Campus-Based Practices for Promoting Student Success: Effective Pedagogy

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Midwestern Higher Education Compact

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About this MHEC Research Brief Series

This research brief is drawn from specific topics examined in the forthcoming MHEC report, *Institutional Practices Conducive to Student Success: An Overview of Theory and Research.*

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Campus-Based Practices for Promoting Student Success: Effective Pedagogy

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Effective Pedagogy

One of the iconic symbols of the collegiate experience is the graying professor pontificating behind a lectern to a massive audience of dreary-eyed students. In fact, 45 percent of faculty at four-year institutions still report "extensive lecturing" as the teaching method used in most of their courses (Hurtado et al., 2012). And yet, over the past few decades a voluminous body of research has emerged demonstrating that the traditional lecture method is far less effective than pedagogies of engagement, mastery learning, and computer-based instruction. Such methods are thought to variously promote student success by increasing social integration and academic engagement (Pascarella & Terenzini, 2005). This research brief provides a description of effective pedagogies as well as a summary of supporting research.

To the extent possible, the literature review in this brief focuses on the results of meta-analyses, which examine the average treatment effect or effect size (ES) over multiple studies. Cohen (1988) offered a set of guidelines for interpreting effect sizes: small =.20; medium = .50; and large= .80. Alternatively, effect sizes can be conceived as the percentile point increase (or decrease) on the outcome measure for the average student who received the "treatment" (e.g., online instruction). Both the effect size and the equivalent number of percentile points are reported.[1]

Pedagogies of Engagement

A key foible of the lecture method is that it is based on the erroneous assumption that students learn by passively absorbing information; they are seen as empty vessels that must be filled with the professor's knowledge. Much to the contrary, research in the field of educational psychology has demonstrated that students learn by actively constructing knowledge through the explanation, application, and integration of new concepts (Barkley, 2010). The most prominent pedagogies that actively engage students in the learning process are cooperative learning, problem-based learning, and service-learning.

[1] The effect size in a meta-analysis is typically computed as the difference between the treatment group mean and the control group mean, divided by the pooled standard deviation. A medium effect size of .50 is equivalent to stating that the average student in the treatment group ranked 19 percentile points higher than the average student in the control group (who ranked at the 50th percentile).

Cooperative learning.

Collaborative or cooperative learning involves small groups of students (typically 2-4) who collaborate to attain a common learning goal. In cooperative learning, the instructor ensures that (a) individual performance is intertwined with group performance; (b) each student is held accountable for his or her performance; (c) students enhance each other's learning outcomes through explanations, modeling, reinforcement, and coaching; (d) students develop requisite social skills for effective teamwork; and (e) students evaluate and improve group work processes (Johnson, Johnson, & Smith, 1998; Millis, 2010). Meta-analyses have provided overwhelming support in favor of cooperative learning relative to traditional individual or competitive learning (Johnson, Johnson, & Smith, 1998; Johnson, Johnson, & Stanne, 2000; Kyndt et al., 2013). Johnson and Johnson (1993) reported that college students who engage in cooperative learning attain higher levels of academic achievement (ES = .49-.53; 19 - 20 percentile points), greater interpersonal favorability (ES= .55 - .68; 19 - 25 percentile points), and greater perceived peer and faculty support (ES = .51 - .60; 19 - 23 percentile points). Academic achievement gains for cooperative or collaborative learning have been demonstrated across various fields, such as physical science, mathematics, computer science, and biology (Marr, 1997; Smith et al., 2005, Springer, Stanne, & Donovan, 1997).

Problem-based learning.

Problem-based learning (PBL) is a student-centered pedagogy that uses representative problems that organize and stimulate the learning experience (Barrows, 1996). In their meta-analysis of 43 studies, Dochy et al. (2003) found that PBL was associated with significant gains in the ability to apply knowledge (ES= .66; 25 percentile points), relative to the traditional lecture method. The relationship between PBL and gains in *content* knowledge was less clear. PBL appears to result in lower knowledge acquisition (ES= -.21; -8 percentile points) but greater knowledge retention (ES= .14; 6 percentile points).

Service-learning.

Service-learning refers to "a teaching and learning strategy that integrates meaningful community service with instruction and reflection to enrich the learning experience, teach civic responsibility, and strengthen communities" (National Service-Learning Clearinghouse, 2013a). Service-learning pedagogies have been developed for a broad array of fields, including environmental studies, nursing, history, medicine, sociology, food services, accounting, biology, engineering, psychology, and English composition (National Service-Learning Clearinghouse, 2013b). Yorio and Ye (2012) conducted a meta-analysis of 40 studies that examined service-learning during college in relation to cognitive development (e.g., GPA, course performance, problem-solving). The average effect size was .53, or a difference of 20 percentile points. More generally, in their meta-analysis of 103 pre-/post-test studies, Conway, Amel, and Gerwien (2009) found that participation in service at all educational levels was associated with gains in a variety of academic outcomes. For example, service participation yielded gains in knowledge or grades (ES= .42; 16 percentile points), cognitive outcomes (ES=.29; 11 percentile points), and academic motivation and attitudes (ES= .58; 22 percentile points).

Mastery Learning

The essence of mastery learning is that students are required to demonstrate proficiency in a lesson or unit before progressing to the next one. Mastery learning is intended to address the problem of variation in student aptitude. The traditional classroom requires that all students adjust to the same pedagogical approach, and thus only students with high academic aptitude are likely to succeed. In contrast, mastery learning provides the *amount and type* of instruction that each student individually requires to attain a high level of academic performance (Bloom, 1968).

In a meta-analysis of 86 studies, Kulik, Kulik, and Bangert-Drowns (1990) found that mastery learning programs in college yielded an average achievement effect of .53 standard deviations (20 percentile points), relative to traditional teaching methods. Students with low academic aptitude derived particularly large learning grains from this approach (ES = .61; 23 percentile points). However, participation in *self*-paced rather than instructor-paced mastery learning courses was negatively associated with course completion (ES=-.14; -6 percentile points).[2]

Computer-based Instruction

Effective pedagogies can be implemented or enhanced with technology. Computer-based instruction has been variously used for transmitting information, drill-and-practice, tutorial instruction, resource guidance, student assessment, problem-solving, and simulations (Kulik &

[2] In instructor-paced instruction, students who attain early mastery of a unit are assigned advanced or "enriched" learning tasks.

Kulik, 1991). More than a thousand studies and dozens of meta-analyses have been conducted on the relationship between technology and learning since the 1960s. Kulik and Kulik's (1991) meta-analysis of 149 studies demonstrated significant gains in course examination scores for college students exposed to computer-based instruction relative to control group participants in traditional classrooms. Effect sizes ranged from .27 to .43, which is equivalent to an advantage of 11 to 17 percentile points. Significant effects were observed for various applications (e.g., drill-and-practice, student assessment) and across a range of subjects, including mathematics, science, social science, language, and vocational training. Students exposed to computer-based instruction, however, were slightly less likely to complete the course (ES= -.06; -2 percentile points) than control group participants in a traditional classroom. More recently, Tamim et al.'s (2011) second-order meta-analysis indicated that using computer technologies for direct instruction (ES= .31; 12 percentile points) and support instruction (ES= .42; 16 percentile points) yielded higher levels of student achievement than traditional classroom instruction. The average effect size in a postsecondary context was .29, or 11 percentile points.

Online learning technologies offer three potential advantages over the traditional classroom. First, online technologies provide alternative means for communication among students and faculty, either synchronously (e.g., web conferencing) or asynchronously (e.g., e-mail). Second, online platforms can promote access to higher education for students who cannot attend traditional institutions. Third, Bowen et al.'s (2012) cost simulations of an introductory statistics course suggested compensation cost-savings of 36 to 57 percent when using a hybrid course relative to face-to-face instruction. However, additional research is needed to confirm cost-savings estimates.

Means et al. (2010) conducted a meta-analysis of 45 studies on the relative effectiveness of online instruction, face-to-face instruction, and blended instruction (online and face-to-face). The results indicated that some online pedagogies were more effective than others. Students made learning gains when exposed to collaborative instruction (ES= .25; 10 percentile points) and expository instruction (ES= .39; 15 percentile points) but not with independent learning (i.e., student determines course content). A comparison of face-to-face instruction with other formats revealed that students in blended courses made greater learning gains than students in traditional classrooms (ES= .35; 14 percentile points), but no differences in academic achievement were observed between students in purely online courses and those in face-to-face courses. An analysis of moderators indicated that the effect sizes did not vary across studies that tested declarative or procedural knowledge (though differences may arise with other types of student outcomes). Means et al. concluded that much of the advantage of an online learning component appears to be due to differences in time on task, curricular content, and pedagogy (e.g., use of collaborative learning) rather than the medium itself. After controlling for differences in curriculum and instruction, the effect size shrank to .13, or 5 percentile points.

While past research has not revealed consistent differences in learning outcomes between students enrolled in purely online and traditional courses (Means et al., 2010), recent research has indicated that online students may be at greater risk of course withdrawal (Atchley, Wingenbach, & Akers, 2013; Carr, 2000; Xu & Jaggars, 2011; Xu & Jaggars, 2013). According to Carr (2000), a large community college in Texas had an online course completion rate of 58 percent, compared to a traditional course completion rate of 71 percent. Carr (2000) also reported that the University of Central Florida's online course withdrawal rate was 9 percent, compared to a 5 percent withdrawal rate for its face-to-face courses. Similarly, Atchley, Wingenbach, and Akers (2013) examined data at a public comprehensive university and found that students enrolled in online courses had a lower course completion rate (93 percent) than did students in traditional courses (96 percent).

Differences in course completion rates between traditional and online students cannot be readily attributed to such factors as student background, academic preparation, enrollment intensity, or course subject area (Xu & Jaggars, 2011; Xu & Jaggars, 2013). Xu and Jaggars (2013) examined the effect of course delivery on course completion among 18,000 students at 34 two-year colleges in Washington. After controlling for self-selection bias, they found that enrolling in an online course negatively predicted persistence and course grades. Specifically, online enrollment relative to face-to-face course enrollment was associated with a seven percentage point decrease in the likelihood of course completion.

Given an increased risk of withdrawal, several strategies have been identified to improve student persistence in online courses, such as administering an online-learning skills assessment prior to course enrollment; providing an orientation program for skill development; using collaborative learning to increase social integration; and ensuring that students and faculty have access to course support services (Lee & Choi, 2011). Additional research is needed to test the relative efficacy of these programmatic components.

Summary

Past research has demonstrated that pedagogy can play a significant role in influencing levels of academic achievement. Cooperative learning, problem-based learning, and service-learning appear to be far superior to traditional methods in promoting academic achievement. Such "pedagogies of engagement" do not treat students as passive learners but rather encourage students to actively construct knowledge through explanation, application, and reflection. Cooperative learning carries the additional benefit of promoting social integration. The provision of individualized instruction for attaining proficiency, or mastery learning, also yielded larger gains in academic achievement than did the traditional methods, which typically assume that all students have equal academic aptitude and similar learning styles. Finally, computer-based instruction and hybrid learning formats, properly utilized, yield larger gains in declarative and procedural knowledge than do traditional methods, though the size of the effects was small to moderate.

Recommended Practices

- Minimize the use of lecturing.
- Incorporate cooperative learning, problem-based learning, and service-learning throughout the curriculum to enhance academic engagement and achievement.
- Adopt mastery learning to promote the acquisition of knowledge and skills, particularly for students with low academic aptitude. The pace of instruction should be set by the instructor rather than the student.
- Promote the adoption of hybrid courses – the combination of online and face-to-face learning – to increase academic achievement and potentially reduce costs. The online component should be reserved for the transmission of knowledge and the facilitation of collaborative learning.
- Identify and implement methods to reduce withdrawal rates of students in purely online courses, such as administering an online-learning skills assessment prior to course enrollment; providing an orientation program for skill development; using collaborative learning to increase social integration; and ensuring that students and faculty have access to course support services.

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