Why We Must Change: The Research Evidence

By Lion F. Gardiner

EDITOR'S NOTE: If faculty subject the quality of their collective work as teachers to the same close examination demanded of work in their disciplines, Lion Gardiner noted in our spring 1998 issue, we will find ample proof of a crisis of educational quality in our nations colleges and universities. Here, at the very heart of what the profession is supposed to be essentially all about, we identify yet another ethical imperative for transformation.

Most faculty work long and hard. We care about educating our students. Thanks to our efforts, many of them experience deep personal transformation during their college years.

However, when we subject the quality of our collective work as educators to the same close examination we demand in our disciplines, we find a substantial body of evidence that clearly demonstrates a crisis of educational quality in our nation's colleges and universities.

This crisis should evoke a serious and determined response from the entire professoriate. But rather than a strong sense of urgency for change, we too often find complacency within our ranks. We seem to turn a blind eye to the quality of our educational processes and results. The busyness of daily routine and the seeming rightness of the familiar obscures the need to change.

Yet the task is urgent. We need to begin immediately to assess, evaluate, and improve the quality of our work.

Fortunately, this improvement is as possible as it is urgent. The professional research literature in higher education can easily provide us with valuable information we can use to understand more fully our effectiveness as educators—if we would only use it.

At the publication of this article, **Lion F. Gardiner** *was an associate professor of zoology at Rutgers University in Newark, New Jersey. His scholarly work had focused on the application of research on student learning and teaching to improving educational processes and student outcomes in colleges and universities. He was the author of three books on quality improvement in higher ed, among them* Redesigning Higher Education: Producing Dramatic Gains in Student Learning *(1996), a review and synthesis of research.*

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In this article, I hope to acquaint readers with important research that has been done over the past three decades on how students learn and what constitutes an effective educational experience.

Society expects college graduates to be able to think critically, solve complex problems, act in a principled manner, be dependable, read, write, and speak effectively, have respect for others, be able to adapt to change, and engage in lifelong learning.[1]

But the educational experience for many college students does not meet these expectations. The studies reviewed here, taken together, consistently show that the college experience for most students comprises a loosely organized, unfocused curriculum, with undefined outcomes, classes that emphasize passive listening, lectures that transmit low-level information, and assessments of learning that frequently demand only the recall of memorized material or low-level comprehension of concepts.

Relatively few students experience high-quality developmental academic advising that could reliably enable them to plan and navigate a complex and difficult collegiate experience.

Each of these deficiencies in educational quality reduces learning and retards development. Each of these practices wastes student and faculty time, as well as student, taxpayer, and donor money.[2]

We have three decades of research showing how our students develop a number of key abilities. For example, researchers have studied our students' capacity to reason using abstract symbols—the foundation for all other higher-order cognitive skills and the basis of most of what faculty want students to learn.

We also have research on student epistemologies. These are the arrays of assumptions they hold about the source of knowledge and value.

Finally, researchers have studied our students' capacity to act in a principled ethical manner.

These studies consistently demonstrate that most college students need a good deal more work in each of these areas.

Many studies suggest our students' ability to reason with abstractions is strikingly limited, that a majority are not yet "formal operational."[3]

These concrete or transitional students may have difficulty understanding the college-level lectures they hear.[4] They will also have difficulty engaging in metacognition—thinking about their own thinking—an essential skill for effective learning.[5]

We know that a strong relationship exists between students' formal

Most students hold epistemological assumptions that prevent them from engaging in critical thinking.

operational ability and their success in their courses.[6]

Critical thinking is a form of higher-order cognition that society requires and faculty esteem.[7] Many of us believe our society would function far more wisely, harmoniously, and safely in a complex, ever more rapidly changing, and dangerous world if leaders and citizens used critical thinking more consistently than they now do.

We urge our students to think critically and give them activities we believe will help them learn how. Yet, 30 years of research show us that most of our students hold epistemological assumptions that prevent them from understanding and, therefore, engaging in critical thinking.

Many of our students are epistemological Dualists: They view the world in rigid categories of black-white, right-wrong, and good-bad, and their knowledge is passively received from "Authorities."[8]

These students, and many others—the Multiplists—don't understand that knowledge is constructed by a very active, personal making of meaning. They don't understand the role played by evidence when they select from among competing hypotheses, opinions, and values. In other words, they do not understand critical thinking processes.

Another area of concern involves moral values. Some in academe suggest our students' moral development is the preeminent college outcome we ought to produce. The best studied of several aspects of moral development, moral judgment, is known to be linked to moral action.[9]

Our students should be able to reason about moral dilemmas using the most complex and abstract of six developmentally progressive moral philosophies.[10] Principled, ethical reasoning requires use of stages five and six. Most of our students are on levels three and four.

All three of these important dimensions of cognition—using abstract symbols, epistemology, and principled, ethical reasoning —as well as the ability to work cooperatively in teams with people different from oneself, require for their development that students be actively involved in learning.

It is unlikely that lectures alone can bring about the profound cognitive reorganizations required, produce the interpersonal skills that must be developed, and foster the substantial changes in disposition toward learning and human diversity required for these important changes to occur.[11]

Central to our capacity to promote these crucial personal changes is the degree to which our students are actively involved in their learning.[12] In fact, the relationship between active involvement and

Student satisfaction with their college experience was 'uniquely attributable to having a true-core curriculum.'

effective learning is so strong that "the effectiveness of any educational policy or practice is directly related to the capacity of that policy or practice to increase involvement in learning."[13]

Active involvement includes frequent student-faculty interaction, both in and outside of class. In a national study, this contact had "significant positive correlations with every academic attainment outcome studied and every self-reported area of intellectual and personal growth, as well as with a variety of personality and attitudinal outcomes and all self-rated abilities except physical health."[14]

Studies tell us that other essential characteristics of effective educational experiences include an environment that is both challenging and supportive, high expectations, clearly defined outcomes, and frequent assessment with timely feedback to students.[15]

What can research tell us about the degree to which we now systematically and consistently provide our students with the environment and experiences shown to be essential to their development of the key abilities?

Let's first look at the curriculum. A curriculum is intended to provide the conceptual framework for what a faculty expects its students to learn and should articulate the faculty's values and priorities.

Most students depend on curricular requirements for guidance. They have limited ability to plan their education by themselves, given their limited educational backgrounds and life experiences.

Over 90 percent of general education curricula in the United States are distributional—that is, students are permitted to select courses from lists of choices.[16]

How effectively does this approach to curriculum provide the close guidance most of our students require?

For tens of thousands of students in a large national study, specific curricular design had little effect on most of 22 general education outcomes examined. The types or breadth of courses, specific courses available, or relative flexibility to choose among courses had little impact on these outcomes.[17] On the other hand, a core curriculum had salutary effects on many developmental outcomes. And a number of dimensions of students' satisfaction with their college experience were, in large degree, "uniquely attributable to having a true-core curriculum."[18]

These curricula, where students took, in common, interdisciplinary general education courses, represented less than 2 percent of the hundreds of curricula in the study.

Research calls into question the ability of most advising, as currently practiced, to help students develop.

The researcher concluded that "How the students *approach* general education and how the faculty actually *deliver* the curriculum is far more important than the formal curriculum content and structure."[19]

Other research has also failed to support the value of distributional curricula for developing student abilities.[20] These investigators suggest that different students require specific groups of courses to profit maximally from their college experience, and they emphasize the importance of academic advising or providing less latitude in choice of courses.

Research calls into question the ability of most advising, as currently practiced, to help students develop (see below).

Designing curriculum without understanding student development can have widespread untoward results. "At far too many institutions, the distribution requirements of general education are unfocused. They encourage randomness, not coherence," one study has found.[21] "Student transcripts often reflect a sense of educational wandering, if not drift," notes one report.[22]

For our curricula to reliably produce learning at the high levels society requires, they will have to be based on planning that involves detailed knowledge of individual student needs and carefully defined outcomes. Curricula will need to be implemented through courses that consistently use research on student learning and development, and their results will have to be continuously monitored by valid assessment.

Courses, themselves, form our students' closest, most sustained connection with the institution and its educational efforts. Most students commute to campus, and many are not involved in cocurricular activities. But they all take courses.

What does research tell us about students' experiences in their courses? To what extent do these primary educational experiences help them develop the key abilities they and society require?

We should recognize that effective course design requires considerable knowledge of how students develop. We should also know that contemporary research-based educational practices provide us a wide variety of approaches to foster this development.

One national study has revealed that only 35 percent of faculty strongly emphasize their institution's curricular goals.[23] Only 12 percent utilize feedback from their earlier students, and 8 percent use the viewpoints of experts in instruction. The conclusion: "The faculty interviewed seemed to teach as they had been taught...."[24]

Between 70 and 90 percent of professors use the traditional lecture as their primary instructional strategy.

Faculty in another national study "overwhelmingly" said developing effective thinking was their primary educational purpose, but most of the 4,000 course goals they submitted related to teaching concepts in their disciplines, rather than developing the intellectual skills they said were so important.[25]

Many studies demonstrate that actively involving students in discussion fosters retention of information, application of knowledge to new situations, and development of higher-order thinking skills—and discussions do this much better than lectures do.[26] Do faculty actively involve their students in the classroom?

Recall that, because many students are not yet formal operational, they have difficulty learning abstractions from lectures. These students require active methods to grasp important concepts.

The superiority of actively involving students has been well established. Yet 70 to 90 percent of professors use the traditional lecture as their primary instructional strategy.[27]

In a study of 155 class sessions at four different institutions, questioning of students comprised 0.2 percent to 9.2 percent of class time.[28]

Institutional type and size, course level, and discipline had no significant impact on the percentage of time spent questioning students. Using data from these same classes, "Despite a ratio of 47 students to 1 professor, professors talked four times more frequently than students."[29]

Even when professors used questions, about one-third did not lead to any student participation.[30] The questions most frequently asked by 19 research university faculty members were about mechanical issues such as time and handouts, or were rhetorical.[31]

At a small liberal arts college with a reputation for using diverse teaching styles, student critical thinking skill was significantly and positively associated with high-level cognitive responses to questions in class.[32] "The amount of time spent listening is negatively related to change in critical thinking and positively related to memorizing."[33] But, in this study, students participated actively during only 14.2 percent of class time.

Clearly, in most cases, students aren't actively participating in class. But how do our classes fare using other measures of intellectual activity?

Studies using the Bloom Taxonomy[34] to assess cognitive level consistently find that, in most courses, transmission of facts from teacher to students and discussion that

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requires only the recall of facts are the dominant class activities, regardless of discipline, the number of weeks into the semester, or size of institution.[35]

In one study, 89.3 percent of questions asked by the faculty required only recall to answer, not comprehension of concepts. Again, this was regardless of institutional size or whether public or private.[36]

In only 0.3 percent to 2.5 percent of class time were students required to use the much more complex skill of evaluation.[37]

In another study, professors spent 2.6 percent of class time questioning students. Forty-nine percent of their questions required memory alone, 4 percent required students to evaluate.[38]

The level of student thinking was related to class size. The median cognitive level in classes of 15 or fewer students was analysis. In classes of 16 to 45 students the median was comprehension. In large classes of 46 to 300 students the median intellectual activity was recall.[39]

If students are not thinking during lectures, what *are* they doing? Their attention drifts after only 10 to 20 minutes.[40] They are listening, asking or responding to questions, or taking notes only half of the time. Up to 15 percent of their time is spent fantasizing.[41]

If the quality of students' learning is related to the quality of their own efforts, we should ask: How hard are they working?[42]

Much or most of students' learning must occur outside of formal class periods. How much effort outside of class do we require of our students?

Studies reveal far less work than most faculty believe is necessary:

- an average of one hour studying per hour spent in class.[43]
- twenty-three percent of students spending 16 or more hours per week.[44]
- a mean of six hours weekly.[45]
- fifty percent claiming 5 or fewer hours weekly; only 3.2 percent spending 20 or more hours.[46]
- thirty-three percent of respondents claiming six hours or more, continuing a four-year decline.[47]

When students do study, they are generally alone, isolated from the assistance their peers could provide. A large percentage tend to use "surface learning" methods that cannot produce deep comprehension of concepts or the capacity to apply them in problem-solving.[48]

Only 14 percent of 745 research university students said they had ever been formally taught how to study, in high school or in college.[49]

If our students do not understand the learning process—the chief engine of education—they

'After four years, these engineering students showed negligible improvement in problem-solving skills.'

aren't going to learn very much in our courses no matter what we do.

One of the most valuable actions we could take to improve learning—and thus the productivity of both our students and our institutions—would be to teach our students how to learn.

In the end, how much course content do students retain? Studies sometimes find rare high values where students retain 50 percent of the content, but values of 20 percent or less are common.[50]

For example, one study done directly following an introductory economics course found that the students had increased their knowledge of the course content by 18.7 percent compared to students who had never taken it.[51]

Although engineering students used memorized formulas successfully to solve physics problems, there were "widespread misconceptions" when they were required to provide "coherent verbal descriptions of abstract concepts" inherent in the problems.[52]

After watching their teachers work 1,000 problems in class and solving another 3,000 themselves outside class, "after four years, engineering students showed negligible improvement in problem-solving skills."[53]

The researcher suggests a reason for this failure to learn: Students were given a limited number of real problems requiring analysis and synthesis for their solution—only 20.6 percent of the 3,000. The rest of the problems were relatively low cognitive-level "exercises," requiring only straightforward application of concepts.

Additional studies suggest that significant percentages of the students who *major* in our disciplines—at the undergraduate *and graduate* levels—fail to comprehend some of the most fundamental concepts and principles in these fields.[54]

Forty-two percent of respondents to a Gallup survey of 696 college seniors could not correctly identify the Koran. The same number were unable to place the U.S. Civil War between 1850 and 1900. Thirty-one percent located Reconstruction after World War II.[55]

Fifty percent of 3,119 students at eight Ivy League institutions could not name the two U.S. senators from their own states. Twenty-three percent did not know there are nine justices on the U.S. Supreme Court, and 59 percent were unable to name four.[56]

The 1992 National Adult Literacy Survey of 26,000 native-born Americans discovered major deficiencies in two- and four-year college graduates' ability to work with text and numbers in straightforward, pre-college tasks such as understanding the meaning of

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newspaper articles, using bus timetables, and calculating prices of supermarket items.[57]

The researchers concluded that the graduates' "*levels* of literateness range from a lot less than impressive to mediocre to near alarming, depending on who is making the judgment."[58]

How is it our students learn as little and perform as poorly as the research suggests? What cognitive demands do our classroom assessments make on our students?

Only 17 percent of 1,700 faculty respondents at a research university said they use essay tests. These same respondents claimed only 13 percent of their questions required problem-solving.[59] This study suggests that most of the tests students were taking required only recall or comprehension-level cognition.

Of 3,500 student respondents in this survey, 82 percent agreed that "despite instructors' insistence that they do not teach facts, most grades are based on tests that are primarily factual in content."[60] At another research university, 87 percent of students agreed that tests primarily assessed recall of facts.

The tests of 19 faculty members at a third research university contained few problem-solving items.[60]

Further research found similar results at "two highly regarded very small liberal arts colleges,"[62] suggesting that institutional size may make little difference in the cognitive demands of assessments.

In many cases, our tests provide students with little intellectual challenge. Nor do they provide valid evidence of learning and development for students or their professors. These tests may also actively reinforce concrete thinking and dualistic epistemologies, and a surface approach to learning.

Researchers raise concerns about the validity and reliability of many teacher-made tests as instruments for mental measurement.[63]

Further challenging our tests' validity, numerous studies demonstrate widespread cheating among students on classroom tests, possibly involving 40 to almost 90 percent of all students.[64] Cheaters in one national study of 6,165 respondents constituted one-third of former students and more than half of current students.[65]

One-third of students with As and B+s cheated,[66] as did two-thirds of 6,000 students at "highly selective" colleges.[67]

Is it any wonder that our undergraduate grades have only a slight association with any measures of success in later life and are even a weak predictor of first-year graduate school *grades*?[68] In light of this accumulated research, what

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are our tests measuring, and what do our grades mean?

For many years, our students have been coming to us from increasingly diverse backgrounds. Many are the first in their families to attend college. They are often less than optimally prepared for higher education, coming with limited knowledge and skills and shaky academic self-esteem.

Once on campus, many of our students encounter a culture far different from any they have previously known. The campus climate can powerfully influence student learning. Finding an inviting, intellectually stimulating, ethically principled, and emotionally supportive environment can enhance students' academic achievement and their willingness to remain in college.[69] In one large study, lack of a sense of community had a stronger impact on students' satisfaction with college than many other variables.[70]

Numerous studies have revealed the difficult, even overtly hostile, climate many students encounter, especially women and students from minority groups.[71] Together, these two populations comprise over half the students on most campuses.

Overall, women experience a less stimulating and supportive environment than men, in and out of the classroom, often one that devalues and discourages them.[72] On primarily majority-group campuses, large percentages of ethnic minority students face overt racism and the threat of verbal and physical violence.[73]

The complexity of our curricula and the outcomes we attempt to produce, together with our students' diverse developmental needs, necessitate careful attention to each person's guidance. In addition, the confusion, fear, and alienation many students feel underscore the importance of our ensuring that each one develops a relationship with at least one member of the faculty, if we are to retain these students and enable them to achieve their full potential.

Today, academic advising is seen as developmental in purpose, concerned with and founded upon students' values and goals and designed to foster their development as whole persons.[74]

Academic advising can be the "hub" of a student's college experience, from which radiate courses, cocurricular activities, career development, personal counseling, employment, and other developmental experiences.[75] Developmental academic advising enables us to ensure each person has a human connection to the institution and feels welcome and wanted. It also enables us to identify and solve problems early. Advising may actually be "the most important kind of

teaching we do,"[76] besides serving as "the institution's quality control mechanism."[77]

High-quality academic advising can increase academic achievement and satisfaction with college, and reduce attrition.[78] But research reveals that to the extent to which students have any academic advising, most of them encounter not a developmental process but one primarily concerned with transmitting information about institutional rules and the clerical details of registration.[79]

The poor quality of academic advising they receive must surely have a powerful retardant effect on our students' development. Providing them with high-quality developmental academic advising throughout their college experience is a significant action we could take to enhance their learning and development.

For well over a decade we have been warned that if we do not put our academic house in order, others, who pay for our services, will step in to do so. They have begun to do this. We must act quickly. We owe this to our students, our sponsors, and ourselves.

We need to admit that our informed critics are often justified in their low appraisal of the educational experiences we provide for a majority of our students. We need to be willing to change, to use good professional practice, and to significantly raise our standards for our students and ourselves.

Today we have the knowledge and tools to actualize a vision of human development on a scale never before possible. A rich array of research has accumulated on student development, learning, teaching, and academic organizations.[80] There are practical, research-based methods that, together, constitute a new standard of good practice in our profession.[81]

If we systematically employ these powerful methods in our work as educators, we can for the first time help virtually all of our students develop to a very high level.[82] The salutary implications of these changes in the way we conduct our affairs for our own society and the world more widely are extraordinary.

Lion Gardiner welcomes comments, questions, and reactions to this article. He can be reached by E-mail: gardiner@andromeda.rutgers.edu.■

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AUTHOR'S POSTSCRIPT

The remarkable emergence, since this article was written, of large numbers of organizations using the Internet to provide learning opportunities constitutes new and potentially serious competition for colleges and universities.

The research reviewed above, together with the interactive multimedia technology and potential for intensive human interaction these Internet organizations can provide, calls into question the notion that the learning they produce will necessarily be inferior to that of traditional institutions.

Indeed, organizations that systematically use research-based best practice at every point in managing learning hold promise to produce learning far superior to

that of many long-established colleges and universities, most of which do not typically use research to inform their educational work. These cyber-based organizations bid fair to put more than a few traditional institutions out of business. If human development is the urgent mission, should this be a cause for mourning?

The more advanced K-12 reform movement has learned that professional staff development is central to organizational transformation and success. A recent response to this need in academe has been the establishment of the National Academy for Academic Leadership: *www.TheNationalAcademy.org*, an enterprise that provides high-quality, professional development services for administrative and faculty decision makers.

As associations of professionals committed to learning, academic staff unions like NEA have great potential for leading the changes in learning that lie ahead for higher education. We need to shape our future while we can, rather than permit regulation or market discipline to shape that future for us, and actualize a grand vision of learning and personal and societal transformation.

Endnotes

[1] Bowen, 1977. Chapter 2 discusses the goals of higher education and includes an extensive Catalog of Goals synthesizing institutional goals discovered in the literature. Candy and Crebert, 1991; Carnevale, Gainer, and Meltzer, 1990; "Challenge," 1995; Marshall, 1989; Van Horn, 1995; Wingspread Group, 1993.

[2] Cornesky et al., 1991; Seymour, 1993.

[3] Dunlop and Fazio, 1976; Hardy-Brown, 1981; Kolodiy, 1975; Kuhn et al., 1977; McKinnon and Renner, 1971; Robbins, 1981; Tomlinson-Keasey, 1978.

[4] Robbins, 1981.

[5] Entwistle and Ramsden, 1983; McKeachie, 1994.

[6] Hardy-Brown, 1981; Hudak and Anderson, 1990.

[7] Kurfiss, 1988; Paul, 1995.

[8] Baxter Magolda, 1992; Belenky et al., 1986; King and Kitchener, 1994; Perry, 1970, 1981.

[9] Rest, 1994.

[10] Colby and Kohlberg, 1987; Gilligan, 1982; Nucci and Pascarella, 1987; Rest, 1979, 1986; Rest and Narváez, 1994.

[11] Karplus, 1977; Pascarella and Terenzini, 1991.

[12] Astin, 1993; Pascarella and Terenzini, 1991; Study Group, 1984.

[13] Study Group, 1984, 19.

[14] Astin, 1993, 383, Astin's emphasis. Based on a major national study. See Note 80.

[15] Locke and Latham, 1990; Perry, 1970, 1981; Sanford, 1966; Study Group, 1984.

[16] Astin, 1993; Hutchings, Marchese, and Wright, 1991.

[17] Astin, 1993.

[18] Ibid., 332.

[19] Ibid., 425, Astin's emphases.

[20] Jones and Ratcliff, 1990.

[21] Boyer, 1990, 14.

[22] "Learning Slope," 1991, 3A.

[23] Stark et al., 1988.

[24] Ibid., 227.

[25] Stark et al., 1990.

[26] Davis and Alexander, 1977; McKeachie, 1994.

[27] Blackburn et al., 1980.

[28] Barnes, 1983 (omitting the single lowest and highest percentages of 0.03 and 20.8).

[29] Fisher and Grant, 1993, 56.

[30] Barnes, 1983.

[31] Lewis, 1984.

[32] Smith, 1983.

[33] Ibid., 100.

[34] Bloom, 1956. The Taxonomy of Education Objectives or Bloom Taxonomy, as it is commonly known, is the standard tool used by teachers for determining the intellectual demand on

students of questions, assignments, and assessments. The Taxonomy is also used in research on curriculum and instruction. The six levels of cognitive demand in the Taxonomy are recall (requiring only memorized material), comprehension, application, and three problem-solving processes: analysis, synthesis, and evaluation. Cognitive demand is thought to increase from recall up to the problem-solving levels.

[35] Fischer and Grant, 1983.

[36] Barnes, 1983.

[37] Fischer and Grant, 1983.

[38] Smith, 1983.

[39] Fischer and Grant, 1983.

[40] Bonwell and Eison, 1991; Davis and Alexander, 1977.

[41] Milton, Pollio, and Eison, 1986.

[42] Pace, 1984, 1990.

[43] Brittingham, 1988.

[44] Boyer, 1990.

[45] Hutchings, Marchese, and Wright, 1991.

[46] "Hours," 1987.

[47] Cage, 1994.

[48] Entwistle and Ramsden, 1983.

[49] Gardiner, 1996.

[50] Brethower, 1997; Gustav, 1969; McLeish, 1968.

[51] Saunders, 1980.

[52] Clement, 1981, 161.

[53] Woods, 1987, 59.

[54] Fuerst, 1984; Zimmerman, 1986, 1987.

[55] Heller, 1989.

[56] "Big Gaps," 1993; "New Poll," 1993.

[57] Barton and Lapointe, 1995.

[58] Ibid., 2, emphasis in the original.

[59] Milton, 1982.

[60] Ibid., 45.

[61] Lewis, 1984.

[62] Milton, 1982, 46.

[63] Milton, 1982.

[64] Boyer, 1990.

[64] Milton, Pollio, and Eison, 1986.

[66] Ibid.

[67] McCabe, 1992.

[68] Baird, 1985; Cohen, 1984; Warren, 1971.

[69] Ender, Winston, and Miller, 1984; Metzner, 1989; Pascarelli and Terenzini, 1991; Tinto, 1997.

[70] Astin, 1993.

[71] Astin, 1977, 1993; Boyer, 1990; Hall and Sandler, 1982; Sandler, 1986; Hughes and Sandler, 1987.

[72] Astin, 1993; Boyer, 1990; Hall and Sandler, 1982, 1984; Hughes and Sandler, 1987; Sandler, 1986.

[73] Arnold, 1993; Bernstein, 1990; Boyer, 1990; Ehrlich, 1988; Pascarella and Terenzini, 1991; Smith, 1989.

[74] Winston, Ender, and Miller, 1982.

[75] Ender, Winston, and Miller, 1982.

[76] Chickering, 1969, 252.

[77] Winston, Grites, et al., 1984, 539.

[78] Metzner, 1989.

[79] Habley and Crockett, 1988.

[80] Astin, 1993. This study employed a sample of almost 25,000 students, thousands of faculty, and 309 institutions, and 146 input, 192 environmental process, and 82 outcome variables. The sample sizes, theoretical robustness, and power of the research design of this study have permitted Astin to illuminate many important ways in which colleges affect students.

[81] Gardiner, 1996. This book reviews and synthesizes hundreds of studies on student development, learning, teaching, and academic organizations. It makes a strong, research-based case for the urgency of change in higher education and provides easy access to high-quality resources to help faculty members, administrators, trustees, and others reflect on their institutions and lead change.

Pascarella and Terenzini, 1991. The authors review and synthesize 2,600 studies of college effects on students conducted since 1968 and provide recommendations concerning the significance of their findings for educating students in colleges and universities.

[82] Gardiner, 1996. A chapter "Can Today's Students Learn? Achieving Success with High Standards for All" reviews evidence that virtually all college students can learn at a high level.

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