julia Partlow**, Shane Horner, **Zack Wilson**
Rock Creek: Ann Cary, Dave Hall, Henry Mesa, Jeff Pettit, Jessica Bernards
South East: Rebecca Ross, Stephanie Yurasits
Sylvania: Alex Jordan, **Beven Kair**, dMarie Carver, Emiliano Vega**, Joe Bradford**, Kathy Bernunzio, **Kelly Mercer**, Ken Kidoguchi, Michele Marden, Phil Thurber**, Terry Tenada**

5. Reflect on the effectiveness of this assessment tool and assessment process. Please describe any changes to assessment methodology that would lead to more meaningful results if this assessment were to be repeated (or adapted to another outcome). Is there a different kind of assessment tool or process that the SAC would like to use for this outcome in the future? If the assessment tool and processes does not need to be revised, please indicate this.

As mentioned in number 2, we were trying to measure the following three areas for Self Reflection:

- Reflection – Core reflective thinking items (basically autonomy & relatedness aspects from self-determination theory (SDT; Deci & Ryan, 2009))
- Orientation – Mastery/performance, internal/external locus of control (hold self or others responsible)
- Competency – Belief about self-ability to perform in math and how achieve that performance (3rd aspect from SDT)

However, the analysis by our consultant indicated that the questions on the survey did not "hang" together well (ie, we had only one grouping of questions that related well enough to analyze). The group of questions that did "hang together" felt closest to the "reflection" area, so we defined is as such.

Possible changes to questions on the survey:

- If we wish to explore orientation or competency areas, we will need to add more questions to the survey that we believe would fall under those categories.

- We can remove some of the questions in the “reflection” area and still remain accurate (consultant shared that we need to keep 3-5 of the questions for future comparisons).

Possible changes to the demographic information:

- Age: We grouped ages based on how Institutional Effectiveness grouped students in the Credit Student Fact Sheet (http://www.pcc.edu/ir/factsheet/indexCRfactsheet.html) but we added in an ‘under 18” and “18-19” grouping. There were no statistically significant differences in age groups beyond age 20. We may wish to group ages differently to see if there are some differences by natural (i.e. developmental) or applied age (e.g. norms) groups beyond age 20 that the current analysis would not detect.
- Credit Hour: We hoped that students would know approximately how many credit hours they had earned from recently registering (PCC opens registration to students based on the number of credit hours earned with group 1 being 80.01 credits or more). The grouping of credit hours for the survey was based on the number of credits a student who has been attending full-time would attain in her/his first year. We added in an “80+” option for students to correspond with group 1 registration and a “bachelor’s or higher” option since it seems that a significant portion of degreed students are returning to college due to the economic times. There were no statistically significant differences in results based on how we grouped credit hours. We may wish to group college credit differently to see if there are actual differences that our statistical approach failed to detect.

Please refer to page 29 for the **Consultant Analysis of the Survey Data** for more detail on the possible changes

Future Self-Reflection and Professional Competence assessments may be more direct. However, we feel we learned a great deal about our students from this survey. It would be interesting to run it again to see if our results are similar either as a test to ensure we have a solid benchmark or, assuming it is a solid benchmark, as a comparison after we have incorporated discipline-level change. Note: If we do run the survey again, we will need to be sure that the two sample demographics are about the same (or else make adjustments for this when doing the comparison).

Spring Quarter 2012 Mathematics Survey

The survey was created by the Mathematics Learning Assessment Standing Subcommittee (Math LAS) with input from two DE Reading/Writing faculty members and a grant-funded consultant.

Approximately ten thousand math students received an email with the survey link. There were approximately 2300 respondents within a 4-day window of the second week of Spring Quarter.

The survey was focused on two of the college's Core Outcomes: Self Reflection and Professional Competence. The Core Outcomes are also the basis for the college's transfer degree outcomes. Link to the Core Outcomes: http://www.pcc.edu/resources/academic/core-outcomes/index.html

The college's definitions of Self Reflection and Professional Competence are given below. However, the Learning Assessment Council (LAC) encourages each SAC to assess student learning for the core outcome in a way that makes sense to, and is appropriate for, their discipline/program. This gives each SAC the opportunity to assess an outcome in a meaningful way.

Survey results given in this document were generated by Survey Monkey.

Self-Reflection:

Assess, examine and reflect on one's own academic skill, professional competence and personal beliefs and how these impact others.

Professional Competence:

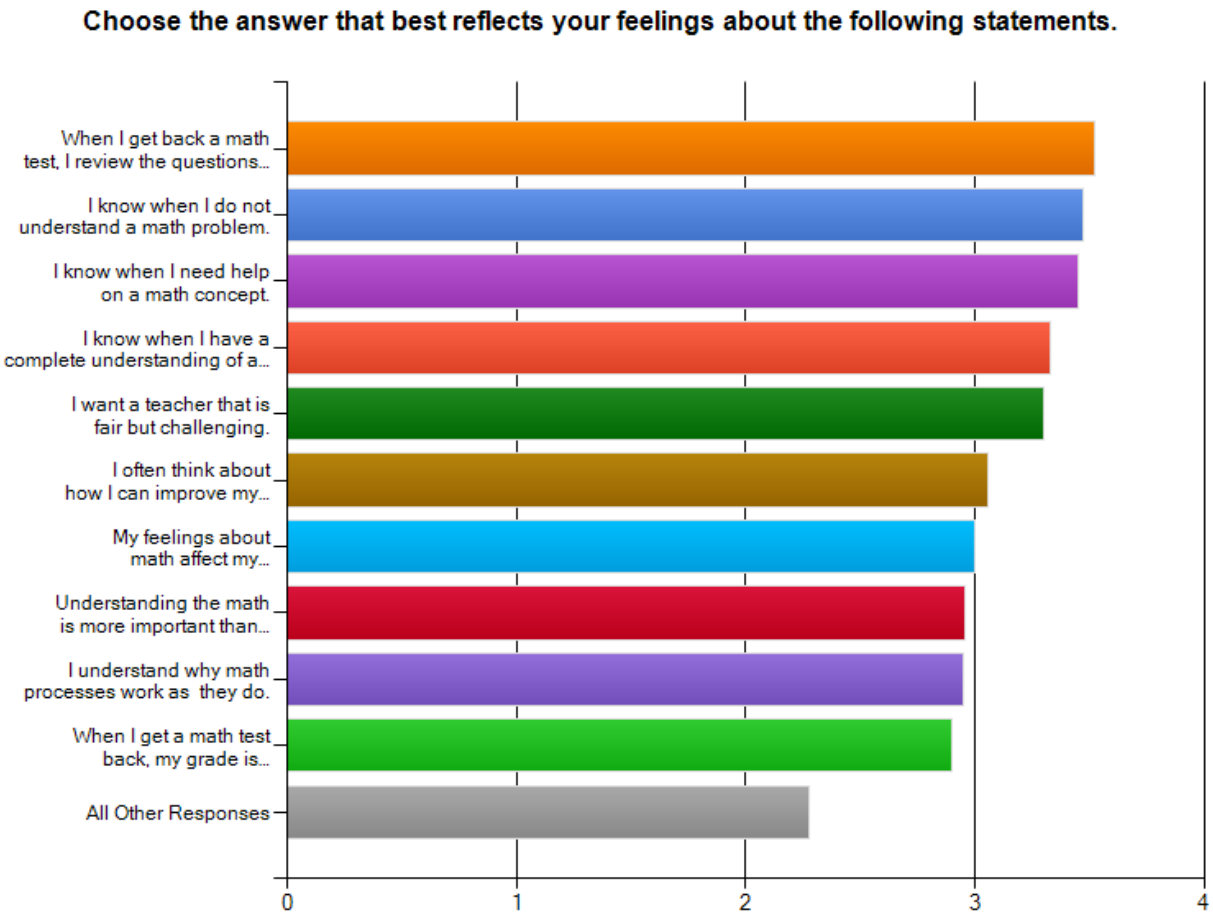
Demonstrate and apply the knowledge, skills and attitudes necessary to enter and succeed in a defined profession or advanced academic program

Question 1:

Choose the answer that best reflects your feelings about the following statements.							
	Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**	**N/A**	**Rating Average**	**Response Count**
I know when I do not understand a math problem.	1.4% (33)	3.4% (78)	41.8% (968)	**52.4% (1,215)**	1.0% (23)	3.47	2,317
I know when I need help on a math concept.	1.0% (24)	2.5% (58)	46.0% (1,066)	**49.4% (1,145)**	1.1% (26)	3.45	2,319
When I get a math test back, my grade is what I expect it to be.	2.8% (65)	18.8% (436)	**58.3% (1,352)**	15.0% (348)	5.1% (118)	2.90	2,319
When I get back a math test, I review the questions where points were lost.	1.1% (25)	3.2% (75)	37.3% (868)	**56.0% (1,302)**	2.3% (54)	3.52	2,324
I understand why math processes work as they do.	3.1% (71)	18.8% (435)	**55.3% (1,277)**	20.6% (475)	2.2% (50)	2.95	2,308
If my work and the answer key don't agree, I think my math is correct and the solutions manual is wrong.	37.6% (873)	**48.5% (1,124)**	8.3% (193)	2.2% (52)	3.3% (77)	1.74	2,319
I often think about how I can improve my math study skills.	2.5% (58)	18.5% (430)	**47.1% (1,093)**	29.7% (689)	2.1% (49)	3.06	2,319
I think about why I feel the way I do about math.	5.6% (130)	21.3% (493)	**45.7% (1,057)**	20.0% (464)	7.4% (171)	2.87	2,315
I know when I have a complete understanding of a math problem and could teach it to someone else.	1.3% (31)	6.6% (153)	**49.2% (1,146)**	41.9% (975)	1.0% (23)	3.33	2,328
My feelings about math affect my learning of math.	5.6% (129)	18.5% (428)	**43.7% (1,012)**	29.9% (693)	2.4% (56)	3.00	2,318
If I have a good textbook, I can learn math on my own without a teacher.	21.9% (509)	**41.8% (972)**	24.0% (558)	11.0% (255)	1.2% (29)	2.24	2,323
The skills I learn in a math class are not important to me or my future goals--I just need to pass the	**40.2% (936)**	36.5% (848)	14.4% (335)	7.7% (180)	1.2% (27)	1.90	2,326

I want an easy math teacher.	14.0% (324)	**43.3% (1,000)**	27.7% (641)	10.3% (237)	4.7% (109)	2.36	2,311
I want a teacher that is fair but challenging.	1.2% (28)	6.7% (156)	**51.0% (1,181)**	39.0% (903)	2.1% (49)	3.30	2,317
Understanding the math is more important than who I have as a teacher.	6.9% (160)	20.6% (478)	**38.7% (899)**	30.8% (716)	2.9% (68)	2.96	2,321
I know if I have a math problem right or wrong before I check the answer.	5.2% (120)	41.5% (963)	**41.7% (967)**	8.5% (198)	3.0% (70)	2.55	2,318
					answered question		**2,332**
					skipped question		**1**

Looking at Question 1 in a different way:



In PCC math classes, what knowledge, skills, habits or ways of thinking have you practiced that might help you in the work place?

	Response Percent	Response Count
Punctuality	59.6%	1,367
Meeting Deadlines	69.3%	1,589
Critical Thinking	76.5%	1,755
Problem Solving	**88.3%**	**2,026**
Working in Groups	51.0%	1,169
Active Listening	72.3%	1,659
Communicating Ideas	49.1%	1,127
Self Discipline	74.2%	1,702
Career Specific Math Skills	38.1%	875
Technology	34.2%	784
Presentation Skills	24.3%	558
Interpret Graphs/Charts	56.4%	1,293
	Other (please specify)	112
	answered question	**2,294**
	skipped question	**39**

Question 3

My career interest requires some mathematical knowledge.

	Response Percent	Response Count
Yes	**76.5%**	**1,767**
No	7.4%	172
Unsure	8.0%	186
I'm not sure what my career interests are yet.	8.0%	186
	answered question	**2,311**
	skipped question	**22**

Question 4

My career interest is:	
	Response Count
	2,019
answered question	2,019
skipped question	314

Engineering	11%	224
Nursing	7%	157
Business	7%	146
Psychology	3%	69
Accounting	3%	68
Computer Science	3%	63
Medical	2%	54
Management	2%	49
Education	2%	41
Health	1%	40
Technology	1%	38
Social Work	1%	37
Design	1%	37
Teacher	1%	33
Tech	1%	30
Medicine	1%	28

Teaching	1%	24
Dental	1%	23
Math	1%	23
Sociology	1%	22
Criminal Justice	1%	21
Law	1%	21
Alcohol and Drug	0%	17

Question 5

Which math class(es) are you currently in? (check all that apply)

	Response Percent	Response Count
MTH 20, 30	11.2%	258
MTH 60	**18.4%**	**424**
MTH 65	16.9%	389
MTH 61, 62, 63	4.7%	108
MTH 70	2.2%	50
MTH 91, 92, 105	0.7%	15
MTH 95	15.0%	345
MTH 111	11.5%	265
MTH 211, 212, 213, 241	1.3%	29
MTH 243, 244	7.6%	175
MTH 112, 251, 252	11.3%	260
MTH 253, 254, 256, 261	4.2%	96
	answered question	**2,299**
	skipped question	**34**

Question 6

How many math classes have you taken at any college? Include current class(es).			
	Response Average	Response Total	Response Count
.	3.72	8,462	2,273
		answered question	2,273
		skipped question	60

Question 7

About how many college credits have you earned?			
		Response Percent	Response Count
0 - 15		**30.8%**	**707**
16 - 30		21.4%	491
31 - 45 (About 1 year of full time college.)		14.2%	327
46 - 80		17.1%	392
Over 80		12.4%	285
I have a Bachelor's Degree or higher		4.2%	97
		answered question	2,299
		skipped question	34

Question 8

What was your grade in your last college math class?

	Response Percent	Response Count
A	**37.1%**	**828**
B	25.5%	569
C	15.0%	334
D	4.8%	106
F	3.9%	86
P	1.0%	22
NP	2.9%	64
Other	9.9%	221
	answered question	**2,230**
	skipped question	**103**

Question 9

Age

	Response Percent	Response Count
Under 18	2.9%	66
18 - 19	14.4%	330
20 - 24	22.2%	510
25 - 29	19.1%	438
30 - 39	**24.1%**	**554**
40 - 49	11.9%	274
50 +	5.0%	116
Decline to answer	0.5%	11
	answered question	**2,299**
	skipped question	**34**

Question 10

Gender		Response Percent	Response Count
Male		39.4%	907
Female		**57.9%**	**1,332**
Decline to answer		2.7%	62
		answered question	**2,301**
		skipped question	**32**

Open-Ended Questions (numbers 11-13):

The open-ended responses were added to the survey to give a more in-depth understanding of the other survey questions if we felt we needed a more nuanced understanding.

Some students' responses to the open-ended questions included personally identifiable information for either themselves or their instructors. To maintain anonymity, identifiable information has been removed by the Math LAS members and this "cleansed" file will be provided to the Math SAC.

The approximately 6000 student responses to the open-ended questions are not included in this LAC report. Instead we have provided the following information for each question:

- The "most important words and phrases" generated by Survey Monkey
- The common trends in student responses that were noted by the Math LAS members as we read through the data removing identifiable information. Note: Frequency (ie, counts) for the trends has not been tabulated – this may be done in the future if the Math SAC decides it is valuable information.

Question 11

How do you know when you are struggling with a math concept? What do you do?

- Answered: 2139
- Skipped: 194

27 Most Important Words and Phrases:

Answer Key Ask for Help Ask Questions Ask the Teacher Book Break Concept Confused Correct Answer Formula Frustrated Google Head Language Learning Center Material Next Step Not Understand Right Answer Seek Help Solutions Manual Stop Study Test Text Book Think Tutoring Center

Most Important Words and Phrases by Percentages:

Ask for Help	19%	425
Concept	18%	405
Ask the Teacher	15%	340
Book	13%	286
Ask Questions	7%	153
Not Understand	6%	129
Wrong Answer	5%	125
Tutoring Center	5%	118
Text Book		

Trends

Note: Students answered two questions in this open-response item. Trend information is given for each question separately. Students did not always identify with just one of the descriptions for each question. Different descriptions may have the same students identifying with them (they are not disjoint).

How do I know I am struggling?

1. Outcome or Procedure based responses
    a. I do not get the right answer
    b. I get lost in the middle of the problem
    c. I get a bad grade
2. "Don't know how to start" response
    a. I don't know how to start the problem
    b. What I read makes no sense
    c. When I do not understand what the teacher is doing/saying
3. It takes me a lot of time to do problems
4. Feelings based response (frustrated, crying, angry, anxious, panic, etc)
5. Conceptual Understanding based response (RARE)
    a. When I have to rely on the solutions manual
    b. When I cannot teach it to another student
    c. When I cannot picture/describe the concept
    d. When I do not know why it works or why I am doing a step
6. Outside blame response - a general complaint about their teacher or the tutoring resources on campus (RARE)
7. "I just know."/"Its obvious"
8. Do not answer

What do I do?

1. "Get Help"

2. Consult resources, sometimes in a hierarchical manner (friend/classmate, tutor, teacher, book, notes, internet resources, family member, spouse, specific campus resource). Some responses included complaints about instructors and/or campus resources as justification for not consulting or choosing to consult last. Some student responses seemed related to student independence.
3. Do nothing/give up
4. Feelings-based response (panic, get angry, despair, cry, etc.)
5. Stare at it/keep trying/do it over and over until I get it/"Wait for the magic to happen."
6. Work to identify where confusion is occurring before seeking help (Conceptual understanding responses are often given in this category)
7. Slow down and reexamine work (Conceptual understanding responses are often given in this category)
8. Do more practice problems/memorization techniques
9. Do not answer the question

Question 12

Think of a time in a math class where you have experienced success. What lead to that success?

- Answered: 2104
- Skipped: 229

26 Most Important Words and Phrases:

Asking for Help Asking Questions Concepts Dedication Discipline Explain Focus Good Instructor Good Teacher Great Instructor Group Work Hard Work Home Work Knowledge Learning Listening Math Passed Paying Attention Positive Practice Problems Repetition Studying Taught Tutor Understand

Most Important Words and Phrases by Percentages:

Math	26% 555
Studying	18% 382
Understand	15% 320
Home Work	14% 312
Problems	14% 305
Concepts	13% 283
Practice	9% 193
Learning	7% 156

Trends:

1. Instructor
    a. Positive
        i. Interesting/Inspiring/Challenging - Creates a positive atmosphere
        ii. Empathetic - Understands anxiety, common math struggles, understands learning style, etc.
        iii. Particular teaching methods - way of grading, assigning test corrections as homework, interactive classroom, videos or other resources available, showing multiple methods, being well organized, taking time to go over difficult topics, creating an atmosphere where people feel comfortable asking questions, making tests align with material taught and covered in homework, not requiring too much work or heavily grading on formatting/grading with strict formatting, giving extra credit.
        iv. Characteristics - patience, compassion, supportive, articulate
    b. Negative
        i. Cite negative teacher traits that do not help them succeed - too fast, just lecture (RARE)
2. Self
    a. Student Traits - good studying habits, practice/homework, not looking at answers, self-teaching, working with others, attending class, actively participating, reviewing before class, time management, making sure to understand concepts before moving forward

b. Student is focused on concepts rather than procedures in learning

c. Benefit of math realized from life experience

d. Attitude about math and learning (positive self-image in math)

e. Repeating course

3. Grade/Post: Evaluation-only responses where student sees very little else as a measure of success (common)
4. Technology and other Resources
    a. Good text book
    b. Tutoring
    c. Calculator
    d. Computer - Internet resources and MyMathLab
5. Analogy for Math (language, sport) (RARE)
6. Never experienced success in math (RARE)

Question 13

Think of a time in a math class where you have NOT experienced success. What prevented you from succeeding?

- Answered: 2076
- Skipped: 257

27 Most Important Words and Phrases:

Ask for Help Asking Questions Attitude Confused Distractions Effort Explain Focus Frustration Grasp Home Work Lazy Lecture Life Math Missing Not Doing Not Paying Attention Not Studying Not Understanding

Overwhelmed Poor Procrastination Professor Review Subject Teacher Test

Most Important Words and Phrases by Percentages:

Teacher	23% 481
Math	23% 478
Home Work	10% 208
Not Understanding	9% 206
Not Doing	9% 204
Test	6% 139
Explain	5% 123
Not Studying	5% 110

Trends

Note:

- Many times location of these experiences was not given and it cannot be assumed that the courses were taken at PCC. Some course identifiers were accidentally removed that specifically identified out-of-state systems.
- Most students cited internal or external reasons when identifying a time when unsuccessful. Some students cited both in their answer. In most cases, these students cited internal first and then external as an addition.

1. External Sources
    a. Teacher: Too fast (too many topics, not enough time), not answering questions/not making students feel comfortable enough to ask questions (very common), online aspects of class (RARE), not enough student centered learning (group work, class discussions, etc.), too much conversation, too much group work, lack of classroom management, too easy/not enough work (RARE), not explaining "why", extra credit not offered

b. Inability to use calculator

c. Material not needed for career

d. Placement in class where bored

e. Memorizing formulas (difficulty learning and remembering, not being able to have notes on exams)

2. Internal sources

a. Student traits: Not coming to class regularly, not doing homework, not paying attention, substance use (very RARE), poor workmanship (trying to skip steps)

b. Anxiety/Depression/Illness/Family trouble

c. Life conflicts/not enough time

d. Negative self-image - thinking that one cannot do math or does not like math

e. Discovering learning style (common ex. that online classes are not a good fit)

f. Timidity to seek help

g. Lack of innate ability in math

h. Taking too much time off between courses (RARE)

3. Have not encountered a time when not successful (more common than expected)

4. Do not explain what caused the lack of success, just that they were not successful

End of MATH Survey Results

College Demographics:

The following information has been collected by the college and has been included here as a reference

District-wide Spring 2012 Enrollment Numbers/Percentages Per Course (12,651 students)

MTH 20	1337, 10.6%		MTH 112	713, 5.6%
MTH 30	27, 0.2%		MTH 212	44, 0.3%
MTH 60	2336, 18.5%		MTH 213	39, 0.3%
MTH 61	153, 1.2%		MTH 241	24, 0.2%
MTH 62	124, 1.0%		MTH 243	742, 5.9%
MTH 63	127, 1.0%		MTH 244	335, 2.6%
MTH 65	2071, 16.4%		MTH 251	285, 2.3%
MTH 70	267, 2.1%		MTH 252	396, 3.1%
MTH 92	14, 0.1%		MTH 253	234, 1.8%
MTH 95	1777, 14.0%		MTH 254	77, 0.6%
MTH 105	80, 0.6%		MTH 256	96, 0.8%
MTH 111	1298, 10.3%		MTH 261	55, 0.4%

General Demographic Information:

The following information is general demographic information from PCC's website: http://www.pcc.edu/about/quick-facts/demographics.html

Student Enrollment 2010–11

- Average age 33; most frequent age 20
- 55% Female, 45% Male
- 62% of credit students are employed full or part time (Spring 2011)
- Total head count: 92,537
- Total full-time equivalent: 32,694
- Credit students: 56,852
- All other students combined: 35,685
- Credit students enrolled full time (>12 credit hours): 38%

New Students (Background Education)

Percentages may not add to 100% due to rounding.

No previous college, 48.7%
Some college, 33.5%
Associate's degree, 4.0%
Bachelor's Degree, 11.1%
Master's / Doctoral degree, 2.7%

Why students come to PCC

Percentages may not add to 100% due to rounding.

Work toward bachelor's degree, 41.3%

Explore new career, 13.9%

Skills to get or keep a job, 10.6%

Personal enrichment, 9.2%

Complete a certificate or technical degree, 7.6%

High school/GED completion, 5.7%

Explore new educational opportunity, 5.5%

Learn English, 3.2%

Improve writing, math, reading skills, 3.0%

Ethnic Backgrounds

Percentages may not add to 100% due to rounding.

Caucasian, 70%

Hispanic, 11%

Asian, Pacific Islander, 10%

African American, 6%

Native American, 1%

Multi-Racial, 2%

Educational Fields

Percentages may not add to 100% due to rounding.

Lower Division Transfer, 53%

Career/Technical, 30%

Adult Education, 6%

Community Education, 1%

Other, 10%

Consultant Analysis of Spring Quarter 2012 PCC Math Survey

The Mathematics Learning Assessment Standing Subcommittee (Math LAS) applied for and was awarded a grant from the Learning Assessment Council (LAC). In part, the money from the grant was used to hire a consultant, Una Chi. Una helped the Math LAS analyze the data from the Spring Quarter 2012 Math Survey on the core outcomes Self Reflection and Professional Competence. She gave a presentation on April 20, 2012 of her work to approximately 20 math faculty (adjunct and full-time representing all three main campuses and Southeast Center).

The graphs and charts given in this document are from Una's analysis and presentation. The comments given in *blue italics* are intended to be supporting information for the results, with inclusion of some of the information given in Una's presentation. Comments have been checked by Una.

Una Chi Biography:

With a B.S. in Psychology (Biology minor), and M.S. in Applied Developmental Psychology, Una Chi is "A.B.D." (all but Dissertation) in her Ph.D. program at Portland State University in the same field as her Masters. She has focused on motivation in education and learning for post-secondary students – especially those "non-traditional" students, such as returning, working, immigrant, and first-generation. It is the jig-saw nature of statistical analyses, their ability to make pictures out of numbers, and the intricacies of designing efficient yet accurate programs of research that motivated her minor in Research Design and Methodology. SPSS, AMOS, HLM, M-PLUS, Excel, and most recently, R, are the tools she uses to create pictures of what data can tell us.

Her work in the 'real-world' includes over five years on a longitudinal research team investigating student engagement in a garden program and the links to academic success in a local middle-school, where over 40 languages are spoken by the students and over 75% are eligible for reduced lunch. Most recently she served as the data analyst for a study of national voluntary youth serving organizations, under a grant to the Institute for Research and Reform in Education (IRRE). Currently, she is working on the undergraduate Psychology department evaluation (every two years) and teaching a course in Adult Development and Aging at Portland State.

Before the data analysis, the Math LAS members and our consultant believed that the multiple-choice questions fit into 3 categories. The 16 multiple choice questions from the survey were examined with a confirmatory factor analysis to see if the data fit a 3 factor (i.e., 3 highly correlated response groups) solution for the three categories:

- *Reflection – Core reflective thinking items (basically autonomy & relatedness aspects from self-determination theory (SDT; Deci & Ryan, 2009))*
- *Orientation – Mastery/performance, internal/external locus of control (hold self or others responsible)*
- *Competency – Belief about self-ability to perform in math and how achieve that performance (3rd aspect from SDT)*

Data did not support the 3 factor analysis, so a series of EXPLORATORY factor analyses were run, and a single highly correlated group of responses was converged upon (i.e., when one response went up, the others went up/down in a highly related way). The interpretation label, Reflective Thinking, was given to this single highly correlated group which are the 11 items given below (a subset of the 16 original multiple choice items).

Response choices for the multiple-choice questions:

1 = strongly disagree, **2** = disagree, **3** = agree, **4** = strongly agree

	N	Mean	Std. Deviation
Reflective Thinking (11 items) *	2327	3.08	.41
• I know when I do not understand a math problem.	2317	3.43	.72
• I know when I need help on a math concept.	2319	3.41	.70
• When I get a math test back, my grade is what I expect it to be.	2319	2.75	.92
• When I get back a math test, I review the questions where points were lost.	2324	3.44	.81
• I understand why math processes work as they do.	2308	2.89	.84
• I often think about how I can improve my math study skills.	2319	3.00	.88
• I think about why I feel the way I do about math.	2315	2.65	1.09
• I know when I have a complete understanding of a math problem and could teach	2328	3.30	.73
• My feelings about math affect my learning of math.	2318	2.93	.96
• I want a teacher that is fair but challenging.	2317	3.23	.80
• Understanding the math is more important than who I have as a teacher.	2321	2.88	1.02
Valid N (listwise)	2195		

If the math department wishes to run this survey again, the number of items under Reflective Thinking can be reduced to 5/6 items and still maintain reliability. Statistics can be examined that would indicate which items should be kept to maintain scale reliability (psychometrics).

The 5 multiple-choice items below did not fit with the Reflective Thinking grouping. The first 2 pairs related. However, there must be at least 3 items (preferably 4) that group together as a significant factor in order to test the factor statistically. The last item fit with none or with all. If these 5 multiple-choice questions are used for future surveys, more questions need to be added that have the potential to fit the same category (aim for at least 5 questions per assumed category when first trying out a factor – this way you have two degrees of freedom should trimming be possible and still maintain the needed 3-item factor).

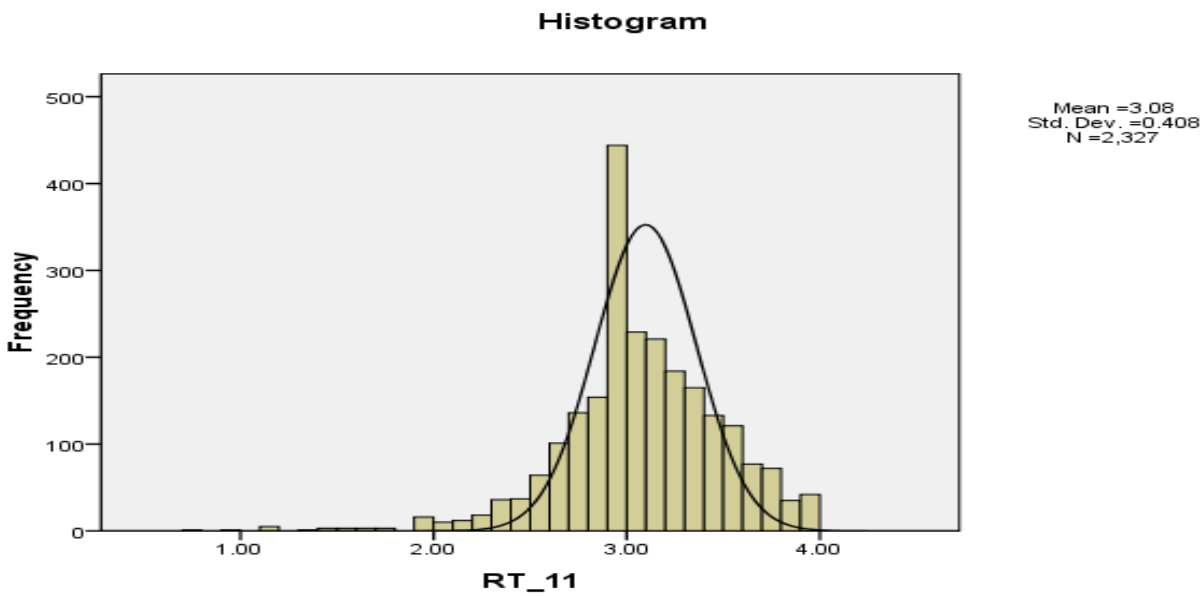
Additional analysis could be explored for this data. Example: "I know when I do not understand a math problem" did not relate to "I know if I have a math problem right or wrong before I check the answer." This is surprising. Student might have been emotionally responding to questions differently. If the grouping was given as "competence" or "arrogance" these may be identified as the same factor.

Response choices for the multiple-choice questions:

1 = strongly disagree, **2** = disagree, **3** = agree, **4** = strongly agree

	N	Mean	Std. Deviation
• If I have a good textbook, I can learn math on my own without a teacher.	2323	2.22	.95
• I know if I have a math problem right or wrong before I check the answer.	2318	2.48	.84
• I want an easy math teacher.	2311	2.25	.98
• The skills I learn in a math class are not important to me or my future goals.	2326	1.87	.94
• If my work and the answer key don't agree, I think my math is correct and the solutions manual is wrong.	2319	1.69	.76

RT_11: Reflective Thinking (11 highly correlated multiple choice items)



*Based on full items model, worked down to single reflective factor. Model fit statistics: CMIN/DF 13.56 CFI .797 RMSEA .073, X^2 596.413, df 44, p = .000. Not a 'good' fit, but given the impromptu nature of the CFA, not so bad! ☺

Note: The statistics given above are "model fit" statistics relevant for doing publication-level data modeling. Ideally the CFI should be above 0.9 and RMSEA should be under 0.05. However, since modeling was not the motivation behind the design of the survey and we will not be publishing this work as empirical support for this model but using what it can tell us in an applied manner, the results are acceptable.

ANOVA Analysis: ANOVA is a statistical test to see if group mean scores on some variable (in our case, Reflective Thinking) are significantly different from each other.

RT_11: Reflective Thinking (11 highly correlated multiple choice items)

Descriptives: RT_11 by Grade in Last Math Class *				95% Confidence Interval for Mean			
	N	Mean	Std. Dev	Lower	Upper	Min	Max
.00 F or NP	149	2.97	.39	2.91	3.04	1.18	3.82
1.00 D	106	2.98	.38	2.91	3.06	1.91	3.82
2.00 C or P	334	3.02	.41	2.98	3.07	1.18	4.00
3.00 B	589	3.10	.41	3.07	3.13	1.18	4.00
4.00 A	828	3.15	.39	3.13	3.18	1.00	4.00
Total	2006	3.09	.40	3.08	3.11	1.00	4.00

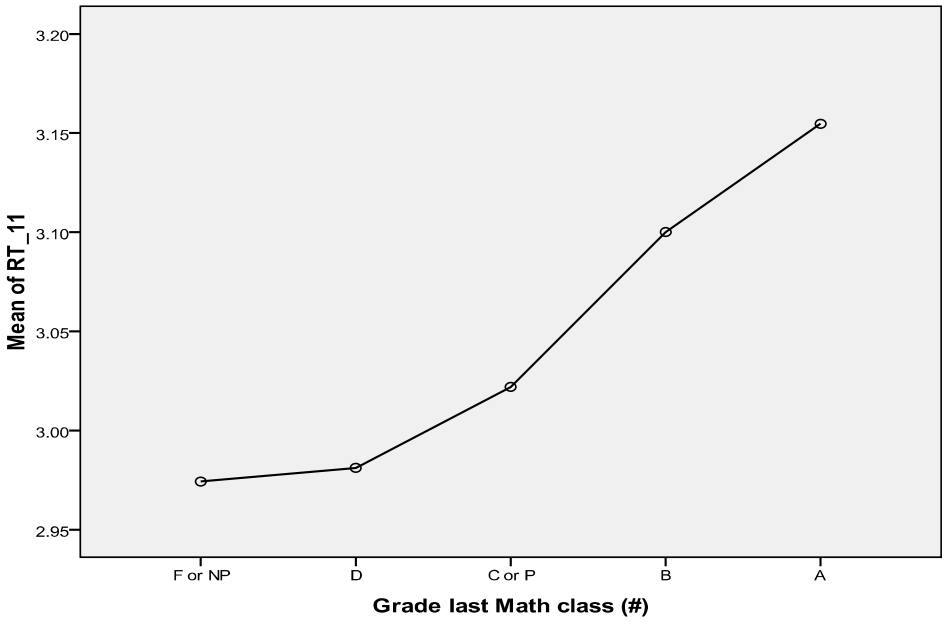
Test of Homogeneity of Variances Levene Statistic .51, p = .730

ANOVA F 13.15, p = .000

RT_11	.00 F or NP	1.00 D	2.00 C or P	3.00 B	4.00 A
.00 F or NP	nd	nd	nd	-0.13	-0.18
1.00 D	nd	nd	nd	-0.12	-0.17
2.00 C or P	nd	nd	nd	-0.08	-0.13
3.00 B	---	---	---		nd

Significant Between Group mean differences.

* Filtered out "Other" cases.



'A' and 'B' students showed significantly higher Reflective Thinking than did 'F/NP', 'D', and 'C/P' students. Note: Research shows that students self-reported grades on an anonymous survey is accurate enough for statistical analysis (e.g. Marsh, H. W.,1984).

RT_11: Reflective Thinking (11 highly correlated multiple choice items)

Descriptives: RT_11 by Age Categories *				95% Confidence Interval for Mean			
	N	Mean	Std. Dev	Lower	Upper	Min	Max
1.00 Under 18	66	3.07	.40	2.97	3.17	1.64	3.82
2.00 18 - 19	328	3.01	.40	2.97	3.06	1.18	4.00
3.00 20 - 24	509	3.10	.42	3.06	3.14	1.20	4.00
4.00 25 - 29	438	3.11	.41	3.07	3.15	.73	4.00
5.00 30 - 39	554	3.08	.41	3.05	3.12	1.00	4.00
6.00 40 - 49	274	3.09	.36	3.05	3.14	1.55	4.00
7.00 50	116	3.12	.43	3.04	3.20	1.18	3.91
Total	2285	3.09	.41	3.07	3.10	.73	4.00

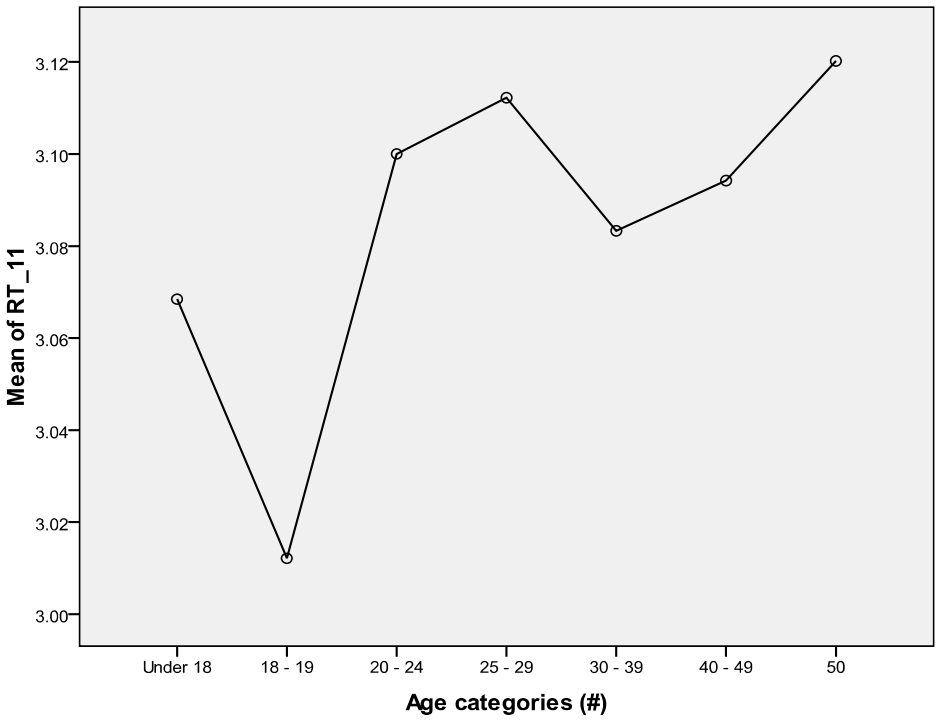
Test of Homogeneity of Variances **ANOVA**

Levene Statistic 1.14, p = .337 F 2.408, p = .025

RT_11	3.00: 20 - 24	4.00: 25 - 29
2.00: 18 - 19	-.09*	-.10*

Significant Between Group mean differences.

* Filtered out "Decline" cases.



The only significant difference is in the 18-19 category when compared to categories 20-24 and 25-29. Consultant suggestion: Consider other theoretical or logical category compressions (such as more developmental and/or life-situation categories) in order to increase the ability to see any small but significant differences. Example: Categories of 18-27 and 28-37 might show a statistically significant difference.

RT_11: Reflective Thinking (11 highly correlated multiple choice items)

Descriptives: RT_11 by Gender*				95% Confidence Interval for Mean			
	N	Mean	Std. Dev	Lower	Upper	Min	Max
1.00 Female	1330	3.07	.39	3.05	3.09	1.18	4.00
2.00 Male	906	3.11	.42	3.08	3.13	.73	4.00
Total	2236	3.08	.40	3.07	3.10	.73	4.00

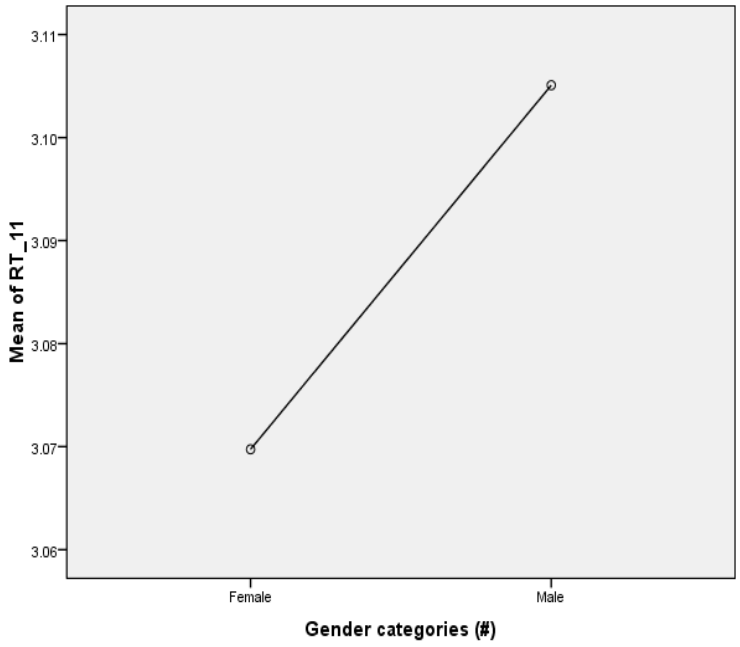
Test of Homogeneity of Variances Levene Statistic 1.59, p = .208

ANOVA F 4.13, p = .042

RT_11	2.00 Male
1.00 Female	.04

Significant Between Group mean differences.

* Filtered out “Decline” cases.



There is a significant difference between males and females on Reflective Thinking. Comment by consultant: Parents and institutions in our (or any) society may (un)consciously mold their children in certain gender stereotyped ways – such as math ability, gender appropriate social norms in interest and/or behaviors, and praise/ignore/chastise feedback around critical thinking.

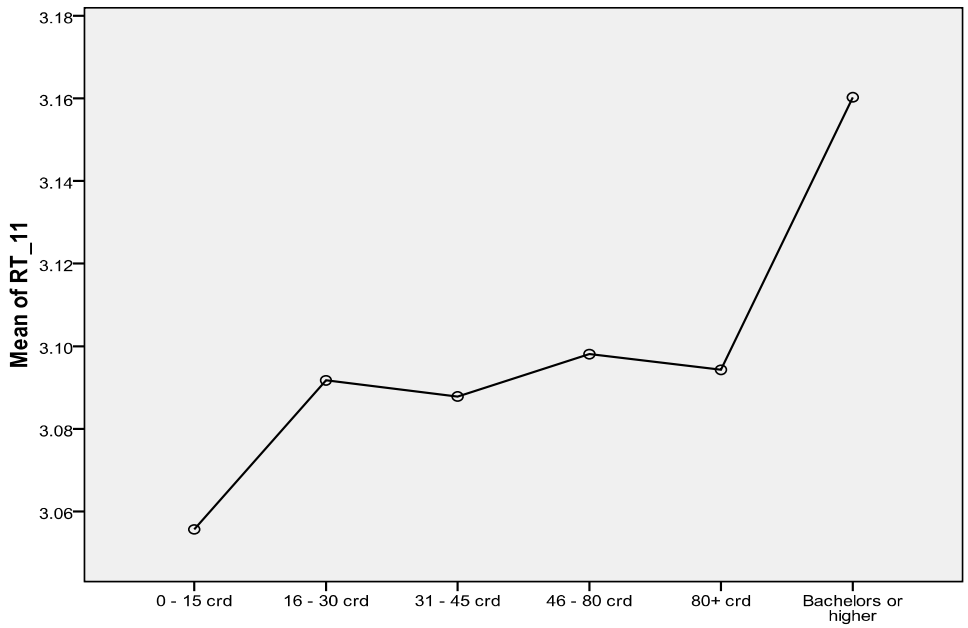
RT_11: Reflective Thinking (11 highly correlated multiple choice items)

Descriptives: RT_11 by College Credits				95% Confidence Interval for Mean			
	N	Mean	Std. Dev	Lower	Upper	Min	Max
1.00 0 - 15 crd	707	3.06	.41	3.03	3.09	1.18	4.00
2.00 16 - 30 crd	489	3.09	.41	3.06	3.13	.73	4.00
3.00 31 - 45 crd	326	3.09	.41	3.04	3.13	1.64	4.00
4.00 46 - 80 crd	392	3.10	.40	3.06	3.14	1.18	3.91
5.00 80+ crd	285	3.09	.40	3.05	3.14	1.18	4.00
6.00 Bachelors or higher	97	3.16	.41	3.08	3.24	2.00	4.00
Total	2296	3.08	.41	3.07	3.10	.73	4.00

Test of Homogeneity of Variances Levene Statistic 60, p = .70

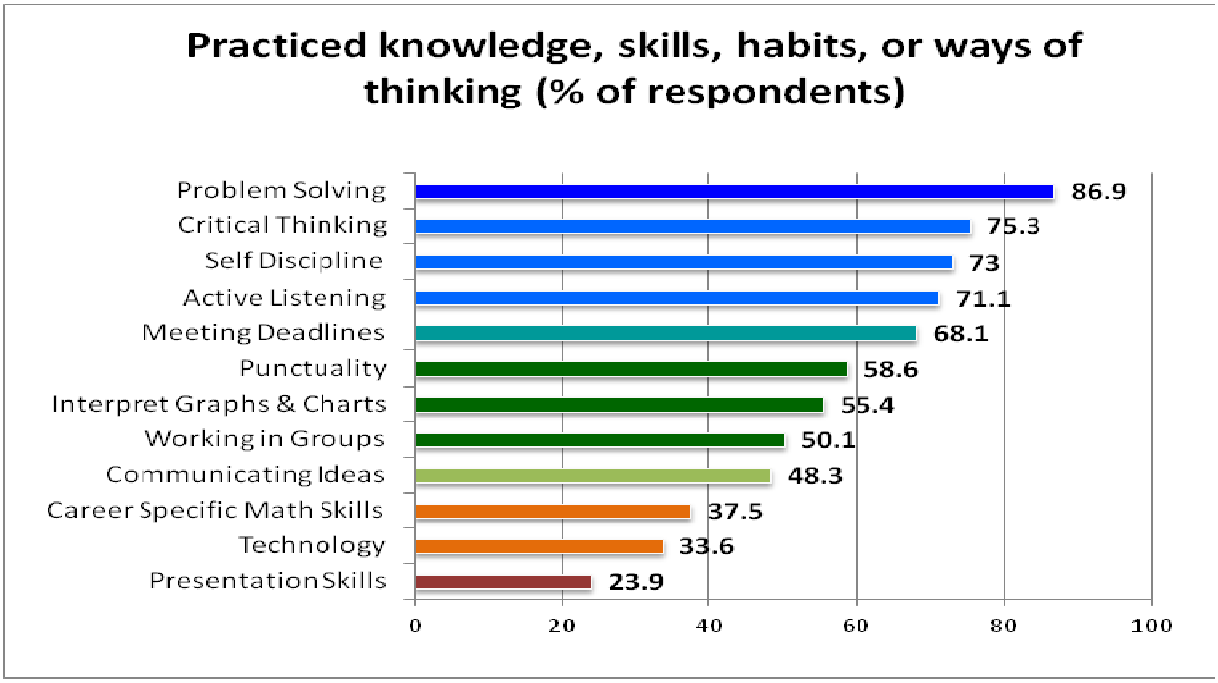
ANOVA F 1.54, p = .174

No significant Between Group mean differences.

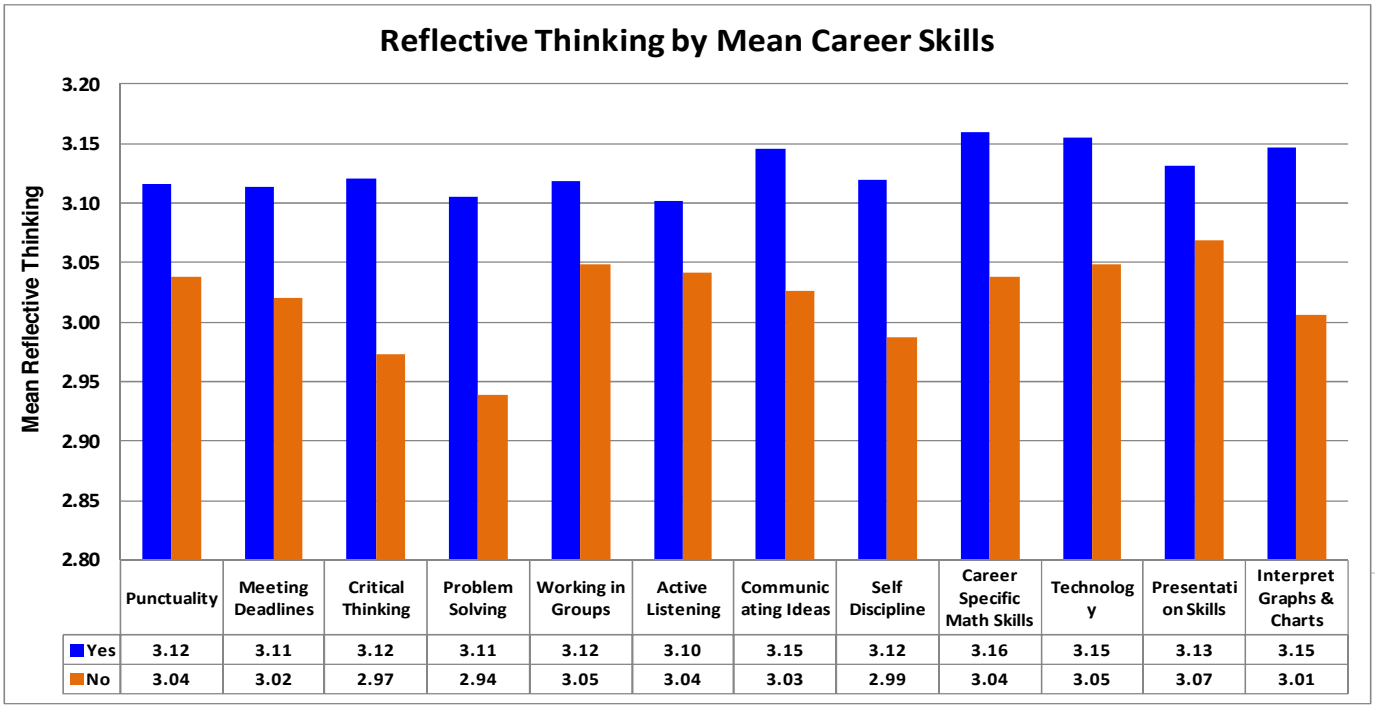


The college credit variable needs significant 'cleaning.' There was outlier student who reported 200 credits. There is no significant difference in Reflective Thinking for any of the credit breakdowns. It is possible to run analysis on different category breakdowns to see if there are significant differences. Consultant suggestion: Group credits by number typically taken in a year.

Survey Question: In PCC math classes, what knowledge, skills, habits or ways of thinking have you practiced that might help you in the work place? Students could choose as many items from "problem solving" to "presentation skills" as they felt appropriate.



Percentages include multiple selections per respondent. *'Decline to answer' removed.*



	Punctuality	Meeting Deadlines	Critical Thinking	Problem Solving	Working in Groups	Active Listening	Communicating Ideas	Self Discipline	Career Specific Math Skills	Technology	Presentation Skills	Interpret Graphs & Charts
Yes	3.12	3.11	3.12	3.11	3.12	3.10	3.15	3.12	3.16	3.15	3.13	3.15
No	3.04	3.02	2.97	2.94	3.05	3.04	3.03	2.99	3.04	3.05	3.07	3.01

Note: All mean differences are significant at p <.00 level. *All graphs generated in Excel using SPSS statistics.*

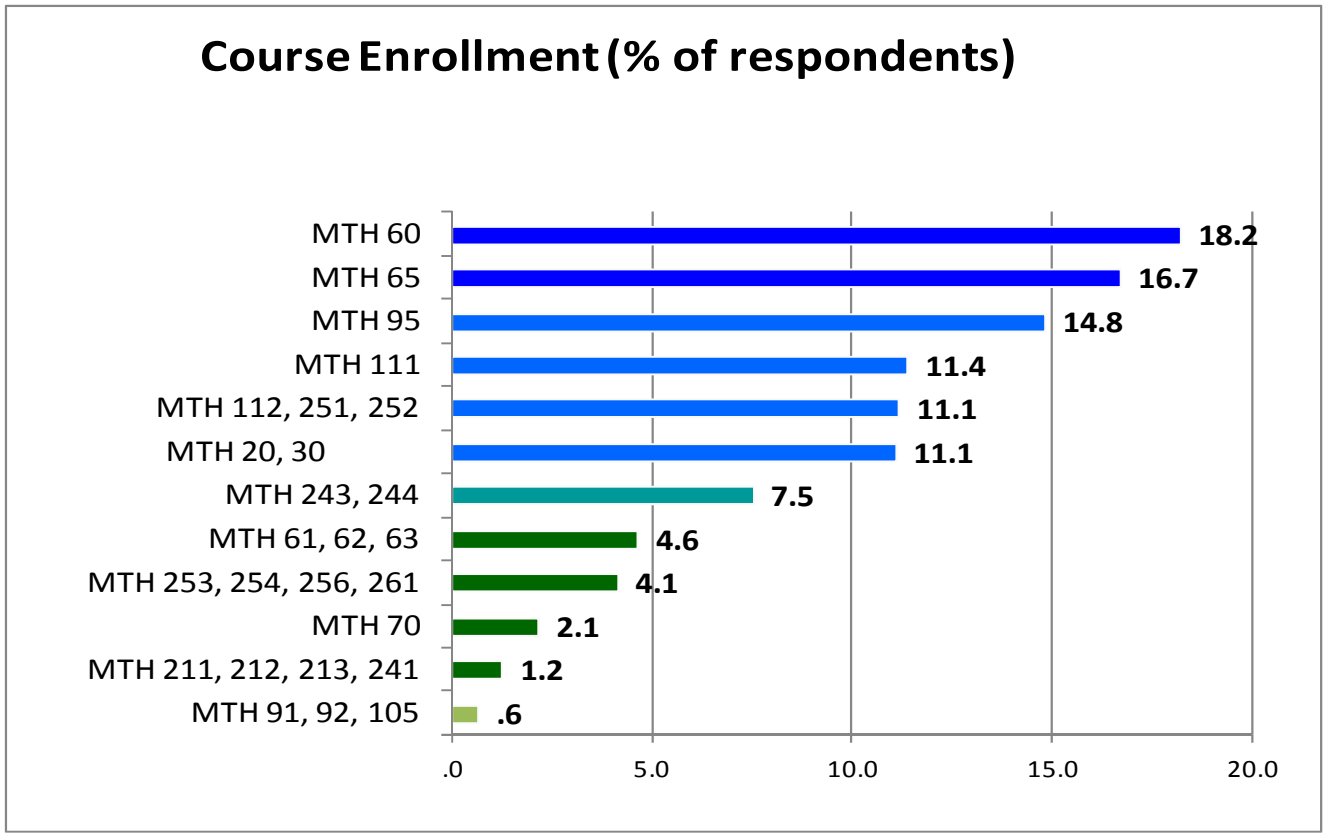
If a student endorses any one of the career skill categories, s/he has higher Reflective Thinking than those who said no to that career skill.

Since students selected multiple options, the average Reflective Thinking score for those who said "yes" to a category (e.g. Punctuality) were compared to those who said "no" (i.e., if we were looking at one single student, they would appear in every category as either a "yes" – Valid ,- or a "no" - Missing). This means we can't see which grouping of categories has higher Reflective Thinking, we can only see by category of those who endorsed versus those who didn't. Consultant comment: Using the frequencies, profiles of students could be built and these profiles could then be comparable, predictive of Reflective Thinking, and indicate target intervention areas.

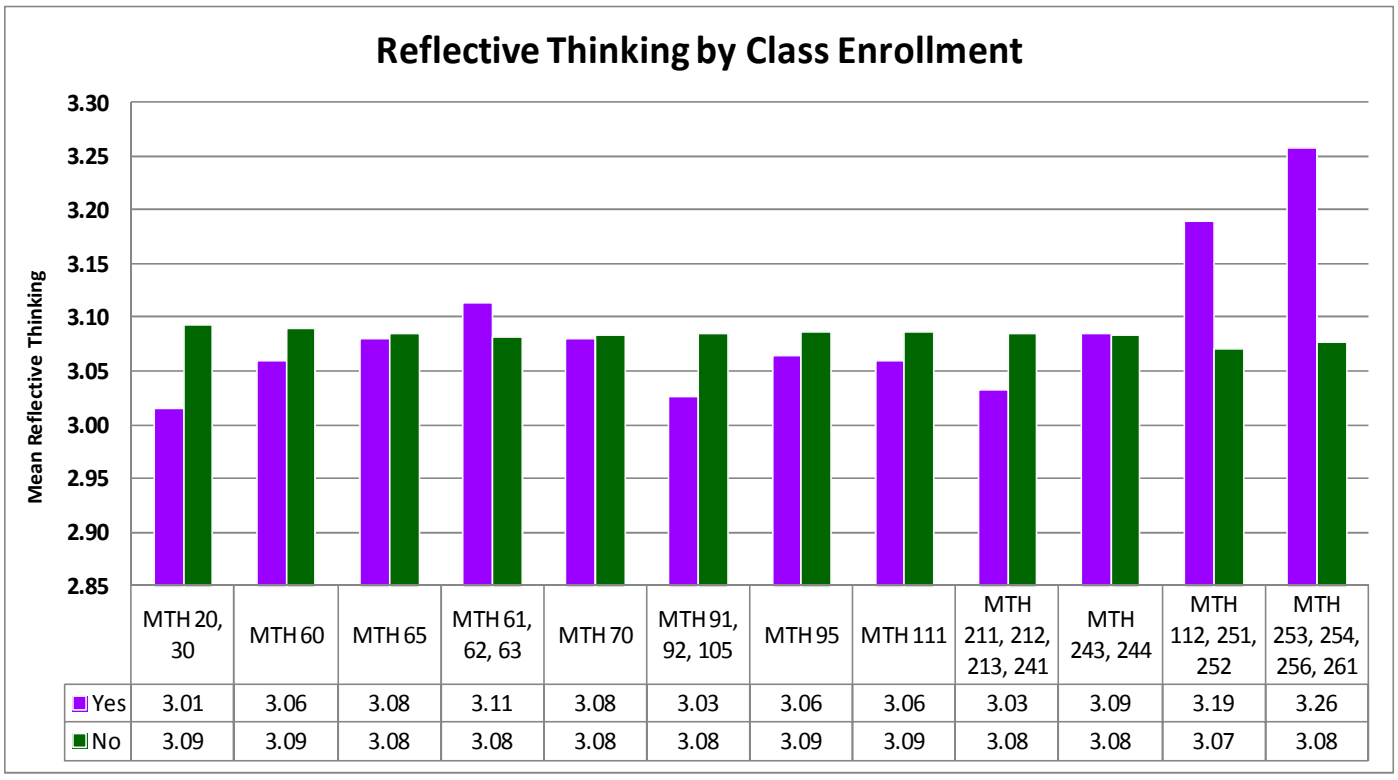
Career Skills: What knowledge, skills, habits, or ways of thinking have you practiced in PCC math classes that might help you in the work place?

	Valid	Missing	Total
Punctuality			
Frequency	1367	965	2332
Percent	58.6	41.4	100.0
Meeting Deadlines			
Frequency	1589	743	2332
Percent	68.1	31.9	100.0
Critical Thinking			
Frequency	1755	577	2332
Percent	75.3	24.7	100.0
Problem Solving			
Frequency	2026	306	2332
Percent	86.9	13.1	100.0
Working in Groups			
Frequency	1169	1163	2332
Percent	50.1	49.9	100.0
Active Listening			
Frequency	1659	673	2332
Percent	71.1	28.9	100.0

	Valid	Missing	Total
CommUnacating Ideas			
Frequency	1127	1205	2332
Percent	48.3	51.7	100.0
Self Discipline			
Frequency	1702	630	2332
Percent	73.0	27.0	100.0
Career Specific Math Skills			
Frequency	875	1457	2332
Percent	37.5	62.5	100.0
Technology			
Frequency	784	1548	2332
Percent	33.6	66.4	100.0
Presentation Skills			
Frequency	558	1774	2332
Percent	23.9	76.1	100.0
Interpret Graphs & Charts			
Frequency	1293	1039	2332
Percent	55.4	44.6	100.0



Percentages include multiple selections per respondent. *'Decline to answer' removed.*



	MTH 20, 30	MTH 60	MTH 65	MTH 61, 62, 63	MTH 70	MTH 91, 92, 105	MTH 95	MTH 111	MTH 211, 212, 213, 241	MTH 243, 244	MTH 112, 251, 252	MTH 253, 254, 256, 261
Yes	3.01	3.06	3.08	3.11	3.08	3.03	3.06	3.06	3.03	3.09	3.19	3.26
No	3.09	3.09	3.08	3.08	3.08	3.08	3.09	3.09	3.08	3.08	3.07	3.08

Note: Mth 20/30, Mth112/251/252, and Mth 253/254/256/261 are significant at the p < .00 level.
All graphs generated in Excel using SPSS statistics.

The only significant categories for Reflective Thinking are 20/20, 112/251/252, and 253/254/256/261. Consultant comment: It would be interesting to check the student mean age of each course grouping to see if they clump. If not, see if there is a relation to age and Reflective Thinking controlling for course.

Math Course Enrollment

	Enrolled	Not Enrolled	Total
MTH 20, 30			
Frequency	258	2074	2332
Percent	11.1	88.9	100.0
MTH 60			
Frequency	424	1908	2332
Percent	18.2	81.8	100.0
MTH 65			
Frequency	389	1943	2332
Percent	16.7	83.3	100.0
MTH 61, 62, 63			
Frequency	108	2224	2332
Percent	4.6	95.4	100.0
MTH 70			
Frequency	50	2282	2332
Percent	2.1	97.9	100.0
MTH 91, 92, 105			
Frequency	15	2317	2332
Percent	.6	99.4	100.0

	Enrolled	Not Enrolled	Total
MTH 95			
Frequency	345	1987	2332
Percent	14.8	85.2	100.0
MTH 111			
Frequency	265	2067	2332
Percent	11.4	88.6	100.0
MTH 211, 212, 213, 241			
Frequency	29	2303	2332
Percent	1.2	98.8	100.0
MTH 243, 244			
Frequency	175	2157	2332
Percent	7.5	92.5	100.0
MTH 112, 251, 252			
Frequency	260	2072	2332
Percent	11.1	88.9	100.0
MTH 253, 254, 256, 261			
Frequency	96	2236	2332
Percent	4.1	95.9	100.0

Question to consultant: What comes first: self reflective behaviors or being good at math?

Response: Ahh, the proverbial chicken and egg question. 1. It is reciprocal – experiences build on & develop self-reflection around math, 2. Students already come into campus with levels of self-reflection and thoughts on importance/relevance of math, and there is nothing we can do about it. Longitudinal studies – where students are assessed upon entry, then that is used as a statistically controllable baseline for later, repeated assessments is one (very expensive & time consuming) way to deal with this. 3. Think more on where PCC can intervene, rather than which comes first - more productive for applied use.

Question to consultant: To answer the "what comes first" question, would we need to have an experiment with a control group?

Response: If you want to show/prove actual cause and effect, yes. Two new entering (demographically matched) groups, baseline assessments, do some intervention to improve self-reflection with group A, don't with group B for ½ the academic year. Assess after ½ year gone, then give intervention to all for the rest of the academic year, and assess a third time. If you really want to make it good, assess a 4th time beginning of their second year.