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Engaging Faculty for Student Success: The First Year Learning Initiative
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State Comprehensive Universities (SCUs) face numerous challenges. In the face of radically reduced support from state legislatures, SCU students and their parents remain extremely sensitive to the costs of higher education and rising tuition rates. For SCU faculty, workloads and expectations balloon, many see the academy shifting from under their feet, and more still believe that they have little say in their institutions' direction going forward. Amid this thicket of complexity, student success has taken center stage as an important—perhaps the most important—foundation for institutional well-being. For SCUs, there is a growing expectation to retain and graduate ever more students. Increasingly, this expectation is driving institutional budgeting— “performance funding” is now a reality for many SCUs and it will surely be a reality for many more in the future.

What can we do to increase student success and retain more of our students? Many things determine student retention, but academic success in the early college career is a major predictor (Belcheir, 2000; Ishler & Upcraft, 2004). Student success is something that—unlike homesickness, the economy, and the vagaries of financial aid—can be directly influenced by faculty and administrators. Anyone concerned about the future of SCUs must put early career academic success at the top of the list.

The good news about student success is that we already know a great deal about how to structure and deliver coursework to maximize learning and, by extension, successful course completion. Research from education, applied cognitive science, and related fields tells us that to improve outcomes we need to move away from the traditional lecture-based class with its infrequent, high-stakes assignments and largely passive pedagogy (see, e.g., Freeman, Eddy, McDonough, Smith, Okoroafor, et al., 2014). In place of a traditional lecture-centric format, we can employ powerful and engaging pedagogies that include using frequent small-stakes assessments, active learning in the classroom, peer-to-peer interaction, and co-curricular learning opportunities. Moving substantial

numbers of our lower-division courses away from weak, outdated strategies to dynamic active-learning approaches would, by itself, virtually guarantee that more of our students will progress toward completing their degrees. The bad news, which we all know, is that it is notoriously difficult to transform how we design and deliver courses across an institution. Simply disseminating information to faculty about “best practices” in no way ensures that those practices will be implemented with any consistency across the key courses that early-career students are most likely to take. Faculty tend to hear calls to “increase success” as code for “water down the material,” which runs counter to deeply-held academic values.

And there is even more bad news—student investment of time and effort is in rapid decline. One long-range study of time use reveals a decades-long slide in the hours that full-time college students report spending on coursework, now down to a record low of 27 hours per week (Babcock & Marks, 2011). The book *Academically Adrift* (Arum & Roksa, 2011) further suggests that these hours are not spent on challenging, high-payoff activities like critical reading and writing, either. Finally, as Rebekah Nathan pointed out in her book *My Freshman Year*, there seems to be a deep disconnect in student and professor mentalities concerning investment in education, with many students focused on “managing and taming professors” rather than on making legitimate academic progress (Nathan, 2005).

All of this adds up to a disturbing mix: intense pressure to increase student success, major barriers to institution-wide transformation, and decreasing willingness of students to do what it takes to succeed in higher learning. It was in this context, during the fall of 2011 at one SCU, that we launched what we would call the First Year Learning Initiative (FYLI) with the goal of promoting retention by improving student academic success in the first year. At Northern Arizona University (enrollment ca. 28,000), we needed to accomplish this goal on a relatively lean budget, and without adding new faculty or new academic requirements. We were also committed to making the initiative authentically grass-roots, true to the practice and culture of our institution, and without the overtones of top-down mandates that tend to trigger faculty and student pushback.

We began by bringing together campus leaders who teach early-career students. This leadership group included not just “power faculty” teaching large introductory courses semester after semester, but also key individuals within academic transitions programs, first year seminar, and e-learning. Meeting initially in small groups, we asked what factors they thought most contributed to student success—in particular, asking them what differentiates first-year students who succeed from those who do not.

Overwhelmingly, our colleagues answered that it is not intellectual giftedness or even necessary high school preparation that sets the successful ones apart. Rather, they emphasized a group of factors including consistent attendance, willingness to invest effort, effective study skills, and good organizational ability. Students vary with respect to these characteristics, but through classroom experience they can consistently increase the underlying skills. We came to refer to this group of factors as socializing students to excellence: namely, building the attitudes and behaviors fundamental to functioning in the university (as opposed to the high school) environment.

We also asked our colleagues about pedagogy and course design features that effectively promote student success. Many of the features cited by the group echoed the best practices in pedagogy and course design literature: formative feedback, active learning, reducing reliance on lecture while increasing time spent on activities such as in-class group work and problem solving (see, e.g., Ambrose, Bridges, DiPietro, Lovett, & Norman, 2010; Chickering & Gamson, 1987; Wieman, 2014). Our group also recommended that instructors monitor not only attendance, but also in-class participation, and that attendance and/or participation count for a part of the course grade.

The “early and often principle” is another major design feature that our colleagues highlighted. Under this principle, some small-stakes work is due early in the semester—within the first week or two—and small-stakes assessments throughout the term complement or replace the traditional infrequent, high-stakes assessments such as midterm exams and term papers. Lastly, our group noted the importance of co-curricular learning—i.e., taking advantage of learning opportunities outside of the classroom in the community and beyond.

These goals for student socialization and best practices would form the basis for our new initiative, but we also knew that we would need mechanisms to

ensure that changes would be sustained over time and across different iterations of courses. To do this, we put into place a third component: alignment. This means that courses—especially large, multi-section ones—must have some kind of unifying coordination scheme that would promote consistency across sections, without imposing a too-rigid, “canned” course structure. Additionally, there must further be alignment between learning objectives, learning activities, and assessments, something that tends to drift across semesters and across uncoordinated sections of a course.

Overview of the FYLI Process

Departments volunteer to earn FYLI “certification” for courses by having one or two people—usually the course coordinator, co-instructors, or others heavily invested in the course—go through a developmental process during which the course is revamped to meet criteria in the areas of student socialization, design, and alignment. FYLI directors negotiate with departments and individual faculty about FYLI expectations in advance of formally beginning the process with each course to ensure that course coordinators, department colleagues, and other stakeholders buy in to the initiative process before any work begins.

Radically different than a traditional “request for proposals” approach to course redesign, the heart of the FYLI process is a sequence of highly structured development conversations between the coordinator(s) of a course and FYLI development facilitators. Facilitators use a defined set of conversational strategies that emphasize active listening and taking a collaborative stance rather than attempting to prescribe or remediate instruction in the course. In the FYLI development process, faculty are brought together in one-on-one conversations modeled on community organizing strategies developed by the Industrial Areas Foundation and other community groups (Chambers, 2008). Through these conversations, we seek to have faculty tell the narratives of their courses and the narratives of their teaching—what motivates them as teachers and their sense of purpose and commitment. Ultimately through these conversations, we seek to develop a new ‘space’ for the course—one that is dynamic and vitally creative, and one that encourages colleagues to take active ownership of the curriculum that they already control.

A key part of the FYLI development conversation—and subsequent conversations between the course coordinator and faculty teaching the course—is a broader collaboration that explores the unvoiced assumptions and practices of those expert faculty members’ disciplinary habits of mind that frame the course. The mining of these assumptions draws heavily from the “Decoding the Disciplines” work of Joan Middendorf and her colleagues at Indiana University (Middendorf & Pace, 2004, and the other disciplinary-focused essays in the same volume). Elements of Decoding are used in FYLI to assist faculty in developing effective scaffolding, as faculty deeply reflect on their own practices as experts to find ways to break down their disciplinary way of thinking into teachable and achievable steps for novice learners in the course. Through FYLI, students in the course can then begin to understand how a biologist begins to think in and do biology.

The one-on-one FYLI development conversations usually take place off campus, in the casual atmosphere of a local coffeehouse. Conversations begin by eliciting the course coordinator’s own experience teaching the course (what has worked, what does not work), and locating barriers to change (difficult or alienated faculty, institutional politics, departmental culture, i.e. “power mapping” community organizing strategies). We then discuss the deeper dynamics at work in the course: Why has the course always been taught in this way? What have the faculty always wanted to do? Why have they not pursued what they really want to do? What keeps students from succeeding in the class?

Development conversations transition to discussing specific ways in which the course will maximize specific aspects of the three FYLI principles: socializing students for success, best practices in pedagogy and course design, and alignment. They center on a set of development questions provided to faculty in advance. These questions probe specific aspects of the three principles (socializing, design, alignment), for example:

In what ways does your course offer a realistic understanding of the commitment (time, effort) that is needed to succeed?

Within the first two weeks of class, in what ways does your course require that students invest effort?

How does your course develop the experiences that students need to succeed in more complex tasks, assignments, or analyses (i.e., scaffolding students up from a novice to an experienced learner)?

How does your course actively engage students?

In what ways does your course use lectures strategically, if at all?

To what degree does your course effectively utilize student learning outside of the classroom (co-curricular learning experiences)?

To what degree does the coordination scheme allow coordinators to take advantage of meaningful, actionable data about student engagement, achievement, and progress in the course?

(The full set of development questions can be downloaded from the FYLI web site, www.nau.edu/fyli)

The development conversations between coordinators and FYLI facilitators constitute only one half of the discussion to bring about change in the course. In parallel, course coordinators lead collaborative discussions with department colleagues in order to identify the best pedagogical practices for the course, agree on major design features and learning objectives, and make other important decisions concerning how the course will work going forward. This component of the FYLI process establishes the pattern for ongoing and regular coordination meetings, which are crucial for driving innovation and maintaining integrity of the FYLI principles across multiple sections and iterations of the course (alignment).

After a series of meetings—typically ranging from three to five—where the complete set of questions is discussed, course coordinators submit two deliverables in order to earn certification. The first is a set of written responses to each of the development questions (briefly summarizing our development conversations), explaining how each criterion was addressed before FYLI, and how it will be addressed differently after FYLI. The second is a document we term the syllabus of practice. This is not the same as a standard student course syllabus, although it should contain the content that is common to all section syllabi, such as learning objectives, texts, and assignments. For many, the syllabus of practice becomes a virtual faculty course handbook that contains pedagogical annotations and explanations written for fellow faculty, not

students. It addresses topics such as collegial advice on effective teaching strategies, expanded descriptions of assignments and assessments, identification of key pedagogies and practices for each unit or assignment, instructions for in-class active learning exercises, and more. In this way, the syllabus of practice documents important practices, supporting consistency even when new instructors rotate in to teach the course, and ensuring that FYLI practices will be sustained from semester to semester.

What do faculty and their departments get out of FYLI certification? We offer a \$3,500 stipend to course coordinators for their time to develop the FYLI-certified course. However, the most powerful incentive we have found for participation in FYLI is the Peer Teaching Assistantship (Peer TA) program. FYLI funds one undergraduate ten hour Peer TA per week to work with each section of each FYLI-certified course. Additionally, Peer TAs do not receive course credit, but rather are paid a \$1,300 stipend for the semester's work. Course coordinators and instructors are empowered to decide exactly whom to hire and how to deploy the Peer TAs in their course. Typical Peer TA responsibilities assigned by faculty include coordinating in-class small group learning activities, recording attendance and participation grades, and holding supplemental office hours.

Peer TA stipends consume the large majority of the FYLI budget, but we believe that they are a uniquely powerful aspect of the program, and not just as an inducement for faculty. The research literature in social psychology suggests that having a relatable “model to look up to” —such as another undergraduate only a year or two ahead of you in the program—is one of the most powerful ways to build academic “self-efficacy,” motivation, and success (Bandura, 1986; Bartsch, Case, & Meerman, 2012). Other research findings document a number of academic and professional development benefits to students who serve as Peer TAs, such as increased preparation for being a teaching assistant in graduate school, building interest in being a future teacher in the discipline, and an opportunity to review material they may have forgotten since taking the course themselves (Otero, Pollock & Finkelstein, 2010; Weidert, Wendorf, Gurung, & Filz, 2012). For many Peer TAs, the opportunity to develop a strong mentoring relationship with an important faculty member in their department is also a key to their socialization in the discipline and establishing a record of work in their career. Serving as a Peer TA also allows

many to begin the process of developing professional relationships with faculty who can then subsequently serve as references for graduate school and other research opportunities.

For most FYLI faculty, financial incentives are not the primary driver for participation. There are a number of more “lucrative” initiatives on campus that faculty could choose to pursue, and the lure of a stipend and undergraduate Peer TA are inadequate to carry truly unenthusiastic faculty through the demanding process of overhauling their course and seeking buy-in from department colleagues for all the changes being made. What does connect many with FYLI is the emphasis on faculty values. Creating a space in which faculty can collaborate on issues that they care about deeply – such as teaching, exercising agency through curriculum, and making decisions through a collaborative process – has captured the imagination of many and is proving to be a means by which some colleagues have been renewed and reinvigorated in their teaching. A theme that we hear echoed across many of these development meetings is “This is what we should have been doing all along—FYLI has given us an opportunity to make it happen.”

Impacts of FYLI

Our assessment plan examines FYLI’s impacts from multiple distinct angles, incorporating institutional, educational, and faculty development goals.

Participation in the Program. The FYLI program has shown a remarkable degree of faculty acceptance and interest, enabling it to grow rapidly since its inception. Year by year, FYLI-certified courses have increased from 28 in Fall 2011 to 44 in Fall 2012 to over 80 courses in Fall 2014. The Peer TA program has also grown to over 400 Peer TAs hired per year, representing one of NAU’s largest sources of career-relevant, academically oriented employment for undergraduates.

Accordingly, the overwhelming majority of first-year students come into contact with FYLI. In AY 2013-2014, 98% of the first-year cohort enrolled in at least one FYLI course—without any kind of formal institutional requirement to do so. This large number reflects FYLI’s inclusion of the courses that first-year students are almost guaranteed to take: English composition, foundational math, and

large “gateway” courses from chemistry, biology, computer science, and social sciences.

An additional metric of FYLI’s scope is the proportion of first year serving courses that are FYLI certified. We defined a course as “first year serving” if there was at least one section of the course with 49% or more first year students. Under this definition, there are 75 first year serving courses on campus. Of these, 37 (49%) are currently FYLI-certified, meaning that about half of all lower-division courses enrolling mostly first-year students have voluntarily joined and successfully completed the program.

Course Completion. FYLI certification is associated with significant improvement in course completion—as evidenced by changes to the “DFW” (drop-fail-withdraw) rate that occur over time in conjunction with certification. Looking across the cohort of FYLI courses certified prior to 2014 for which historical DFW data were available, we compared DFW for the prior eight semesters before certification to DFW post-certification.¹

Mean DFW before certification was 20.56% (SD=8.13) and 18.62% (SD=7.23) after certification. Thus, on average, DFW dropped 1.93% as a function of FYLI (2.66% when courses simultaneously participating in a campus-wide blended learning initiative were excluded from the analysis). This DFW drop is statistically reliable (paired t [47]=2.17, $p < .04$), and replicates similar findings found for the prior two years of the program.

During FYLI’s first year, we also compared changes in DFW across FYLI courses and other large, lower-division courses (a comparison that is impractical to repeat now that so many of these courses have joined FYLI). Here too, we found that FYLI courses experienced significantly greater reductions in DFW—11% versus 3%—compared to their non-FYLI counterparts. The trend is clearly in a positive direction: FYLI correlates with student success, as measured by successfully completing the course.

Cost Saving for Students. The 2% drop in DFW associated with certification is a seemingly small effect. However, when viewed in light of the large size of the program, it is clear that this small percentage represents a major impact on the student experience and student costs. The total annual headcount for FYLI—i.e., the number of enrollments across all students and classes—was 41,202 in AY 2013-2014. In a sense, each one of these 41,202 enrollments represents one

opportunity for a DFW to occur—i.e., a chance that a student will be unsuccessful in the course. Assuming—based on the DFW analysis presented earlier—that the DFW rate would have been about 20% across these courses without FYLI, then approximately 8,240 “DFW events” would have occurred ($41,202 \times .2$). With FYLI, the expected DFW rate falls to about 18%, equaling 7,416 ($41,202 \times .18$) DFWs—a difference of 824. In other words, FYLI prevents about 824 DFWs from occurring per year.

The implications of this “prevention effect” for costs to students are substantial: Each DFW event represents a student’s failure to earn credit for a course he or she enrolled in and paid for. The estimated cost of taking one NAU course at the in-state tuition rate is \$1,716.² At this per-course cost, preventing 824 DFWs through FYLI produces a savings to students of \$1,413,984 annually.

Conclusion

For SCUs to both survive and thrive in an era of enormous pressure—budgetary, legislative, parental—they need to be aggressive in exploring every avenue for building student success. Through FYLI, our institution has found a way to increase the chances that its students will successfully complete foundational courses in the early college career. By building student academic success, FYLI not only promotes academic progression, but also produces significant cost savings to students of nearly \$1.5 million annually. At SCUs, where college costs are being scrutinized like never before, programs with a clear connection to student success and a wide reach throughout the student population offer the best payoff for resources invested.

More broadly, FYLI demonstrates that it is possible to change the unchangeable: Faculty, when brought into meaningful collaboration that both empowers and emphasizes the values of the academy, will take ownership of student success. But to make this happen, university leaders must move beyond making suggestions or issuing mandates. Rather, they must come together with faculty to genuinely discuss the pressing need to transform the way in which we design and deliver foundational college courses. They must also work collaboratively with faculty to pursue the means that flow from the disciplinary values of the faculty to insure the transformation that will help our students succeed.

Community organizing offers a powerful framework for accomplishing this kind of deep transformation. Through this framework, colleagues engage colleagues in a free exchange of ideas, opening curriculum to creativity and innovation, and envisioning both what they can do differently and what they need to do. This process promotes deeper and more substantive change compared to simply checking off program requirements in trade for Peer TAs or stipends.

We come as novices into dialogue with the disciplinary experts who coordinate each course. This allows us to help frame very learner-centered development conversations about the most effective pedagogies and practices to be deployed in the course. Rather than starting from the point of view that teaching is something to be remediated and repaired, we take the discussion back to the core objectives faculty want their courses to accomplish. We ask: What do students coming into the course assume is true about the discipline of psychology? Engineering? Theater? What is actually true? If you could change one thing about your students' understanding, what would it be and why? For faculty who live out their professional lives in service to their disciplines, these are the questions that motivate change—yet in the hectic pace of the typical SCU, opportunities to engage with them are few and far between. Initiatives that offer a space for deep reflection and growth are the ones that faculty will want to engage with, even in the face of so many competing pressures and responsibilities.

One aspect of FYLI that connects so well with colleagues is that it is solidly grounded in the research on teaching and learning. We were conservative in building FYLI's set of practices, for the most part sticking with those—active learning, frequent formative feedback, reduced reliance on lecture—with established track records in the literature. Although our development process does not overtly emphasize the research basis for FYLI's practices, we are prepared to present it to faculty who want more evidence or simply wish to build their own understanding. For example, numerous studies have all supported the idea that frequent quizzing, even over material students have not mastered, is highly effective for building memory for material (Karpicke & Blunt, 2011; Karpicke & Roediger, 2007, 2008; McDaniel, Roediger, & McDermott, 2007). This is a counter-intuitive claim for many, yet a review of the evidence gives needed

weight to the idea that FYLI courses need to provide multiple opportunities for students to take low-stakes quizzes. For some faculty and some departments, the ability to see evidence supporting the approach has meant the difference between enthusiastic participation and rejection.

FYLI' s persuasive power is ultimately derived from its fundamental focus on speaking to core faculty values, as opposed to just administrative priorities, budget pressures, and the like. Faculty do not come to a conversation about course design as blank slates; rather, they likely have well-founded concerns that the real motive behind it all is to water down course content, de-skill teaching, or heavily standardize courses. These are all assumptions that can be addressed head-on in colleague-to-colleague discussions. We intentionally built FYLI' s requirements and development questions to make it clear that the program seeks to increase both faculty agency and academic rigor. Similarly, we articulate that multi-section coordination is desirable not because it turns teaching into mere delivery of scripted or canned content. Instead, coordination supports rigor by ensuring that no one is alone in asking more of students. Additionally, coordination brings faculty together regularly into collaborative meetings on the progress of students in the course in which they discuss what additional support they may need to provide their students. Ultimately, we find that when faculty come together to pool their collective wisdom about the most effective practices for their course, they discover that, working together, they can most successfully realize their shared goals as disciplinary experts and most effectively help their students to succeed.

The challenges that led to FYLI' s creation are not unique to Northern Arizona University. All SCUs grapple with the need to build student self-accountability for academic success, in an environment with ever-increasing pressure to bring more students up to higher levels of achievement with an increasingly stressed faculty. In these ways, SCUs are more similar than they are different. FYLI offers a framework for addressing these shared challenges while not only respecting, but increasing, faculty agency through our passion for our disciplines and through our shared academic values.

Notes

¹ These analyses were conducted using data provided by NAU's Office of Curriculum, Learning Design and Academic Assessment; we gratefully acknowledge their assistance in compiling them.

² This estimate was calculated using the web site [Collegecalc.org](http://www.collegecalc.org), <http://www.collegecalc.org/colleges/arizona/northern-arizona-university/#creditCost>

References

Ambrose, S.A., Bridges, M.W., DiPietro, M., Lovett, M.C. & Norman, M.K. (2010).

How learning works: Seven research-based principles for smart teaching [Amazon Kindle version].

Arum, R., & Roksa, J. (2011). *Academically adrift: Limited learning on college campuses*. Chicago: University of Chicago Press.

Babcock, P., & Marks, M. (2011). The falling time cost of college: Evidence from half a century of time use data. *Review Of Economics & Statistics*, 93(2), 467-478.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.

Bartsch, R. A., Case, K. A., & Meerman, H. (2012). Increasing academic self-efficacy in statistics with a live vicarious experience presentation. *Teaching of Psychology*, 39(2), 133-136. doi:10.1177/0098628312437699

Belcheir, M. J., & Good Faith Fund (2000). Predicting the probability of graduating after four, six, and ten years. Research Report.

Chambers, E.T. (2008). *Roots for Radicals: Organizing for Power, Action, and Justice*. New York and London: Continuum International Publishing Group.

Chickering, A. W., & Gamson, Z. F. (1987). Seven principles for good practice in undergraduate education. *AAHE Bulletin*, 3-7.

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of The National Academy of Sciences of The United States of America*, 111(23), 8410-8415. doi:10.1073/pnas.1319030111

Ishler, J.L.C., & Upcraft, M.L. (2004). The keys to first-year student persistence. In M. Upcraft, J.N. Gardner, & Barefoot, B. O. (Eds.), *Challenging and Supporting*

the First-Year Student: A Handbook for Improving the First Year of College.
Hoboken, NJ: Jossey-Bass.

- Karpicke, J. D., & Blunt, J. R. (2011). Retrieval practice produces more learning than elaborate studying with concept mapping. *Science*, 331(6018), 772-775. doi:10.1126/science.1199327
- Karpicke, J. D., & Roediger, H. (2007). Repeated retrieval during learning is the key to long-term retention. *Journal Of Memory And Language*, 57(2), 151-162. doi:10.1016/j.jml.2006.09.004
- Karpicke, J. D., & Roediger, H. (2008). The critical importance of retrieval for learning. *Science*, 319(5865), 966-968. doi:10.1126/science.1152408
- McDaniel, M. A., Roediger, H., & McDermott, K. B. (2007). Generalizing test-enhanced learning from the laboratory to the classroom. *Psychonomic Bulletin & Review*, 14(2), 200-206. doi:10.3758/BF03194052
- Middendorf, J., & Pace, D. (2004). Decoding the disciplines: A model for helping students learn disciplinary ways of thinking. *New Directions for Teaching and Learning*, 98, 1-12.
- Nathan, R. (2005). *My freshman year: What a professor learned by becoming a student*. Ithaca, NY: Cornell University Press.
- Otero, V., Pollock, S., & Finkelstein, N. (2010). A physics department's role in preparing physics teachers: The Colorado learning assistant model. *American Journal Of Physics*, 78(11), 1218-1224. doi:10.1119/1.3471291
- Weidert, J. M., Wendorf, A. R., Gurung, R. R., & Filz, T. (2012). A survey of graduate and undergraduate teaching assistants. *College Teaching*, 60(3), 95-103. doi:10.1080/87567555.2011.637250
- Wieman, C. E. (2014). Large-scale comparison of science teaching methods sends clear message. *Proceedings Of The National Academy Of Sciences Of The United States Of America*, 111(23), 8319-8320. doi:10.1073/pnas.1407304111

