

TLC PROGRESSION REPORT MARCH 2010

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Program managers at Pasadena City College's Teaching and Learning Center (TLC) want to know if their mathematics-focused interventions (XL, Math Jam, and MathPath) are moving students through the basic skills math sequence faster than mainstream PCC students. The TLC is collecting data on their students using a database they commissioned. After eight years of programs serving thousands of students the data now exists to begin asking these progression-related questions.

The questions at the heart of this report are those of progression through the basic skills sequence. Do students who participate in the TLC interventions complete the sequence faster than those who do not participate in a TLC intervention? The sequence achievements used in this report are completion of Math 125, Math 131, transferable Statistics courses, combined Math 125 & English 1A, combined Math 131 & English 1A, and the general competencies for an Associate in Arts, Associate in Science, and IGETC transfer minimums.

The data was taken from the TLC database (TLC-DB) and compiled in spreadsheets that were then used to produce chi square analyses and bar graphs of the data. This report reports on these findings to show how many students complete various basic skills sequence progression markers.

For this analysis, six cohorts (.XL1-.XL6) were combined to create one .XL group and the first two cohorts of Math Jam (2006/2007) were combined to create one Math Jam group. A comparison group was obtained by matching to the 2006 Math Jam cohort on various demographic data and having taken Math 402 Fall 2006. Using chi square analyses, these groups were compared to each other on how many students completed each of these markers in seven semesters.

Also, the intervention groups were split into "ability-related" groups based on their ACCUPLACER Arithmetic and Algebra placement scores: Math 450, Math 402, and Math 125. As might be expected, those groups scoring higher on the placement test reached further along the academic trajectory. Those who placed into Math 125 seemed to gain exponentially more from the .XL intervention than their Math 402- and Math 450-placed contemporaries. This finding was not replicated with the Math Jam Math 125-placed students.

This report supports the intensity factor - .XL students did better than the Math Jam students on all markers. While both groups did better than a comparison group, the .XL students, especially the Math 125-placed group, did better than all other groups.

Because this report supports the intensity factor the next steps might be to raise the intensity on the most needy of students. Further comparison groups should be drawn to see if those placing into Math 125 who do not receive the intervention do as well as the TLC groups. If that were the case, an argument could be made for focusing an intense intervention on only those who place into Math 450 and Math 402. This would narrow the TLC's efforts to the most needy and could present the most bang for their buck.

Future analysis should narrow the focus of student selection to see if those experiencing only one intervention perform differently than those who take advantage of more of the TLC's offerings, such as MathPath and MaS or MESA. Also, the comparison group identification seems troublesome. Without using placement scores as a matching variable, it is difficult to say that any group is really a good match. Further exploration into satisfactory comparison groups is necessary.

BACKGROUND

The Teaching and Learning Center (TLC) has been functioning for almost 10 years and satisfactory data has accumulated so that some questions about student success can be answered. The availability of data is a direct outcome of the TLC's database capabilities. The TLC-DB is now well established as a resource and tool for tracking student success data. This report is one of the earliest uses of this resource.

The TLC has undertaken numerous programs, each developed with different parameters in mind. For instance, .XL focuses on providing a summer bridge experience to first year, underprepared, Basic Skills students. After serving 4 cohorts through the .XL program, the TLC directors were challenged to provide a similar experience to a larger cohort. This "ramping up" effort was named Math Jam and consisted of a 2-week summer program with a fall incentive structure. After 4 years of running Math Jam and .XL programs contemporaneously, the TLC wants to know how well each group has progressed through PCC's Basic Skills math sequence.

XL is focused entirely on Math 402. XL students are recruited from local high schools and are generally first year students. All take Math 402 in the summer, which (regardless of their placement test) sets them up to take Math 125 in the fall. The cohorts range from 32-66 students.

Math Jam began summer 2006 with a cohort of 77 students. It is a 2-week intensive course where students are grouped in classes focused on each of three levels of Math – 402, 125, and 131. Students place into the group based on their ACCUPLACER math component scores. The second year 137 students participated, including 71 student athletes. The 2008 and 2009 cohorts served 95 and 152 students respectively.

The questions asked by this report are aligned with progression. That is, how quickly do TLC students progress through the sequences of courses that prepare them for college transfer? A few markers along the route provide opportunities to compare program effects. As well, a group matched on key variables is used to compare to PCC mainstream students progressing towards degree and transfer readiness.

EVALUATION QUESTIONS

This report asks how quickly TLC students progress toward transfer and how their progression compares to a matched group of PCC students. The basic skills math sequence, during the first eight years of the TLC, included three levels of math. They are Math 402, Math 125, and Math 131. This sequence changed at the same time this report was being written, adding one more level below Math 402 – Math 450. This classification will emerge as we report the data in this report. Each is described here.

- **MATH 450 – Numerical Foundations** (4 units). This course is four classes below transfer. While this course has been available at PCC for some time, it is offered in limited sections and was not, until recently, a requirement in the basic skills sequence. The curriculum includes building whole number arithmetic skills, a brief introduction to fractions, decimals, and percents and incorporates study skills for success in mathematics courses.
- **MATH 402 – PREALGEBRA** (4 units). This class is three courses below transfer and, until the recent adoption of Math 450, was the first math course available to students needing remedial math. It covers modern concepts in prealgebra; basic operations with

whole numbers, integers, rationals and irrationals; structure of the real number system; the metric system; and equations. This course is mandatory for students who do not take the placement test but can be waived with counselor recommendation. There are no prerequisites for this course and students who take the ACCUPLACER test and score below 70 on the Arithmetic section are required to take this class.

- **MATH 125 – ELEMENTARY ALGEBRA** (4 units). This class is two courses below transfer and covers basic operations with integers, polynomials, algebraic fractions and irrational expressions; solution and graphing of linear and quadratic equations and functions. Prerequisites are Math 402, 400B, or 401C, or ACCUPLACER Arithmetic score greater than 70 and Algebra score greater than 34. Academic counselors may waive prerequisites and place a student into Math 125. Students in .XL and Math Jam take Math 125 relatively soon after the summer. For some, the summer prepares them for the Math 402 course (Prealgebra), for others the summer readies them for Math 125 or 131.
- **MATH 131 – INTERMEDIATE ALGEBRA** (4 units). This class is the last class in the basic skills sequence and covers fundamental algebraic operations; linear, quadratic, exponential and logarithmic functions; inequalities and systems of equations; determinants. Prerequisites are Math 125 or Math 126C or Math 127B or Math 128B or ACCUPLACER Arithmetic and Algebra scores above 70. Completing this course clearly indicates some trajectory towards degree/transfer readiness.

Other indicators of successful progression, beyond the basic math sequence, are also of interest. For instance, once a student completes the basic skills sequence, do they move further towards transfer? Transfer itself is a difficult measure to collect data on so we use some proxy measures that inform a student's trajectory.

- **ENGLISH 1A – READING AND COMPOSITION (4 units)**. This course is transferable to the CSU and UC system. It covers development of expository and argumentative essays, instruction in writing annotated papers, and analysis of various forms of writing with emphasis on expository and argumentative essays. Prerequisites include English 100, ESL 33B, or scoring higher than 80 in Reading Comprehension and higher than 94 in Sentence Skills ACCUPLACER sections.
- **Stats 15, 18, or 50** – These three statistics courses are part of the general competencies for transfer. They fulfill the Math competencies for transfer to either the CSU or the IGETC system. Combined with English 1A, these courses make students transfer-ready.
- **MATH 125 & ENGLISH 1A** – because English 1A is a transfer course, this combination of courses shows clear progression towards transfer. It is a step below transfer ready because students need Math 131.
- **MATH 131 & ENGLISH 1A** – because English 1A is a transfer course, and Math 131 is the last math course in the basic skills sequence, this combination of courses shows clear progression towards transfer.
- **Associate of Arts Degree General Competency Requirements** – the general competency Math and English requirements for an AA are important to consider because not every transfer student needs to take Math 131 to be transfer-ready. Other courses meet the Math requirements and they are considered using this formula. This analysis uses the Reading, Written, and Mathematics general competency requirements. (for a full list of courses see Appendix A)
- **Associate of Science Degree General Competency Requirements** – as with the AA degree, the general competency Math and English requirements for an AS are important to consider because not every transfer student needs to take Math 131 to be transfer-ready. In fact, Math 131 is not considered a competency requirement for an AA degree. Other courses meet the Math requirements and they are considered using this formula. This

analysis uses the Reading, Written, and Mathematics general competency requirements. (for a full list of courses see Appendix A)

- **Intersegmental General Education Transfer Curriculum General Competency Requirements** – fulfilling the IGETC requirements permits a student to transfer to a campus in either the CSU or UC system without the need, after transfer, to take additional lower division general education courses to satisfy campus GE requirements. We use Area 1 (English Composition) and Area 2 (Mathematical Concepts and Quantitative Reasoning) sections in this assessment. (for a full list of courses see Appendix A)

EVALUATION PROCEDURES

While there are numerous programs served by the TLC, this report focuses on those of Math Jam and .XL. These two are the most similar programs in their content and the student they serve. MathPath 1 (Math 125 and 131 in one semester) was considered, but there is evidence that the MathPath 1 student is different from either the Math Jam or the .XL student. They are more likely to be returning or advanced students and they are twice as likely to transfer to a 4-year school within 12 terms than a comparison group.

The groups created for this report are Math Jam, .XL, and 402 Comparison. Each are described here:

- **Math Jam** – the first two cohorts of Math Jam were selected and aggregated into this report's Math Jam. These two cohorts started in the summer of 2006 and 2007. The 2007 cohort included a large group of student athletes that were removed from the data set for this report. Where Math Jam cohort is reported throughout this report it includes the 2006/7 cohorts minus the 2007 student athletes. The Math Jam 2008 and 2009 cohorts have not been in the mainstream long enough to adequately discuss their success.
- **.XL** – the first six cohorts of .XL students (.XL1-6; 2002-2007) were aggregated to create the reported .XL group.
- **402 Comparison** – this group was created by asking PCC's Institutional Research and Planning Office (IPRO) to identify a comparison group matched to the first Math Jam cohort (2006) (over-matched 200% if possible) on five variables:
 - 1st year status (new students) Fall 2006
 - Registered for Math 402 that 1st semester
 - Gender
 - Ethnicity
 - Age

During the development of this report, some discussion at PCC centered on the difference between a student who places into the lowest Math class (Math 402) and one who places below the lowest class. For this reason, we further parse the TLC cohorts by their ACCUPLACER Math scores. Based on their scores, individuals are categorized into Math 450 (below Math 402), Math 402 and Math 125. Math 450 was created as a grouping variable despite the fact that the Math 450 was not a prerequisite in the basic skills sequence when these groups were originally created. This report assumes there is a qualitative difference between those students who place into 402 and those who score lower on the ACCUPLACER exam. The 450 group is explored in this report.

This report uses seven terms, or two years, as the point at which data is reported. The number of successful TLC students in any class falls off considerably after seven terms, allowing limited statistical analysis. Seven terms provides six .XL cohorts and two Math Jam cohorts – somewhat limiting the number of students upon which this report can speak, but it was decided that seven terms (2 years) is an adequate amount of time for a student to complete the basic skills sequence and become transfer ready.

The TLC's database (TLC-DB) was used to obtain data on these groups. The database is connected to the PCC MIS database that tracks all courses, students, and grades. The TLC lab manager updates the TLC-DB regularly. Both program-supported students and the comparison groups were entered into the database and assigned to a program (or comparison group). Data on these students were obtained during the normal database update process so that the data on both program and comparison students was of equal validity.

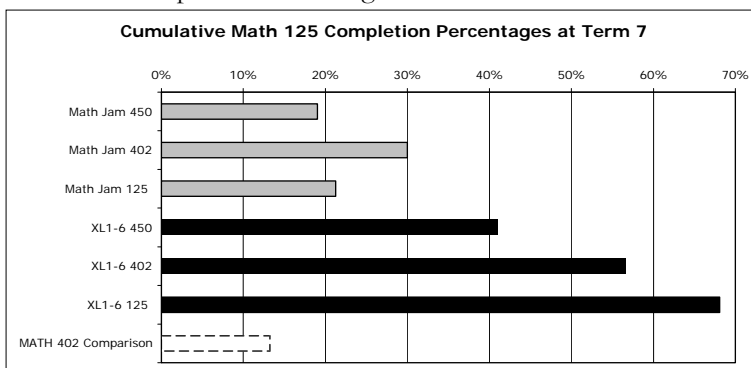
To automate these processes, a script was written into the database and used to report these data. This functionality has been included in the database's capability so that these reports can be accomplished on a regular basis. Further computations, including comparison analyses and producing figures, was completed in Microsoft Excel.

Course completion in this report means a student got a reported grade of A, B, C, or CR.

FINDINGS

The first marker of student success and progression is the completion of Math 125. Completing Math 125 in seven terms does not seem to be difficult for most of the TLC students. Except for the Math Jam 450 and the Math Jam 125 groups, significantly more TLC students pass Math 125 than the comparison group (X^2 , $p < .05$). While the 450 and 125 groups have more students passing, it is not significant.

Figure 1. Cumulative Math 125 Completion Percentages at Term 7

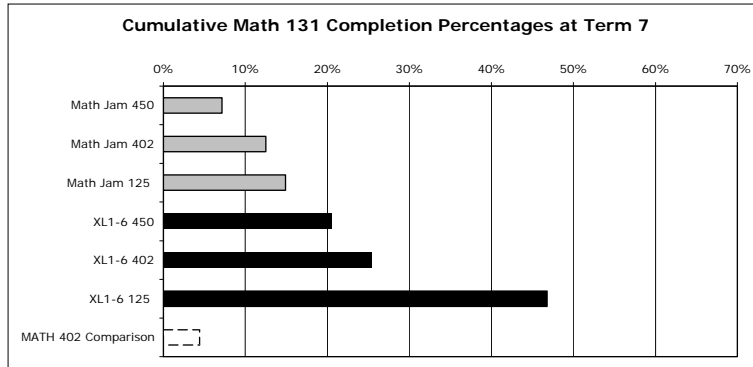


This first figure shows an unexpected anomaly. Fewer Math Jam 125 students passed Math 125 (21%) than Math Jam 402 students (30%). The second cohort of Math Jam (2007) comprised 12 students placing into Math 125. Only one of those 12 passed Math 125 in seven semesters (8%). This is contrasted with the first cohort of Math Jam where nine of 35 students (30%) passed Math 125. It is possible that they simply passed over Math 125. As is evident in the next figure, this cohort goes on to pass more Math 131 classes.

Figure 1 shows something evident throughout this report and supports the premise put forward during this reporting period. Those who place into Math 450 do worse than those who place into Math 402 or 125.

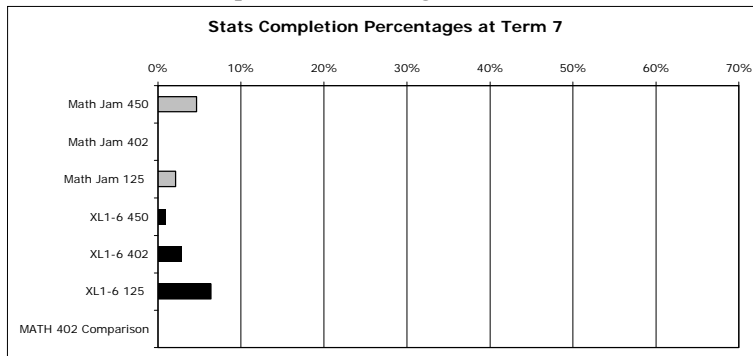
In figure 2 the anomaly of the Math Jam 125 placed group's completion rates is gone. Completion of Math 131 looks to be related to two variables – intervention and placement scores. More students in .XL complete 131 than those in Math Jam or the comparison group, and the higher they place on the ACCUPLACER test the more likely they are to pass Math 131. The only groups that do not complete significantly more Math 131 classes are the Math Jam 450 and 402 groups. All other groups complete significantly more Math 131 classes than the comparison group.

Figure 2. Cumulative Math 131 Completion Percentages at Term 7



Completing a statistics class is not necessarily a requirement for transfer. But, many students are counseled to take statistics because it does fulfill the math requirement for transfer to many four-year institutions. In figure 3 we see the percentage of TLC students who pass a statistics course. Compare these completion rates to those in the comparison group (0%) and we see more TLC students completing statistics.

Figure 3. Cumulative Statistics Class Completion Percentages at Term 7



In figure 4 we see the return of the anomaly for the Math Jam 125 placed group data. Once again, their completion of Math 125 & English 1A is lower than their Math Jam peers who placed into lower math courses. Oddly, this is not rectified with the Math 131 & English 1A figure (figure 5). There seems to be no explanation of why this occurs. These students, despite their placement test scores indicating they higher performing, do not do any better on this landmark than classmates. For both achievement markers, none of the Math Jam groups complete significantly more Math & English than the comparison group. On the other hand, significantly more .XL students complete them than the comparison group.

Figure 4. Cumulative Math 125 & English 1A Completion Rates at Term 7

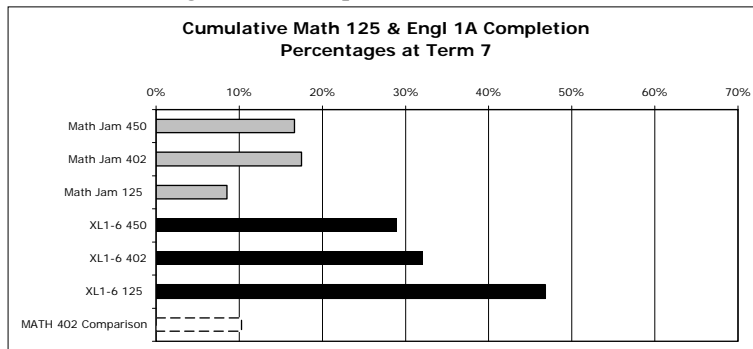
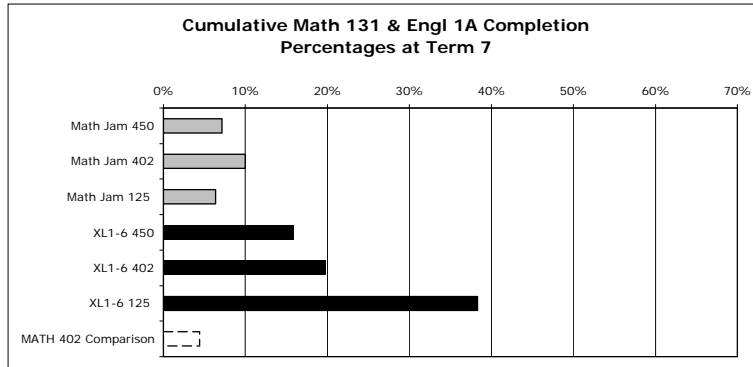


Figure 5. Cumulative Math 131 & English 1A Completion Rates at Term 7



For both Associate in Arts and Associate in Science degree competency requirements (Figures 6 and 7) we see a clear separation of the Math 125 .XL group from the others. Relatively little difference exists between the groups placing into Math 450 and Math 402. Though all groups perform better than the Math 402 Comparison group, the Math Jam 125 Placed group continues to perform low compared to their counterparts in Math Jam. While significantly more .XL students complete the AA general competencies, no Math Jam group performs significantly better than the comparison group.

Figure 6. Cumulative AA General Competencies Completion Rates at Term 7

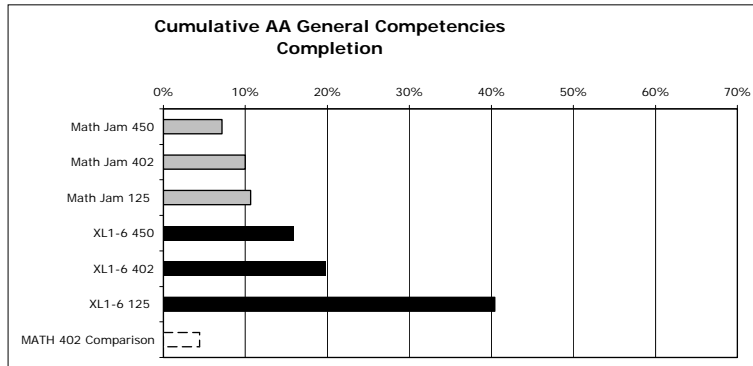
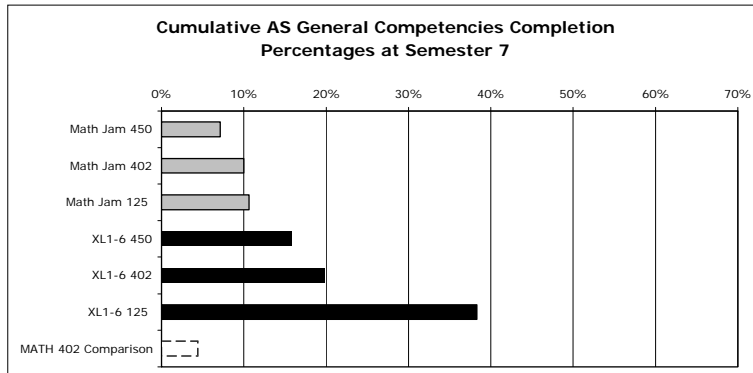


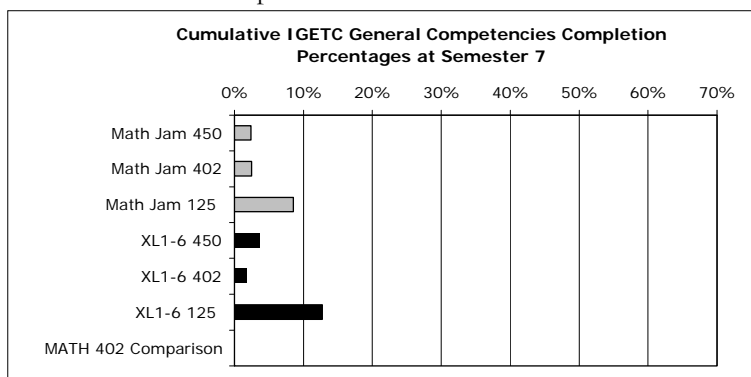
Figure 7. Cumulative AS General Competencies Completion Rates at Term 7



Finally, in Figure 8 we see the Intersegmental General Education Transfer Curriculum (IGETC) general competency requirement completions for our groups. Interestingly, here *both* Math 125 Placed groups excel above their counterparts and both show significantly more completions than the comparison group. No students from the Math 402 Comparison group completed these requirements in seven terms. The pattern of

data in this figure is inconsistent with the other data in this report. Very few students achieved this landmark. Those who placed into Math 125 from both intervention groups still outpace their contemporaries. But, the next lower-ability group, Math 402, does not come close to their achievement.

Figure 8. Cumulative IGETC General Competencies Rate at Term 7



DISCUSSION

.XL students outperformed Math Jam students and a comparison group, on all success markers in this report. This provides support for the intensity argument behind .XL – the more time with students (6 weeks vs. 2 weeks) the more impact the TLC has on student achievement.

Math Jam students outperformed the comparison group on all markers. Except for an unusual anomaly in the data where Math 125-placed students did poorer than Math 402-placed students in Math 131, Math Jam students did better than their comparison group and less well as the .XL groups.

With few exceptions, those placing into higher math classes also performed better than those who placed lower. While this stair-step effect seems to permeate this report, the Math 125-placed students benefited to a greater degree. For instance, twice as many Math 125-placed students completed their AA general competencies than those who placed into Math 402.

There is an obvious trade-off between intensity and achievement. Those receiving a 6-week intervention, especially those who arrive with higher abilities, do better than those receiving a 2-week intervention. These findings raise the question “Is the higher numbers of students affected by Math Jam worth the reduced achievement of this group over the .XL groups?” Either way, all groups of students benefited from the TLC interventions, but to different degrees.

Other than the issue of intensity of intervention, a question of focus is in order. Since we see that intensity helps the higher placing students, would this intensity be better placed on the lower-scoring student? The next phase of development at the TLC may serve the students better if they focused on the lowest scoring students with the highest degree of intensity.

LIMITATIONS

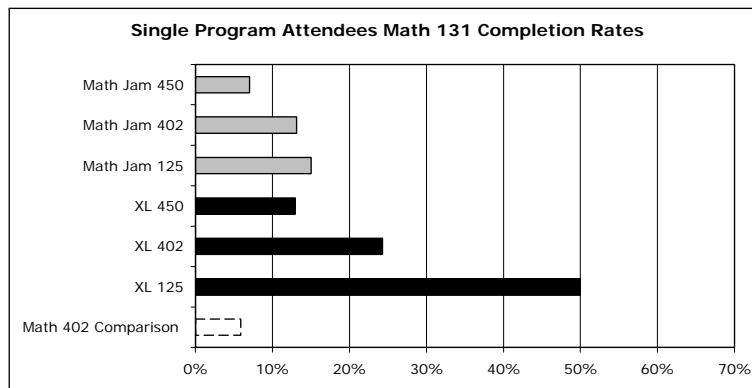
The comparison group was created by matching on demographic variables and having taken a Math 402 course the same semester as the starting cohort of Math Jam (Fall 2006). This is not an academic ability matching and therefore, these groups might be academically different. The difficulty of matching on

placement scores is that many students never take the placement test. They are not required to take it. When they do not take it they start in Math 402 (or Math 450 in the near future). This means that our comparison group may be either a) academically more (or less) advanced and just didn't want to take the test, or b) may have taken the placement test, and placed into 402. The latter option would make them most comparable to the middle-level group of students, in which case the TLC students still outperformed the comparison group and this report's findings have strong validity. If the former scenario holds, this group lacks validity as a fair comparison and the report should be taken with some trepidation.

There is some concern that the students in the TLC programs are not be experiencing only one intervention. During the writing of this report it has come to our attention that many .XL students who do poorly are encouraged to attend Math Jam. Math Jam begins right after .XL ends. Others complete .XL and later take MathPath 1 or 2 within the next year. Therefore, some students may be experiencing a cumulative effect of interventions, casting doubt on this report's parsing of .XL and Math Jam affects.

NEXT STEPS

It is clear that the interventions are having an impact on student achievement. But, is that the result of multiple interventions? Future analyses might reduce the student pool to only those who have participated in just one intervention. A relatively quick analysis on this data was done and is shown here. As with the above data, there is a stair-step to the data but the .XL 450 group scores lower than the Math Jam 125 group. Further exploration of this finding is warranted.



While narrowing in on the intervention effect focuses success prediction on the intervention itself it strays from discussing success for the TLC as a whole. This report shows clear evidence of success.

More investigation on later Math Jam groups (2008/2009) may inform the anomaly in the data for those Math 125 Placed students who did worse than their Math 402 Placed counterparts.

APPENDIX A

DEGREE REQUIREMENTS

ASSOCIATE IN ARTS DEGREE GENERAL COMPETENCIES

English – Pass one of the following: English 1A, 1C, 14, 100, 130, any English course which fulfills Area C (Humanities), or by satisfactory score on equivalency exam.

Humanities English: 1B, 5A, 5B, 9, 10, 11, 12, 24, 25A, 25C, 25D, 25E, 25F, 25G, 25H, 25I, 25J, 26, 30A, 30B, 30C, 44A, 44B, 44C, 45A, 45B, 46A, 46B, 47, 48, 49A, 50, 51, 52, 53, 54, 57, 59, 60, 61, 78A, 78B, 82A, 82B, 82C

Written Expression – English 1A or by satisfactory score on equivalency exam.

Mathematics – Pass one of the following: Business (BUS) 14A, 14B, Computer Science (CS) 45, Mathematics 131, 133AB, 134AB, 139, or a Math course that fulfills the general education requirement in Critical Thinking, or by satisfactory score on an equivalency exam.

Critical Thinking: Mathematics 3, 5A, 5B, 5C, 8, 9, 10, 12, 15, 22, 38, 55; Statistics 15, 18, and 50

ASSOCIATE OF SCIENCE DEGREE GENERAL COMPETENCIES

Reading – One course from the following: English 1A, 1C, 14, 100, 130, any English course which fulfills Area C (Humanities), or by satisfactory score on equivalency exam.

Humanities English: English 1B, 5A, 5B, 9, 10, 11, 12, 24, 25A, 25C, 25D, 25E, 25F, 25G, 25H, 25I, 25J, 26, 30A, 30B, 30C, 34, 35, 36, 37, 44A, 44B, 44C, 45A, 45B, 46A, 46B, 47, 48, 49A, 49B, 50, 51, 52, 53, 54, 57, 59, 60, 61, 78A, 78B, 82A, 82B, 82C, 119

Written Expression – English 1A, or by satisfactory score on equivalency exam.

Mathematics – One course from the following: Business 14A, 14B, Computer Science 45, or a math course which fulfills the general education requirement in Critical Thinking, or by satisfactory score on equivalency exam.

Critical Thinking Math: Mathematics 3, 5A, 5B, 5C, 8, 9, 10, 12, 15, 22, 38, 55, 131, 133AB, 134AB, 139 Statistics 15, 18, and 50

IGETC GENERAL COMPETENCIES

AREA 1 – English Communication. All students must complete two courses (6 semester units), one from Group A and one from Group B. Students transferring to a CSU must also complete a course (3 semester units) from Group C.

- Group A: English Composition: English 1A
- Group B: Critical Thinking/English Composition: English 1C, Philosophy (PHILO) 25, Physical Science (PHYSC) 2

— Group C: Oral Communication (CSU Only): Speech (SPEECH) 1, 10

AREA 2 – Mathematical Concepts And Quantitative Reasoning: Math 3†, 5A, 5B, 5C, 9†, 10, 12†, 22, 55; Statistics (STAT) 18†, 50†

† - course has credit limitations