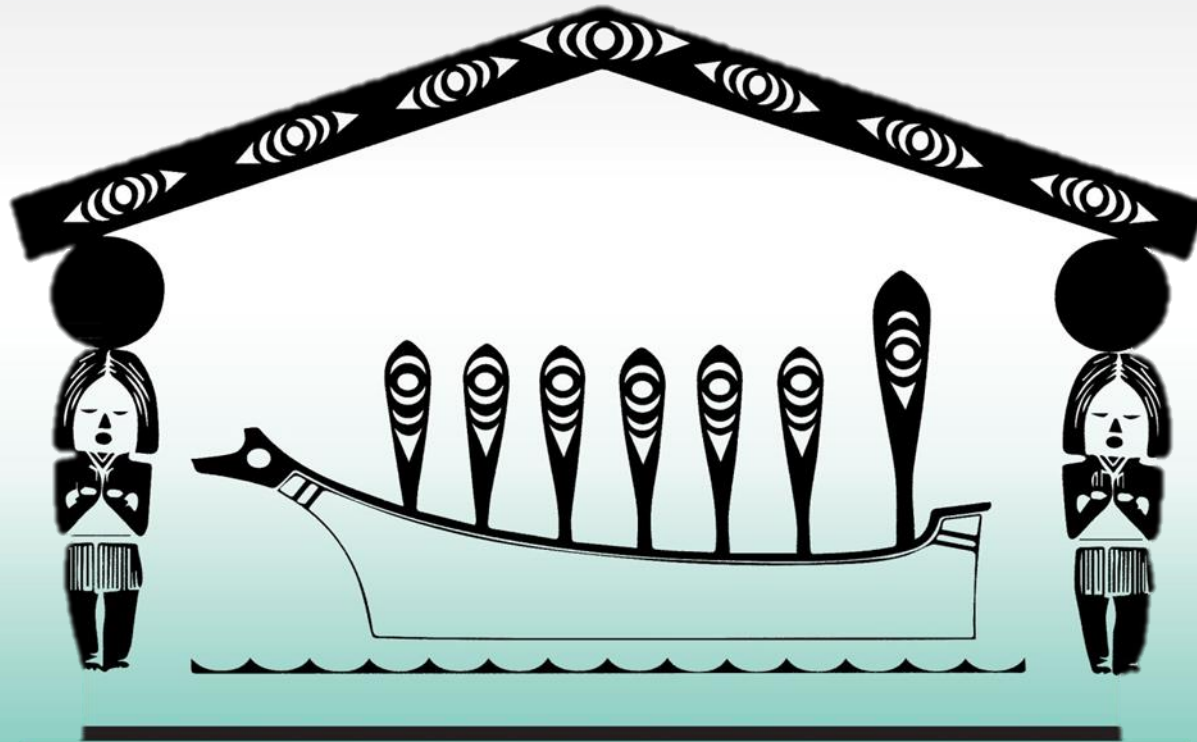


Student Success Initiatives
in Developmental Education

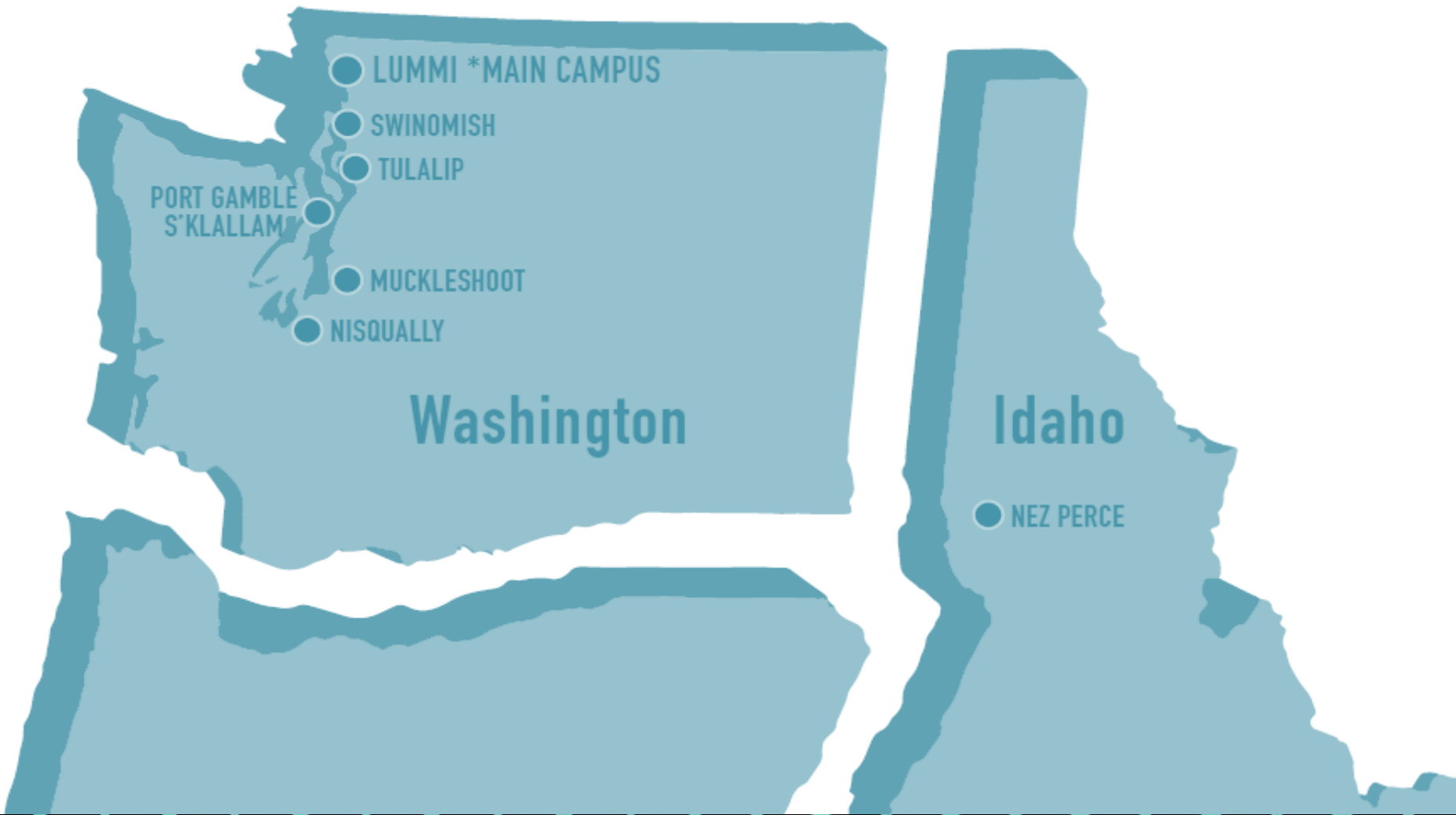




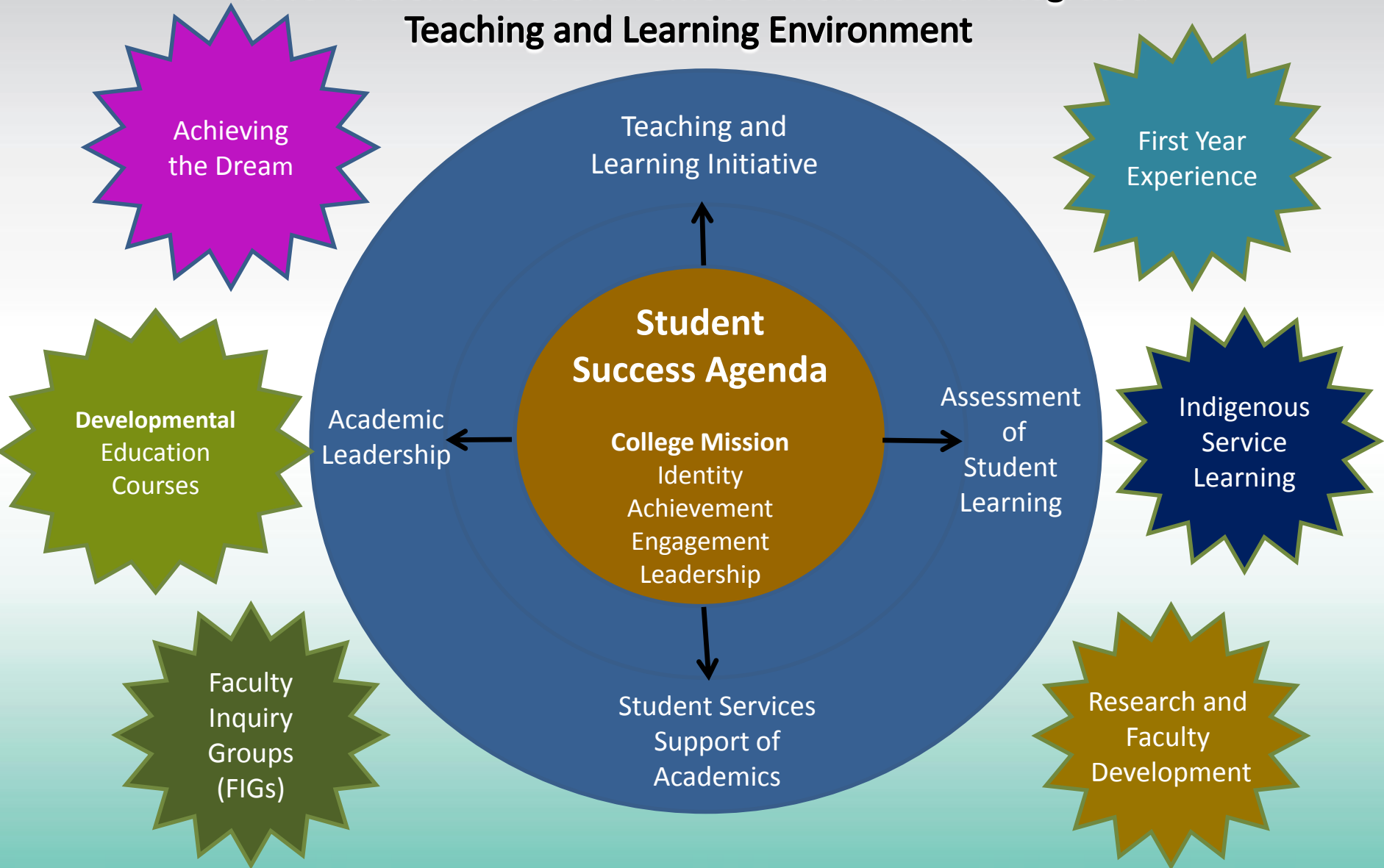


- Tribal College in Washington State
- One of 37 Tribal Colleges in the US
- About 700 degree-seeking students
- 86% Native students
- Six service locations in the Northwest
- Average ATD cohort size: 138 students





NWIC Academic Model: Promote a Holistic and Integrated Teaching and Learning Environment





Promoting Student Learning and Persistence through Engaged Teaching

Some 60 percent of the nation's 13 million community college students are unprepared for college-level courses and must enroll in at least one developmental course...[and] less than a quarter of students in developmental math courses earn a degree or credential within eight years.

(Carnegie Foundation for the Advancement of Teaching)





Promoting Student Learning and Persistence through Engaged Teaching

The math and science departments at NWIC have observed that some students have successfully completed college-level math classes, yet continue to struggle with the quantitative components of science programs. These students tend to avoid taking math or science courses mostly due to past fears or bad experiences in conventional math classes.





Promoting Student Learning and Persistence through Engaged Teaching

Our math faculty has concentrated on strengthening student quantitative fluency, critical thinking and problem solving skills in math classes.

Currently the math faculty at the Lummi campus are using a student-centered constructivist pedagogy and competency-based assessments and grading policies. *(Conceptual Based Learning/Inquiry Based Learning– Number Talk (Ruth parker–Jo Boaler)*





Promoting Student Learning and Persistence through Engaged Teaching

There is preliminary evidence that this pedagogy increases student engagement and achievement, improves their understanding of the course content and develops students understanding of the standards for Mathematical Practice. (conceptual based learning/Inquiry based learning)





- MATH 098 Elementary Algebra Fundamentals of algebra including multiple representations of algebraic objects (formulas, graphs, tables, and contextual descriptions); negative numbers; linear equations and graphs; linear inequalities; integer exponents; and operations on polynomials. Emphasis is on the concepts of equivalent expressions and solutions. Prerequisite MATH 070 or Placement test (5 CR) (N)
- MATH 099 Intermediate Algebra Extends the fundamentals of algebra including systems of linear equations; factoring polynomials; rational expressions (equivalence, common denominators, multiplication and division); square roots (simplification, addition and multiplication); and solutions and graphs of quadratic equations (including the quadratic formula). Emphasis is on multiple representations of algebraic objects. Prerequisite: MATH 098 or Placement test (5 CR) (N)
- MATH 102 College Algebra Revisits and expands concepts of linear and quadratic equations and graphs from the point of view of the concept of functions and their domain. Emphasizes multiple representations of functions and their use as models for applications. Includes, but is not limited to, systems of equations, radical expressions and rational exponents. Prerequisite: C or better in MATH 099 or test above Intermediate Algebra. (5 CR) (QS, NS)





Promoting Student Learning and Persistence through Engaged Teaching

Course participants learn mathematics within an environment that fully models in-depth mathematical content, instructional practices, including inquiry-based mathematics, and formative and summative assessment strategies found in high-quality mathematics classrooms





Promoting Student Learning and Persistence through Engaged Teaching

- Daniel Wildcat emphasized the need to reject the idea that there is only one acceptable way at arriving at knowledge, critiquing the portrayal of the scientific method, and emphasized the fact that there is natural variability in cultures and customs. He suggested that our classes should embrace this natural variability.





Promoting Student Learning and Persistence through Engaged Teaching

- One of the key features in our pedagogy in math these days is that we have removed the teacher from their role as “answer book” and sole source of authority on knowledge in the classroom; an integral part of our classroom approach is the explicit validation of students’ diverse “ways of seeing”, emphasizing the fact that all of us (including the instructor) can be enriched by a learning environment in which different perspectives are shared.
- In our classrooms, we have largely (though not entirely) replaced the model of “teaching by telling” with one in which the students learn by doing.





Classroom Environment

- Universal design: The math faculty adopted a "universal design" model that takes the kinds of modifications that would be useful for all students' learning styles. Universal design for Learning focuses on three principles 1) multiple methods of representation that give the student a variety of ways to acquire information and build knowledge, 2) multiple means of student action and expression that provide the student alternatives to demonstrate what they have learned and , 3) multiple modes of student engagement that taps into the students interest and motivates them to learn





Classroom Environment

☐ Focuses on integrated concepts, instead of isolated skills; focuses extensively on sense-making, rather than the replication of procedures; encourages and urges the use of manipulative and pictures





Classroom Environment

☐ Allows generous time (esp. now, with the extended class time) for students to complete a small set of rich problems, instead of a daily barrage of new information and apparently disconnected procedures; does not include timed exams; students' understanding is assessed through a variety of methods and is not based on a points system-captures students learning as opposed to capturing points





Classroom Environment

☐ Allows students many opportunities to show their understanding; allows and encourages students to continue working on developing their understanding throughout the quarter (because what matters is their understanding at the end of the quarter, not their performance on a particular assessment), instead of promoting/requiring the memorization of skills in the short term that are then promptly forgotten.





What is 18×5

Without using paper

Without using algorithms





What is 18×5

Without using paper

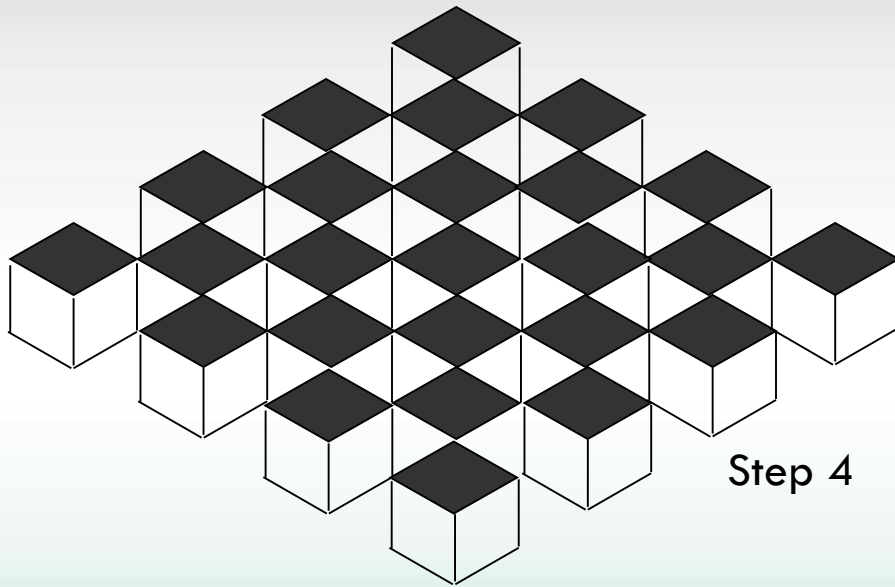
Without using algorithms

https://www.youtube.com/watch?v=KIXUYY97-NU&feature=em-share_video_user

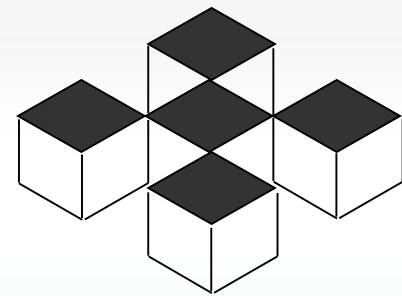




Sample *Patterns* Task



Step 4



Step 2

How many cubes will it take to build the 10th step?

How many cubes will it take to build the n^{th} step?


Explain why your answers make sense geometrically.





Promoting Student Learning and Persistence through Engaged Teaching

The data below shows some evidence of the difficulties students have with completing the developmental math sequence and moving on to college-level math. Over a nearly four (4) year period (from summer quarter 2008 to spring quarter 2012) at the Lummi campus:

- 73 students started in Math 070; only 7 of them completed a 100-level math class, of which only 4 with a C- or better.
 - 175 students started in Math 098; only 39 of them completed a 100-level math class, of which only 24 with a C- or better.
 - 74 students started in Math 099; only 39 of them completed a 100-level math class of which only 29 with a C- or better.
 - In total, out of 292 students, only 57 passed a 100-level math class with a C- or better.
- 



Promoting Student Learning and Persistence through Engaged Teaching

1. How have student and faculty beliefs around math shifted since the new math pedagogy has been introduced and implemented?
2. How have student's approaches to math-related tasks in science classes changed since the implementation of the new math pedagogy?





Promoting Student Learning and Persistence through Engaged Teaching


3. How has student success in science, statistics and in Capstone projects changed since the implementation in the new math pedagogy?
4. Has the implementation of the new math pedagogy affected the time it takes for students to move through the developmental math sequence and successfully complete a college-level math course?





Promoting Student Learning and Persistence through Engaged Teaching

Fifty-six total students enrolled in a Dev-Ed math course in fall 2014. Out of the 56 students;

- 21 passed with a C or better,
 - 11 passed with less than a C, and
 - 24 either failed, withdrew, or did not complete the course. These numbers do not take into account any students who fail a course due lack of attendance
- 



Promoting Student Learning and Persistence through Engaged Teaching

Students complete evaluations of both the course and the instructor. This allows us to identify the degree to which the learning outcomes for the course are achieved. This feedback is used by the instructor and the department to refine the curriculum and pedagogies used. Project specific questions will be added to current course evaluations to capture information regarding the value and challenges inherent in implementing a new pedagogy.





Promoting Student Learning and Persistence through Engaged Teaching

- Increase the mean percentage of students who complete college-level math classes (calculated considering student cohorts who start in each quarter) from 20% to 35%.
- Increase the number of students passing developmental math classes with a “C” or better by 10-15%.





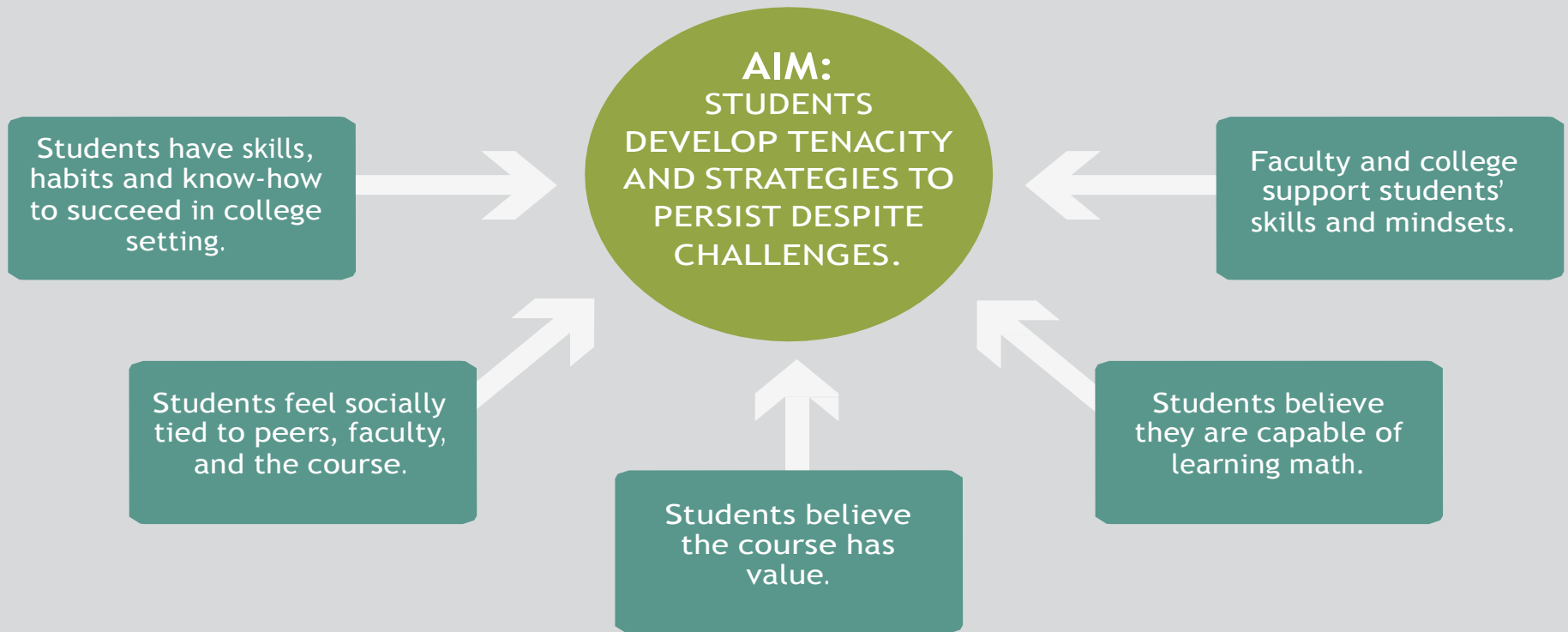
Promoting Student Learning and Persistence through Engaged Teaching

- At least five (5) math and science faculty across the NWIC campuses participate in training and professional development in the new math pedagogy.
- At least three (3) extended campus sites implement the new math pedagogy.
- STEM students at all NWIC campuses increase their critical thinking, higher-level problem solving and symbolic reasoning skills.



Promoting Student Learning and Persistence through Engaged Teaching

DRIVING TOWARD PRODUCTIVE PERSISTENCE
PSYCHOLOGICAL STRATEGIES FOR STUDENT SUCCESS



SOURCE: These drivers are excerpted from the January 2013 version of Carnegie's Productive Persistence Driver Diagram. To see the complete diagram, please visit www.carnegiefoundation.org/productive-persistence.



Promoting Student Learning and Persistence through Engaged Teaching

One strategy - the reading about how the brain changes as you learn, that challenges the concept of "I am just not good at math" - has been a part of our Math 098 classes for over a year.





Promoting Student Learning and Persistence through Engaged Teaching

- We have begun to collect some material - namely, stories of students who have overcome adversity to begin to learn. We haven't put them to use in the classroom yet, but we have discussed the ways of doing so.





Promoting Student Learning and Persistence through Engaged Teaching

The goal of mathematics reform efforts is to develop students who are challenged by messy, ill-defined situations or complex problems; students who are able to use the important mathematical ideas to understand the power of mathematics as a way to reveal significant patterns and relationships that surround them. Meeting this goal will require great changes to the content of mathematics courses, of the learning environment, and of the role of the teacher. *Ruth Parker*

