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ABSTRACT

This study sought to locate excellent readers and excellent reading courses among majors and courses chosen by college freshmen at three postsecondary institutions: a private, residential, suburban, four-year liberal arts college with religious affiliation; a two-year public (commuter) community college outside the same metropolitan area; and an urban, public, Research I university with a primarily commuter undergraduate student body. Courses and majors were clustered, and data collected on 251 college freshmen from the private college in 1988 and from 392 freshmen from the two public institutions in the fall of 1991 (and from 245 of these students for a spring follow-up testing). reported in terms of which college majors comprised better readers, the types of freshmen courses that are taken by better readers, which freshmen courses were associated with the greatest reading gain, and the effect of college developmental courses. Three major trends were identified: (1) the best readers were generally enrolled in non-applied scientific majors and courses; (2) some humanities courses without obvious English prose content (i.e., music and foreign languages) were associated with improved reading skills; and (3) no positive association was found between reading progress and developmental courses. Contains 21 references. (GLR)

College Courses which Attract and Generate Good Readers*

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Abstract

This study seeks to locate excellent readers and excellent reading courses among majors and courses chosen by college freshmen at three postsecondary institutions. Majors and courses which attract the best college readers are found more frequently in natural sciences fields. Literature and composition courses work well to increase reading achievement, but some science, foreign language, and music courses are also associated with reading gain. College developmental courses showed a poor connection with reading gain. The identification of majors and courses associated with reading and reading gain has utility for college reading instruction, research and tutoring.

Research on college reading is typically done exclusively in college reading classrooms, and not among the general fare of freshman classes (Bliesmer, 1973; Geerlofs & Kling, 1968 ; Kerstiens, 1971; Kulik, Kulik, & Schwalb, 1983 Morante, 1986; Robinson, 1950; Sanders, 1980; Thompson, 78; Tillman, 72-73) . Such research looks almost entirely at readers who have been designated "underprepared," and not at readers of all levels of ability. This type of investigative limitation precludes a number of important views: 1) an understanding of the full effects of the college environment, 2) the possibly illuminating effects of types of good reading instruction and learning outside college reading classrooms, and 3) the study of excellent, or "model" readers. College reading research considers effects within college reading programs. Researchers in the field of higher education have long stressed the importance of the consideration of potentially confounding factors outside college course environments (e.g. student background, full college environment) in the understanding of learning in college (Astin, 1970; Astin, 1977; Pascarella, 1985; Pascarella and Terenzini, 1991)

Some argue that college reading research should be reserved only for underprepared students -- that it is only these unique students who should be considered in relation to the problem of reading gain in college. Yet there is much question regarding the quality of college reading assessments used to separate "underprepared" students for reading classrooms at the outset. It may be that populations in college reading classrooms are not truly unique. We may think we have included in our developmental program a special group of students whose literacy needs are like no others, while we may have in fact gathered some very well prepared students and have failed to include others who are not prepared at all (Davis, Daiser, Boone, & McGuire, 1990; Wood, 1989; Morante, 1989).

Further, the now rare description of a "model" college reader and of a "model" environment for reading gain is an invaluable tool for the college reading instructors and advocates. If we can locate college classes which promote reading gain, even if they're outside developmental programs, we can study the instructional and content methodology of these courses. Developmental educators often seek students who read extremely well -- in order to observe reader "protocol," to find good tutors, or discover what model student readers have done to acquire their useful skills (Johnson, 1978).

Another predispostion in developmental fields is an association with the liberal arts as a sort of "parent" field. To a great degree developmental programs are associated with college English and communications departments. Those who teach developmental reading are associated with English, language arts, composition or the humanities. These content areas may be part of instructors' training, past, or even present teaching load. Due to this association, instructors share orientations with those in the English fields. Often, developmental course instruction and content are designed with an English or composition course method in mind. When educators are found to run a developmental lab, they're chosen from among those with backgrounds in English and humanities courses. When tutors are found to staff a developmental lab, they're chosen from among the advanced and successful students in English and humanities courses.

Do those in the English related fields and language arts have a "corner" on the understanding of reading and of reading instruction? Is it possible that those outside "arts and letters" have the skills and pedagogic know how to help college students read well? The observation of excellent reading and excellent reading

instruction in the natural setting of the entire college – among all students and all classes – affords a pure, wider, and more realistic appraisal of the ways in which real college freshmen get to be better readers in real college environments.

What can be learned about college readers by stepping outside college reading programs, and by stepping outside the liberal arts? The purpose of this inquiry is to observe the wide range of college freshman as they travel through their first year of school, to first find the great readers and then find the courses which do a great job in increasing reading ability. To better understand the freshmen in their relation to reading, four questions are posed and explored:

1) Which college majors are likely to be comprised of better readers?
2) Which types of freshman courses are taken by better readers?
3) Which freshmen courses are best associated with reading gain, when initial ability is taken into account?
4) What is the association between college developmental courses and success, when initial ability is taken into account?

Groupings of Courses and Majors

Rather than present only laborious lists of individual majors and individual courses in their association with reading, the majors and courses can be grouped together to approach the four questions above. A look at relationships within specific areas as well as in groups of areas may better identify dominant or bold trends which may remain hidden in single major or single course scenarios. For a given freshman sample, for example, where we might examine fifty-two majors at a four-year institution in order to see in which fields better readers study, a clearer image of association could be determined by reducing the fifty-two groups into ten, or even four groups of majors which are alike.

Any grouping of courses for this type of investigation should be a parsimonious and topic-sensitive classification which reflects basic differences among directions taken by freshmen. One such classification is Biglan's (1973) inclusive and systematic division of disciplinary fields, validated and employed over the last two decades. This division of disciplinary fields has consistently located the lines of separation among fields of college study for a variety of purposes.

For the present study, courses are grouped in both large and medium-sized groups. The first and most broad categorization of courses is a Biglan (1973) classification of subjects using subject dimensions of hard to soft paradigms, and pure to applied orientation. Fields are sorted according to the degree of conformity in disciplinary paradigm, and to the degree of commitment for practical application. See Figure 1 for an illustration of the Biglan classification system. The physical sciences, mathematics, and computer science, for example, all employ consistent disciplinary paradigms, where other fields (such as literature, history, psychology, or linguistics) may use many or less defined paradigms. Pharmacology and engineering are fields where practical application is central, while philosophy and the humanities do not emphasize application as much. Because each field has a "soft/hard" designation, and a "pure/applied" designation, all undergraduate fields of study fall into one of the following four categories: Hard Applied Courses, Hard Pure Courses, Soft Applied Courses, and Soft Pure Courses. This categorization creates four distinct, salient groups of forty-seven (see Appendix A) undergraduate courses possibilities.

The medium-sized grouping are topic subcategories of these four Biglan-paradigm groups. Hard Applied Courses include three general subject matter areas: science, math, and computer study. The Hard Pure Courses contain only math and science. Since the remedial math courses are believed to be of a nature separate from the college and advanced and courses, they are considered separately. Therefore, three hard pure topic subcategories are considered: pure science courses, pure math courses, and remedial math. Soft Applied Courses include two topic subcategories: social science and the humanities. The Soft Pure Courses also contain the social sciences and the humanities; however, since again the remedial courses are different from college courses, remedial humanities are also considered separately. The soft pure topic subcategories are therefore: pure humanities, pure social sciences, and remedial reading/study skills courses. See Figure 2 for a complete overview of the grouping structure at each of the levels.

Sample and Instruments

Freshman from three very different institutions are observed in this investigation: 1) a private, residential, suburban, four-year liberal arts college with religious affiliation, 2) a two-year, public (commuter) community college outside the same metropolitan area, and 3) an urban, public, Research 1 university with a primarily commuter undergraduate student body. Institutional record provided data from the private liberal arts college. The two public postsecondary institutions were part of a national, longitudinal study created for the study of college student learning; these latter, more detailed observations were made possible by the National Center on Postsecondary Teaching, Learning and Assessment (NCTLA), which is funded by Grant: R117G10037 from the U.S. Department of Education.

At the private four-year school, college application records of student intended majors, initial placement Nelson-Denny Reading Form D Scores, enrollment patterns in developmental courses, and end-of first-year grade point averages for all 251 entering freshmen in 1988 were collected. Students chose from 52 possible majors offered at the college. The Nelson-Denny Reading Assessment is the most frequently used placement test for college placement in college across the United States (Boylan, 1983; Geerlofs & Kling, 1968; Wood, 1989; Fairbanks, 1974). It is a multiple choice exam which evaluates comprehension, vocabulary and reading rate. Nelson-Denny test makers recommend this assessment in a number of ways: as a screen for the placement of both advanced and developmental readers, as a diagnostic tool, and as a valid measure of future college success (Nelson-Denny Reading Test, 1981).

At the two- and four-year public institutions and through the NCTLA longitudinal panel study, student intended majors, college course taking patterns, and 1991 freshman pre- and posttests of reading achievement were obtained. Students were recruited to the NCTLA study by mail, and from the population of students attending precollege orientation. They were informed that they would be participating in a longitudinal study and that they would receive a generous stipend for their participation. The total population from which the sample was drawn were all freshman students at the four-year and two-year public institutions who were enrolled for 6 or more credit hours during their first semester of college. 322 students from the four-year institution and 70 students from the two-year college provided fall scores for the study. 210 students from the four-year institution and 35 students from the two-year college returned for the spring follow-up testing for the study.

Data collection was conducted at the public institutional sites in the fall of 1991. The data collection lasted approximately four hours and students were paid a stipend of $35. The data collected included a precollege survey, that gathered information on student demographic characteristics and background data, and Form 88B of the Collegiate Assessment of Academic Proficiency (CAAP). The CAAP was developed by the American College Testing Program to assess selected general education skills typically obtained by students in the first two years of college, whether in a two-year or a four-year institution (ACT, 1990). The CAAP reading comprehension test is a 40 minute, multiple choice test which includes 36 items that assess the reading comprehension skills of referring, reasoning, and generalizing. The test consists of four prose passages of about 900 words in length that are representative of the level and kinds of writing commonly encountered in college curricula. The passages were drawn from topics in fiction, the humanities, the social sciences, and the natural sciences. The average KR-20 internal consistency reliabilities for the reading comprehension test range between .84 and .86. The answer form for the CAAP modules asks students to indicate their choice, among 22 descriptions, of college major.

A follow-up testing of the sample took place in the spring of 1992. This data collection included Form 88A of the CAAP reading comprehension module. Students were paid a second $35 stipend for their participation in the follow-up testing. The National Center for Postsecondary Teaching, Learning, & Assessment Follow-up Survey was also completed during follow-up testing. In it, students were asked to indicate by circling a number from zero to five how many of each kind of college courses had been taken. Forty-seven course possibilities were presented within the survey, such that students indicated the number of courses he or she had taken. Exact courses and survey questions are reproduced in Appendix A.

Analysis

First, two questions were generated to help locate the best readers among college freshman samples. The first question, "Which "intended major" group is comprised of better readers?" can be approached by ranking the first order correlations between intended major group and initial reading assessments, or ranking the mean reading scores of students of each major -- in the case of the private institution, the Nelson-Denny placement test, and for the two public schools, the CAAP reading module given during the fall of freshman year. The nature of the relationship between reading ability and choice of major among freshmen was investigated at each of the three different schools. For the private institution, N=251, for the public 4-year institution, N=322, for the public two-year institution, N=70.

The second question, "Which types of courses are comprised of the better readers?" is approached by ranking the first order correlations between course groups and initial reading assessments, or by ranking the mean reading scores of students in each course type. This question was applied to data for each of the two public institutions, where data on actual courses taken could be explored. For the public 4-year institution, N=210, for the public two-year institution, N=35.

The third and fourth questions were generated in order to facilitate the location of the courses and course groups best associated with reading gain. For the question, " Which freshmen courses are best associated with reading gain, when initial ability is taken into account?," multiple linear regression is utilized in the estimation of course group effects on reading improvement. The uniformity of

information and sample size (N= 210) at the four-year public institution presents an appropriate situation for the support of this level of analysis. The end-of-freshman-year CAAP reading test is regressed on groups of courses and individual courses. To correct for learning effects which may be a result of student precollege ability in each of the three areas, the fall pretest scores are entered first, or used as covariates. In this way, differential learning resulting from different initial abilities rather than from, for example, the general college experience, will not confound effects associated with courses taken. A course group or individual course was entered *after* the covariate in order to determine this impact. Multiple regression is used in order to both evaluate and compare the contributions of various course types to the freshmen year increase in skills.

The final question, "What is the effect of college learning and reading courses on reading and other gains?" is also approached through multiple linear regression. For the four-year public institution, the end-of-freshman-year CAAP reading posttest is regressed on groups of courses, individual courses and developmental courses. For the private institution, the end-of-freshman-year grade point average is regressed on groups of majors and on the number of developmental courses taken. For the private institution, N=251, for the public 4-year institution, N=210.

Results

1) Which college majors are likely to be comprised of better readers?

Table 1 presents majors at each of the three schools ranked according to the reading achievement of the students within that major. It's important to note that not all majors available at a given institution are selected by students in a given year (in this case, either 1988 or 1991), and that, in the case of the public institutions, a smaller portion of the freshman class is represented in the sample, such that some available majors may have gone unrepresented. In addition, though some majors have been chosen by as many as sixty students, some have been chosen by only one student. Small N sizes in some majors leave some hierarchical positions open to question. Though many correlations used to formulate the hierarchy are stable, the calculation of means or correlations will not be stable for each major in this situation.

Yet what is interesting, despite sample sizes among the majors in the hierarchy, is that patterns emerge when schools are compared. Great readers turn up in similar places at these disparate institutions. While it would be inappropriate to draw out distinctions between institutional types, given these limited samples, the similarities among major fields ranked with respect to reading achievement are quite striking. In this sense, what may be viewed only as a possible relationship at one school is strengthened by the replication of effect at the other schools.

For example, though majors which are part of a "letters," or humanities fields are close to the top of each hierarchy (e.g. philosophy, letters, communications, fine and applied arts), majors in the natural sciences also have very high ranks (e.g. biochemistry, physics, biology, engineering, physical science, health professions). Business and computers majors seem lower, as does reading achievement, generally for students in other social sciences.

Table 1 also presents hierarchies of reading achievement among student majors after majors have been grouped into Biglan categories. After the grouping of

majors, N sizes are larger and the nature of each Biglan major groupings at a given college is more likely to resemble that same Biglan group at another institution. The hierarchical patterns are clearer and more similar when majors are grouped. At both four-year institutions, *students in Hard Pure Majors are the best readers.* The community college sample contains no students with Hard Pure majors. At two of the three schools, Soft Pure Majors (which include English and the Humanities) are comprised of readers who rank only second in ability. In addition, at all of the three schools, the lowest reading scores are found among students in Soft Applied majors.

2) Which types of freshman courses are taken by better readers?

Which actual courses are taken by skilled readers? Relationships between reading ability and courses taken are explored at both public institutions. Table 2 presents the "top ten" courses for good readers at each of the public institutions. As might be expected, some literature and letters courses have high ranks, for example English literature, philosophy, linguistics, and humanities courses. Yet other courses are equally well situated. Chemistry, natural science, engineering, biology, and microbiology courses, for example, are associated with expert reader enrollment. Courses taken by readers with the least reading skill fit the expectations and knowledge of developmental and less "academic" course taking patterns.

After courses are grouped, the hierarchical pattern evidenced in the first analysis the re-emerges. Not only are hard pure courses comprised, as a whole, of the better readers at each of three institutions, but the same hierarchy found among majors at each school is found among courses at each school: on the whole, the best readers are not in the liberal arts, they're in the sciences. Hard pure courses contain readers whose average score is higher than soft pure courses. Again, readers' achievement in the hard applied fields is somewhat weaker than in hard pure fields, and readers in the soft applied fields have the lowest scores.

3) Which freshmen courses are best associated with reading gain, when initial ability is taken into account?

Table 3 summarizes the effects of college courses on reading achievement for 210 students at the four-year public institution. None of the larger four Biglan-paradigm categories were found to contribute significantly to an increase in freshman reading scores, suggesting that these groupings are too coarse and mask more subtle effects on reading skills. However, within the second tier, both the applied sciences and the pure humanities have a significant contribution. In addition, courses which have been created specifically to increase reading skills -- remedial academic and literacy skills courses -- do not have a significant effect. Because both the pure humanities and applied sciences have been shown to contribute significantly in reading, further analysis was executed in these areas. Table 4 reports contributions of applied science courses. Courses taken by students in this sample in applied sciences included nursing, pharmacy, drafting, and engineering. Of these courses, the engineering courses seem to have had the effect produced in this "layer". This effect is marginal, however, and individual course contributors remain somewhat unclear.

Table 5 presents further breakdown of the effects of courses in pure humanities areas. Courses in such areas as dance, religious studies, music

performance and foreign language are too disparate in topic to be considered in one grouping. These courses are probably quite varied in content, instructional presentation, and in the types of learning performed by students. Pure English courses were separated from liberal arts courses which also require reading and writing. Music, art, performing arts, and foreign language courses were also separated into groups to examine effects. True to the view, in developmental education, that reading achievement is a problem best approached by students of English, the effects of both English literature and composition courses is the strongest. Surprisingly, foreign language courses also contribute significantly to the learning of the reading of the English language. Even more surprising is the significant contribution of courses in music.

In summary, no effects were documented for reading when Biglan-paradigm course groups were examined for effect. At the second tier, both applied science courses and pure humanities courses contribute to reading gain. At the next level, English, foreign language and music studies show a relationship to reading gain. At the level of individual courses, literature, composition, and engineering courses also appear to contribute.

4) What is the association between college developmental courses and success, when initial ability is taken into account?

The lack of evidence for support offered by developmental courses at the public 4-year institution is disturbing. The implication is that while courses which were not created to increase reading skills are successful in doing so, those created to increase reading do not do so. Because this appraisal is non-significant, we cannot discount a hypothesis that developmental reading courses taken by this sample have no positive effect. Yet given that a control for ability is in place, one might hope that positive effect on reading would be evidenced, rather than a standardized weight of -.0148 for study skills, or a standardized weight of -.0622 for remedial math in developmental courses.

In order to explore the further the relationship between developmental courses and college progress, end-of-freshman-year grade point average is regressed on student major groups and on the number of developmental courses taken by 251 students at the private institution. The analysis of developmental course effects is meant to mirror, inasmuch as is possible, the design implemented at the public 4-year institution. Where at the public institutions, the end-of-freshman-year CAAP reading posttest was regressed on groups of courses, for the private institution, the end-of-freshman-year grade point average is regressed on groups of majors and on the number of developmental courses taken. Grade point averages are reported for 251 students at the private school.

Results are reported in Table 6. Unfortunately, the negative effect trend is reproduced here, and we might therefore question the hypothesis that developmental courses taken by this sample have no effect. Unlike effects at the public institution, effects on GPA at the private college are significant. As we might suspect, this particular assessment does not account as much of the variance in freshman performance as does the CAAP pretest, used at the public institution. Both are entered as a control for ability and entered before the various majors of the freshman year. The same hierarchy of effects from majors appears in this analysis, and the same disappointing *negative* contribution from developmental coursework does, too.

The use choice of major to indicate course taking patterns is a proxy arrangement, as is the use of the GPA measure as indicative of learning. Discrepancies between learning and grades are well documented (Pascarella and Terenzini, 1991) In fact, were this result not reproduced in recent literature, it would remain uninteresting due to the weaknesses in these measures. Astin's (1993) recent summary of an exhaustive multi-institutional estimation of effects for college students on learning (among many other outcomes) strangely reports this identical effect. The measures of reading gain in this study are more precise than the grade-point-average measure, though probably less convincing than the CAAP pre and posttest, which has been constructed to measure reading and differs only in form from pre to post use. Astin has used verbal portions of initial ACT scores as a measure of initial ability, and various senior year standardized measures as outcomes: the Graduate Record Exam's verbal and composite scores; the National Teacher Examination's general knowledge, communication skills, and professional knowledge subscores.

Astin reports that, among contributors to GRE verbal scores, "Involvement measures showing negative associations include ... receiving tutoring in courses. This last variable may well be the result, rather than the cause, of poor verbal skills." For the GRE composite scores, he reports, " Negative correlations involve...receiving tutoring...." For the National Teacher Examination's General Knowledge, Communication Skills, and Professional Knowledge subscores, he reports, "Two other involvement variables show negative associations with all three NTE tests, after the effects of entering student and environmental variables are controlled: taking remedial or developmental courses, and receiving tutoring in courses. Both these involvement measures may be the result of poor performance, rather than the cause of it." The three clues (from the public and private institutions, and then from Astin's work), increasingly valuable in credibility, began to form an unpleasant image developmental educator may need to consider.

Discussion

Three unsettling trends have surfaced through this inquiry. First, our best readers don't always appear in fields traditionally associated with excellent reading and with the study of reading. In these samples the overall trend is for the great readers to appear in the non-applied scientific majors and courses. Not only do the best readers appear in non-applied scientific fields, but a hierarchy of ability was replicated among samples for the applied, pure, hard and soft Biglan groups. Second, for this sample, some humanities courses which don't necessarily incorporate the reception of English written prose, for example the study of music and of a foreign language, as well as some courses which are scientific in nature, act as a strong and clear support system for the advancement of reading skills. The third trend is that while reading and reading gain are associated in some way with certain courses mentioned above, no positive pattern of association between reading progress and the developmental courses appeared.

What follows is consideration of the explanations for the preceding results, including design error and limitations, and consideration of the implications of these results for developmental educators.

Finding great readers

With respect to the first trend, why would it be true that great readers appear more in the non-applied scientific fields? If it is indeed the case higher reading scorers accumulate in hard pure fields, perhaps the scores tell more about general ability than about reading ability alone. Possibly students who do well on all tests, or are simply of higher general academic ability, are encouraged to pursue what some consider to be more the prestigious scientific fields. It would then be the case that students study science due to reading or academic ability and not the case that students have a higher reading ability due to the study of science. At the private institution, however, the highest scores on the writing placement exam were not associated with students in hard pure fields at all, but rather with the students in soft pure majors, a group which never contained the best readers. Students in the hard pure majors didn't have higher ability as writers -- those in the soft pure fields did. Overall ability was therefore not the decisive condition of students in the hard pure fields.

Alternately, an argument could be made about the nature of the CAAP and Nelson-Denny reading measures. Both are multiple choice exams, similar to those often employed in hard pure classrooms. By using these multiple choice measures we may only be showing that those who have more practice in taking hard-pure type exams will perform better on hard-pure type exams.

Yet it could be that a long history of conventions for true comprehension which are encouraged and taught by those in the hard pure fields are superior. Perhaps English departments don't "own the deed" to reading gain after all. Perhaps the pure science courses or those in the applied sciences act as a support system for the advancement of reading skills in a way we have not yet imagined in developmental classrooms. If natural scientists, however, are naturally better -- that is the skill is part of the package that comes with pure science proclivity, as music and math ability seem to also come together, or as art and imagination -- the knowledge that better readers are in pure science fields is still useful. How can we use the information that great readers appear more in some scientific fields? The possibility that our better readers are in hard pure fields opens a window of opportunity to developmental educators. We may find a way to more easily locate models, tutors, and examples of the comprehension process.

Producing great readers

Why would it be true that the study of the applied sciences, of writing, of music, and of a foreign language act as a strong and clear support system for the advancement of reading skills? That writing contributes to reading is an important finding, though not particularly surprising; one must read in order to write. As for the courses which seem completely unrelated to reading, three hypothetical explanations are offered. First, these courses may involve an academic rigor which brings about extensive literacy involvement and practice. Second, these may be courses that are merely taken along with other courses which are not a surprise in their literacy associations. It has been suggested that course effects be better studied in clusters, such that course "constellation" effects are detected (Ratcliff & Associates, 1988). English literature and composition are part of a common liberal arts major curriculum which might predictably also include music and foreign language study.

A third proposition is that music and foreign language study require learners to face unfamiliar elements in symbolic systems in order to receive a message. For a reader of English to become successful he must pass by occasions where he is faced with unfamiliar elements and continues on toward making these elements familiar. We know students in developmental classes who fare poorly on assessments because they stop at this type of roadblock rather than proceed. The reader who is comfortable in the face of unfamiliar "foreign" words, new musical notation, or rare vocabulary is more likely to continue than to give up. It would be interesting to know whether learning the feeling that "roadblocks" are an expected and necessary part of the reading process would help readers. In this case, through the students' acceptance of a particular road block experience, practice in any symbolic system could produce reading gain.

Through knowledge of these unusual contributing courses we may find new ways, within the non-reading curriculum, to teach reading. We can use the information that the study of music and of a foreign language act as a strong and clear support system for the advancement of reading skills not so much in practice as in the theory and conceptualization of the learning process -- that what increases reading may be this ability to face a foreign symbolic set and to master it, no matter the actual symbol system or adequacy of prior knowledge.

Evaluating developmental courses

With respect to the last trend, why would it be true that no positive pattern of association between reading progress and the developmental reading courses was found? Astin's study does clearly associate verbal skills gain with other types of majors and courses. Why isn't reading remediation generating a clear positive effect on reading in these types of analysis? The first target for consideration in solving the mystery of apparent poor performance for developmental courses should be the investigative design itself. Is the association between poor reading and remediation somehow too strong to be "erased" through control measures? The statistical quirk of usual greater gains for weaker initial readers (regression toward the mean) could be expected to associate developmental learners with positive, rather than significant negative change. Are too few remedial courses being taken to generate the same solid effect that is generated by other types of courses?

Assessment quality has already been questioned. We have questioned the assessments on their reliability -- whether we have accurately separated skilled and less skilled readers. What about validity? Can we really define and therefore assess great reading when we see it, especially in lieu of examples of "model" performers? Are these measures of reading -- the CAAP and Nelson-Denny -- all too removed from the kind of comprehension learned and successfully employed in college? If this is the case, true increase is not even being measured.

If within the overall environment for freshmen, developmental courses are in some way weaker in producing reading gain, is this a result of the population or of the courses? We may be completely missing a variable for developmental students which better explains the differential progress. Possible feature of low achieving readers at the college level for which we have not controlled include differential motivation, attribution of control in learning, or some cumulative influence of years of frustration caused by weak literacy in academic situations. We do quite frequently attribute to developmental learners very separate sorts of learning attributes. We may be correct in assuming that for college freshmen

readers of lower ability a very strong interaction between learning and ability prevails. But we may just be labeling students by placing them into developmental courses, and then in the process creating a student or instructor expectation of inferior progress.

Perhaps developmental courses are somehow weaker than other courses in eliciting reading gain. Do our courses overemphasize method and therefore lack the rigor or "time on task" practice provided in the content areas? Perhaps the two second-tier groups--humanities and applied science courses--require more reading than other developmental courses, and it may be that reading practice, not instruction in reading itself, better promotes an increase in freshman reading scores. As surprising as the weak effect of remedial courses is the strength of effects from pure and from applied science courses: in the latter case, especially engineering. Though neitner course type above is intended as a course in literacy, both course types contribute to it. The salient element may be "rigor," or course level of difficulty. Perhaps the pure and applied sciences require extensive out-of-class work and demand a high level of student engagement in skill development.

How can we use the information that no positive pattern of association between reading progress and the developmental reading courses was found? We may be able to identify covariates which would change the sign of the contributions. Such an identification would inform us that our learners are special, and that they therefore require special instruction. Knowledge of developmental reader characteristics and methods for courses may surface. If the possibility exists that developmental courses could increase in efficiency through the study of these mechanisms, a more careful observation of the entire set of impactors for reading gain are in order.

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Appendix A

The NCTLA follow-up survey requests students indicate their freshman year course taking patterns . Five of the survey's questions are worded in the following manner:

12. Please indicate the number of college courses you have taken in each of the following natural sciences or engineering fields by circling the appropriate number after each course category:

(Please circle only one number in each row.)

Astronomy	*0*	*1*	*2*	*3*	*4*	*5*
Biology	*0*	*1*	*2*	*3*	*4*	*5*
Botany	*0*	*1*	*2*	*3*	*4*	*5*
Chemistry	*0*	*1*	*2*	*3*	*4*	*5*
Engineering	*0*	*1*	*2*	*3*	*4*	*5*

Courses listed in this type of question include, in addition to those listed above:

Geology, Microbiology, Physics, Zoology, Pre-Algebra, Algebra, Calculus, Statistics, Computer Science, Geometry, Matrix Algebra, Accounting, Business Math, Anthropology, Audiology/Speech Pathology, Child and Family Studies, Communications, Economics, Geography, History, Political Science, Psychology, Sociology, Social Work, Drawing, Drafting, Architectural Design, Criminology, Education, Study Skills, Agriculture, Business, Physical Therapy, Pharmacy, Physical Education, Nursing, Computer Programing, Art History, Art Appreciation, Studio Art, Dance, Theater, Music Appreciation, Music Performance, Composition or Writing, English Literature, Foreign Language Humanities, Philosophy, Linguistics, Classics, and Religious Studies.

Note: The following courses were taken by no students in this freshman sample:

Zoology, Child and Family Studies, Architectural Design, Physical Therapy, Agriculture, Applied Art, Social Work.

Figure 1. Overview of Biglan Classification

DISCIPLINARY FIELD CATEGORIZATION (Biglan, 1973)	
SOFT APPLIED FIELDS	**SOFT PURE FIELDS**
Education	Anthropology
Human Resources	Psychology
Occupational Therapy	Music
Physical Education	Studio Art
Public Policy	Philosophy
Social Work	Theater
Business Administration	English
Economics	Foriegn Language
Architecture	History
Accounting	Linguistics
Information Systems	Religion
HARD APPLIED FIELDS	**HARD PURE FIELDS**
Dentistry	Anatomy
Orthopaedics	Chemistry
Medical Chemistry	Microbiology
Pharmacy	Physiology
Nursing	Biology
Engineering	Mathematics
Computer Science	Cell Biology
Statistics	Geology
Agriculture	Astronomy
Bioengineering	Physics
Pathology	Genetics

Figure 2. Overview of Course Grouping Structure

Large Groups	Medium Groups	Individual Courses
Hard Applied Courses	Science	Nursing, Pharmacy, Drafting, Engineering, Architectural Design, Agriculture, Physical Therapy
	Computers	Computer Science, Computer Programming
	Math	Statistics, Accounting, Business Math
Hard Pure Courses	Science	Geology, Astronomy, Botany, Microbiology, Biology, Chemistry, Physics, Zoology,
	Math	Geometry, Calculus, Matrix Algebra
	Remedial Math	Pre-Algebra, Algebra
Soft Applied Courses	Social Sciences	Audiology/Speech Pathology, Criminology, Business, Education, Social Work, Child and Family Studies
	Humanities	Communications
Soft Pure Courses	Social Sciences	Anthropology, Economics, Geography, History, Political Science, Psychology, Sociology
	Humanities	Drawing, Art History, Applied Art, Studio Art, Dance, Theatre, Music Appreciation, Music Performance, Composition or Writing, English Literature, Foreign Language, Humanities, Philosophy, Linguistics, Classics, Religious Studies
	Remedial: Study Skills	Study Skills

Note: These courses were taken by no students in this freshman sample: Zoology, Child and Family Studies, Architectural Design, Physical Therapy, Agriculture, Applied Art, Social Work.

TABLE 1: MAJORS CHOSEN BY TOP READERS			
	PRIVATE 4-YEAR	PUBLIC 4-YEAR	PUBLIC 2-YEAR
CHOSEN BY TOP READERS (in descending orde	Biochemistry * Philosophy Music Education Physics Biology PreEngineering Computers PreNursing Math Political Science Social Science Business/Economics History Literature/Communication Elementary Education Sociology Special Education International Business Physical Education Accounting Nutrition Chemistry Jazz	Letters Fine and Applied Art Communication Engineering Physical Science Biology Foreign Language Social Science General Studies Marketing Computers Architecture Health Professions Community Service Business	Social Science Communications Health Professions Fine and Applied Arts Architecture Industrial/Trade Engineering Education Letters Business Home Economics Computers
LARGE GROUPINGS: MAJORS CHOSEN	Hard Pure Majors Hard Applied Majors Soft Pure Majors Soft Applied Majors	Hard Pure Majors Soft Pure Majors Hard Applied Majors Soft Applied Majors	(No Hard Pure Majors Soft Pure Majors Hard Applied Majors Soft Applied Majors
correlation, * $p < .05$			

TABLE 2: COURSES TAKEN BY TOP READERS		
	PUBLIC 4-YEAR	PUBLIC 2-YEAR
TAKEN BY TOP READERS (in descending order)	Art History** Chemistry* Calculus* Drawing* Education* English Literature* Anthropology Engineering Linguistics Philosophy	Humanities Political Science Natural Science History Math Biology Algebra Chemistry Microbiology Physics
TAKEN BY LOWEST READERS (in descending order)	Business Math Study Skills Accounting PreAlgebra Algebra	Technical/Trade Courses Music Appreciation Child and Family Studies PreAlgebra* Sociology**
LARGE GROUPINGS: COURSES TAKEN	Hard Pure Courses* Soft Pure Courses Hard Applied Courses Soft Applied Courses	Hard Pure Courses Soft Pure Courses Hard Applied Courses Soft Applied Courses
correlation, * $p < .05$, ** $p < .01$		

TABLE 3 : COURSE GROUPS: EFFECTS ON READING			
Biglan Category	Contribution	Course Group	Contribution
Pretest	7611***	Pretest	.7236***
Hard Pure Courses	.0680	Math	..0304
		Science	.0062
		Remedial Math	-.0622
Soft Pure Courses	.0570	Humanities	.1578*** See Table 5
		Social Science	-.0592
		Remedial: Study Skills	-.0148
Hard Applied Courses	.0460	Science	.0964* See Table 4
		Math	.0533
		Computers	-.0103
Soft Applied Courses	-.0048	Humanities	.0601
		Social Sciences	-.0511
beta weight, * p < .05, ** p < .01, *** p < .001			

TABLE 4: READING: APPLIED SCIENCE COURSE EFFECTS	
PRETEST	.7671***
Engineering	.0814 p < .1
Drafting	.0409
Nursing	.0000
Pharmacy	-.0051

TABLE 5: READING: HUMANITIES COURSE EFFECTS			
PRETEST	.7551***	PRETEST	.7440***
English	.1089*	Literature	.1399**
		Composition	.0908 p < .1
Foreign Language	.0956*	Foreign Language	.0801
Music	.0703 p < .1	Music Performance	.0628
		Music Appreciation	.0348
Art	.0518	Studio Art	.0522
		Art History	.0264
		Drawing	.0092
Performing Arts	-.0236	Theatre	.0195
		Dance	-.0500
Liberal Arts	-.0321	Linguistics	.0203
		Classics	.0122
		Religion	-.0093
		Philosophy	-.0228
		Humanities	-.0481
beta weight, * p < .05, ** p < .01, *** p < .001			

TABLE 6: DEVELOPMENTAL COURSES: EFFECTS ON READING	
Nelson-Denny (1981) Reading Pretest	.1525*
Hare Pure Majors	.1564*
Soft Pure Majors	.1092
Hard Applied Majors	.0403
Soft Applied Majors	.0403
Developmental Courses	-.1602*
beta weight, * $p < .05$	