STUDENTS EDUCATING STUDENTS:
The Emerging Role of Peer Effects in Higher Education

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Abstract

The quality of the education a student gets at a college or university depends both on the school's resources – faculty, facilities, libraries – and importantly on the quality of his or her fellow students. He or she simply learns more – better, faster, more deeply – in the company of able students than with weak ones. Put that way, the proposition seems reasonable, persuasive, and appealing – we can usually get by simply by asserting it. But as we've looked more closely at those "peer effects," we have encountered an increasingly complicated, subtle, and often slippery set of issues: at base, not much is known about peer effects in higher education, despite their potential importance. The purpose of this paper is, in a sense, to describe the structure of our ignorance – what it looks like, why it matters, and what might be done to overcome it – a research agenda.

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Williams Project on the Economics of Higher Education

"The real intellectual life of a body of undergraduates, if there be any, manifests itself, not in the classroom, but in what they do and talk of and set before themselves as their favorite objects between classes and lectures. You will see the true life of a college … where youths get together and let themselves go upon their favorite themes – in the effect their studies have upon them when no compulsion of any kind is on them, and they are not thinking to be called to a reckoning of what they know."

> Woodrow Wilson (from Burton Clark and Martin Trow in College Peer Groups)

I. Introduction

The proposition is simple: the quality of the education a student gets at a college or university depends both on the school's resources – faculty, facilities, libraries – and importantly on the quality of his or her fellow students. He or she simply learns more – better, faster, more deeply – in the company of able students than with weak ones. This suggests a primary reason colleges and universities, and potential students, care so about the quality of a school's students – why selectivity looms so large in quality rankings like US News' and why student quality is such a deadly serious business to colleges and universities.

Put that way, the proposition seems reasonable, persuasive, and appealing – we can usually get by simply by asserting it. But as we've looked more closely at those "peer effects,"

we have encountered an increasingly complicated, subtle, and often slippery set of issues: at base, not much is known about peer effects in higher education, despite their potential importance. The purpose of this paper is, in a sense, to describe the structure of our ignorance – what it looks like, why it matters, and what might be done to overcome it – a research agenda. So this is very much "a work in progress," but we have come to feel that it's essential to frame the questions clearly at the outset.

To that end, the next section asks why peer effects matter. Section III provides a brief review of relevant prior research on peer effects. Section IV specifies the key questions researchers must confront, along with a discussion of possible mechanisms for the transmission of peer effects. Section V lays out our proposed research strategy. Section VI offers some conclusions.

II. Why Do Peer Effects Matter?

Peer effects appear to be central to the way educational services are produced and, through that, to the structure of the "firms" and "markets" that make up higher education. Most specifically, peer effects help explain why *selectivity* among applicants is seen to be essential to educational quality and why the "firms" in this industry sacrifice significant revenues by massively turning away customers, hence revenues, in order to maintain student quality (and why the public universities that can't legally turn students away do create enclave "honors colleges" or quality differentiated campuses where they can). And why competition for "student quality" is driving an increasingly fierce competition among the most selective colleges and universities.

The long debate in K-12 policy circles on the desirability of ability-sorting of students often rests on implicit assumptions about the symmetry of peer effects – whether weak students pull strong students down more than strong students lift weak students up. Proponents of sorting assume that streaming will do harm to able students that can't be offset by gains to the less able; opponents assume that gains to the less able will outweigh any losses to the more able. If hard

evidence could be got that one or the other of these is most usual, even from the college level, it would help to focus that discussion.

If peer effects work, and if they start to work in the early grades, the strong arguments for early intervention with disadvantaged children are made stronger since early improvements will not only raise the performance of a child directly but, through the effect of that improvement on his peers, have a multiplier effect over time. Dollars spent early will have a larger payoff than dollars spent late, other things equal.

In the long debate about the role of increased resources in improving education it has always been difficult to separate neighborhood (peer) effects from the effects of resources in K-12 schools – neighborhoods well endowed with able peers are usually well endowed with resources, too (Hanushek, 1986). Colleges, in contrast, bring together students from varied backgrounds to share the same resource levels, so they should allow that separation between peers and resources to be made more effectively. Public educational policy will be better informed with a clearer identification of those two forces.

Much is being made of the threat to conventional higher education from high-tech (and often for-profit) competition – Peter Drucker has famously predicted the immanent end of the university as we have known it. Yet if peer effects are both important and difficult to generate through electronic media, there will be severe limits on the kind and quality of education those new information technologies can replace. The distinction between "training" and "education" may become increasingly central.

Affirmative action appears to be sensitive to peer effects in two ways. It's not a big step from the destructive "stereotype anxiety" that psychologist Claude Steele of Stanford University identified as reducing the academic confidence and competence of black students to the role of peer expectations and values in triggering or suppressing that anxiety. The importance of "a comfort zone" in which minority students encounter positive peer effects is apparently evident in the Mellon study of C&B data in HBCUs. Parallels with the more general effects of institutional

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ethos, of course, suggests that these peer effects, while they may be supportive of the student, can have either a positive or negative impact on educational outcomes (Steele, again). A different role for peer effects has emerged from the debate on public affirmative action policy where the argument has been made that since it is socially/morally/politically unacceptable to let minority representation fall significantly in our best public colleges and universities – and no proxy has appeared to replace the explicit consideration of race in admissions – it will be necessary to set lower standards for all students in order to achieve acceptable levels of minority representation. That, if peer effects are important, will undermine the quality of public education in a way that affirmative action never did (Rosen, 1998).

The most basic puzzle in all of this may be not about peer effects, per se, but more fundamentally about why everyone cares so about a school's student quality – college administrations and boards, alumni, students, parents, US News, etc. That concern supports an economic anomaly of major proportions: colleges restrict their supply (limit enrollments) in the face of strong and persistent demand in order to be able to select among applicants and admit only those of highest quality, a policy that clearly costs the school tuition revenues and (on a more idealistic plane) the opportunity to serve more students. Take Williams as a convenient example. If we accepted all of the 4,500 students who apply for our 500 seats in the freshman class each year, our current yield rate of around 50% would mean that 2,250 of them would come and, at an average net tuition of $23,350, we'd have, after four years of doing that, over $40 million in additional revenues each year. Ignoring the fact that we'd also have a lot more in cost, what's going on? And, while this anomaly is clearest at the best colleges, very few schools are truly "open admission" and that number is shrinking.

Peer effects offer one explanation for such strange behavior in seeing a college's student-customers as the only potential suppliers of an important input to educational production and one that varies markedly among individuals. If there are peer effects, schools care about their student

quality because of their peculiar "customer-input" production technology (Rothschild and White, 1995; Winston, 1996). And if there are peer effects, students care about their fellow-students for the same reason – because they are both an indicator of and contributor to high quality education.

But other explanations are often presented as alternatives to peer effects – though frequently by way of citing education as an example of something like status associations. Still, it is useful to look more closely at these alternatives.

Some are easy. Alumni care about the quality of students at the Old Alma Mater (more generally, the quality of the school) because its reputation redounds to them– by implication, the better are current students, the better they must have been in their day to pass through those same portals. Ex post distinction. Colleges, on the other hand, care about their student quality for straightforward marketing reasons – good students provide a visible endorsement effect that implies institutional quality: "Those who have choices choose us."

More seriously, there may be significant networking effects provided by the students of a school. They will meet and get to know fellow students who will sometimes be helpful in later life – and good students are more likely to achieve greater success and hence be of greater help. So schools sell an investment not just in what-you-know, but also in who-you'll-know-later and that investment may sensibly be recognized by both student and college as important. (In days past, marriage contacts would have been a significant sub-market in this kind of investment.)

But what seems most often to be presented as an alternative to peer effects on learning is some sort of status association – that colleges provide a student with utility-enhancing association with the rich and famous (or bright and nerdy) – they are clubs formed to establish restrictive

association or, alternatively, they are restaurants part of whose appeal is provided by association with one's fellow diners. There's no investment component in this, just the pleasure of cozying up to others who themselves have social status. More selective colleges provide more impressive fellow-customers, hence more of that kind of satisfaction.

A complementary but different source of utility attaches simply to winning. Selective colleges are, by definition, hard to get into, so having done it is a source of achievement – Edmond Hillary's explanation for wanting to climb Everest, "Because it's there".

At the other end of a continuum of social nobility would appear to be a college's idealistic objective function such that they want their excellent education to go to those who'll use it to best contribute to society – colleges see themselves as educating future leaders so they admit those applicants whose prospects of becoming influential leaders are the greatest. That's often explicit in the wealthiest colleges (Klitgaard, 1985; Rosovsky, 1990).

Economically, these alternatives have to do with (a) increasing demand (marketing) (b) providing utility directly (status or winning), (c) producing a different, non-learning, product (networking), or (d) serving idealistic social objectives. It's clear that these are very different from each other and from the peer effects that simply increase the quality of educational services and learning that a college produces. And it's clear that they're not mutually exclusive. A car, for a familiar example, can provide both transportation and status and the status component will be much influenced by who else owns that kind of car. But your Mercedes isn't any safer, nor will it stop shorter or hold the road better, if other Mercedes owners are rich or famous or klutzes or Grand Prix drivers.

The implications of all this for our examination of peer effects would appear to be:

- that these things are very different, even if all help us understand why people and administrations may care about a school's student quality;

- that all of them are probably at work in higher education, especially at the top of the hierarchy – at Harvard and Swarthmore and Duke;

- that because they're not mutually exclusive, persuasive evidence that one exists doesn't suggest the absence of another;

- that it's probably useful, in service of clarity, to stick to common usage and let "peer effects" describe only students' effects on other students' <u>learning</u>;

- that in light of the very high costs incurred by schools – in "sales volume" and tuition revenues, if nothing else – in service of student quality, it remains unclear why most of these things would be of sufficient importance to justify those costs to the school, absent peer effects on learning.

- that the customer-input technology of higher education does not appear to be very common in other production processes – certainly not as common as the status and association effects that have got recent attention and got mixed up with them.

So we're back to "Do peer effects really exist?" It's important whether other satisfactions accrue to alumni or students or parents from the selectivity of colleges and universities. It is also important whether there's an underlying <u>educational</u> rationale – affecting learning – for that selectivity. We have to concede that we hope that the answer will be positive. Like most educators, we'd like to find that peer effects on <u>learning</u> – a college's primary mission – are real rather than face the idea that all that attention to student quality is driven by less noble motives. In any event, it seems important to know whether the magnitude of any educational benefits associated with peer effects warrant the resources expended to achieve them.

III. What is the Evidence So Far?

We're not starting completely from scratch, so it's useful, briefly, to sketch out what others have found out about peer effects – in higher education, K-12, in psychology labs, and in other social sciences. Indeed, one of the interesting aspects of studying peer effects is that it has attracted the attention of researchers from such a wide variety of disciplinary perspectives – usually with different motivating questions but all linked by the important role ascribed to peer effects.

Certainly the most influential piece of social science research incorporating peer effects is the famous study *Equality of Educational Opportunity* – completed over thirty years ago (James Coleman et al., 1966). This study, known more commonly as the "Coleman Report", popularized the use of "education production functions" – equations relating schooling inputs (e.g. family background, peers, student-teacher ratios, spending per student, etc.) to schooling outputs (e.g. grades, retention, etc.). Employing over a half million students, from approximately three thousand elementary and secondary schools, Coleman and his associates sought to measure the features of school environment that led to differences in student attainment. A key finding of this study was that "…a pupil's achievement is strongly related to the educational backgrounds and aspirations of the other students in the school."   Indeed, peer characteristics were found to be notably more important than teacher characteristics or non-social aspects of the school. This report spawned a virtual cottage industry of researchers attempting to pin down the parameters of the education production function (Summers and Wolfe, 1977; Hanushek, 1986). While there continues to be great controversy over the determinants of student achievement, the educational production function provides a useful way of organizing a diverse literature. Formally, the education production function might be specified as follows:

Educational outputs = f(inputs)

indicating that educational outputs (grades, attitudes, "achievement", retention, etc.) are a function of the educational inputs. A useful way of distinguishing between the array of inputs is to separate them into those associated with student's prior performance, family background characteristics, peer (or neighborhood) characteristics, and other institutional characteristics. These four inputs, combined with different outputs, can be used to characterize much of the social science literature on peer effects. It is worth noting that the inclusion of a measure of prior performance allows for the use of a "value added" measure of output. That is, we can see whether a change in some input is associated with a change in some output.

Much of the literature contributed by economists focuses on the impact school spending has on either grades or wages (Burtless, 1996). To disentangle the effects spending might have on student performance it is necessary to control for other variables – such as the quality of the peer environment – that are likely to be correlated with spending. Peer effects are, for this task, simply a nuisance that must be statistically controlled to enable the researcher to accomplish their chosen objective of measuring the benefits of additional spending. Typically, a measure of a school's average student quality – usually average SAT scores – is included in wage or grade equations and usually has a significant and positive coefficient (Ehrenberg-Brewer, 1996; Behrman et al. (1996); Turner, 1996). Indeed, it often looks like resources – spending per student – may work primarily through its effect on attracting student quality and allowing greater selectivity. In all, the evidence of peer effects is positive but not strong. It should be noted that the use of a peer effect argument in most modern educational production functions shows, at least, economists prior belief in the potential importance of peers effects.

Where economists have used peer effect evidence explicitly (McPherson and Schapiro, 1990) they have drawn on a small K-12 literature, especially a study of approximately 7,000 Montreal students between the first and third grades (Henderson et al., 1978). This study found compelling evidence that peer effects were both important and nonlinear. That is, student

performance rose with the average classroom IQ score. The increase, however, slowed as the mean IQ rose. It should be noted that their model did not allow the measured peer effect to vary with the students initial ability level.

A recent K-12 study used the impressive NCDS British data that follows the entire cohort of children born in a particular week in Britain in 1958. This study related the children's standardized math and reading scores – taken at the ages of 7 and 11 – to measures of their parents and schooling inputs (Robertson and Symons, 1996). Peer effects were captured both by the varying socioeconomic background of the student's peers, along with the "streaming" of students by ability within schools. They found clear evidence that peer effects were positive and their data suggested, too, that they were nonlinear – that poor students were helped more than strong students were hurt. Given their own abilities, students were best off if they were in the top group of a school that sorted by ability and worst off in the bottom group of such a school.

The economics literature has also considered an important methodological issue that is pervasive in all research on peer effects; people often *select* with whom they associate. This contrasts sharply with an experimental situation in which we might randomly assign people to differing peer environments and then measure their effect on educational attainment. If the peers with whom one associates are linked with attributes of the person that also affects their attainment (and which are unobservable to the researcher) then we might falsely attribute a peer effect where one does not exist. For example, suppose people who associate with low ability friends tend to do worse in school. Perhaps they would have done poorly even if they didn't associate with such people. That is, what might at first look like a peer effect might really be a case of "birds of a feather flocking together." At least two studies by economists have looked at the issue of such "selection bias" in the context of peer effects. Evans et al. (1992) studied peer effects in the context of teen pregnancy and school dropout behavior. They use the econometric technique of instrumental variables to attempt to control for such bias, finding that peer effects disappear once such concerns are incorporated into the empirical model. Steven Rivkin (1997) questions these

results and shows that the results are sensitive to the type of instrumental variable used. These papers suggest the importance of taking the selection issue seriously. They also suggest the value of a good experimental or quasi-experimental approach to the measurement of peer effects – something we pursue below.

While it is not possible in this paper to survey the study of peer effects from all disciplinary perspectives it is probably worthwhile to summarize briefly the various strands from the diverse literatures that have considered such effects.

Sociologists have spent considerable time studying "neighborhood effects" – particularly in the context of urban poverty. The central issue in this literature is whether and how proximity to concentrated poverty increases the odds that an individual will themselves be/remain poor. Christopher Jencks and Susan Meyer (1990) present a useful taxonomy of models including "contagion theories", theories of "collective socialization", "competition theories", and "relative deprivation theories" (see also, Crane, 1991; Rosenbaum, 1993). Writings by William Julius Wilson combines elements of these approaches in his influential book *The Truly Disadvantaged* (1987).

Both psychologists and sociologists (and economists!) have studied the impact peers have on adolescent substance abuse and teen pregnancy. Here the literature commonly involves the definition of the relevant network of friends and linking the behavior of the friends to the individual under study (Mounts and Steinberg, 1995). Deleterious effects of substance abusing friends is often found, but the problem of selection bias seems particularly troublesome in this area.

Developmental psychologists – often following the *ecological approach* (Bronfenbrenner, 1979) – have also studied the impact peers have on grades. Almost all of these studies focus on the elementary and secondary school level (Delgado and Gaitan, 1986; Ide et al., 1981). A relevant strand of this issue studies the factors that influence a person's vulnerability to influence. In addition, there is an interesting debate in the area of child and adolescent

development over the relative importance of the family versus peers in a persons development. Indeed, in her recent book "The Nurture Assumption" Judith Harris argues that peers are much more important than parents in human development. In sum, the psychological literature affirms the existence and importance of peer effects for elementary and high school students. Again, selection issues seem problematic in the nonexperimental empirical studies. At the college level, Pascarella and Terenzini (1991) summarize the effect of peers on a variety of outcomes including attitudes, values, and educational attainment.

Finally, it is worth noting that educational researchers from various disciplines have considered the benefits of "peer assisted learning." These studies show the benefits of group versus solitary learning. In as much as they are interested in designing "optimal learning environments" the effects of peers is important to their analyses. (Alexander et al., 1974; Frazer et al.,1977; Joiner et al., 1995).

IV. Do Peer Effects Exist in Higher Education?

Given the discussion above, it seems that there are several recurring questions that are central to understanding peer effects. We turn to them next.

- *Do peer effects exist in higher education?* They might be the product of wishful thinking at elite and selective institutions trying to convert their snob appeal and their prestige race – with the promise of association with the rich and famous – into something of genuine educational and social value. But they could be very real. Right now, peer effects seem to be a litmus for optimists – or romantics – since reactions to the plausibility of a genuine effect on <u>learning</u> is either taken as obvious or dismissed with haste and often derision as hopelessly idealistic. So, examining their existence has to be the first order of business and, controlling for potentially confounding variables – particularly given the self selection issues discussed above – is the central empirical challenge.

- Are peer effects *nonlinear*? That is, do the benefits of improving the peer environment diminish at some point? The answer to this question is at the heart of a utilitarian justification of mixing students of different ability levels. Would the aggregate of learning in higher education be increased if students were randomly assigned to different schools? Would the loss in learning a high ability student suffers by being moved to a lower average peer setting be offset by the gains a weaker student garners in a better peer setting? In what way are peer effects dependent upon a students ability level?

- *Is there an "intimidation effect"?* Do students have to be "pretty close" in some meaningful sense in order to influence each other? Would a student who is significantly below the peer average do better or worse than expected? What other factors will influence the magnitude of the peer effect?

- *Who are the peers?* It's necessary to limit these questions to a sub-domain of Social Psychology – to exclude parents and professors and other employees of the college or university. Where might peer influences be most easily detected? On the team? In the dining hall? In the dorm room or the debate team or…? Which of the possible sources are most important?

- Are peers *individuals*, or groups, or is a *broader "institutional ethos"* more influential? And how much can the college intentionally shape, or change, that ethos?

- Do peer effects work with equal force *for better* (good behavior and academic performance) *or for worse* (binge drinking, drugs, and the lost opportunities of "a bad crowd")?

- Do peer effects need *physical proximity* or can they function just as effectively through *"cyberspace"?*

- Do peer effects endure or do their effects dissipate rapidly over time?

There is a great deal of evidence from studies in social psychology that addresses these issues and suggests that peers do in fact exert tremendous influence on college students in numerous ways. We'll review this literature briefly and suggest its relevance to policy questions in higher education. An economic framework for understanding peer effects is found in the appendix.

TALK AND ITS COGNITIVE CONSEQUENCES

One of the things that people do is talk. Certainly the talking and discussing that college students do has important effects. Some of these effects are directly relevant to the college's goal of graduating well-educated students, students who are knowledgeable, savvy, thoughtful, and wise. There are a number of ways that talk among students can help them develop these qualities. First, students can transmit information. They can explain things to each other -- facts, concepts, perspectives, techniques, strategies for learning. Second, in addition to imparting knowledge, they can affect the ways students think and therefore the way they acquire and process new information. Jean Piaget discussed the development of cognitive schemas, or knowledge structures, in childhood. Schemas can be thought of as our general knowledge about the physical world, events, people, groups, activities, etc. Often new information goes through a process of assimilation to schemas. That is, the information is interpreted in terms of existing schemas, stored in familiar categories, and simply fit into comfortable and familiar ways of looking at the world. Sometimes however the data don't fit the existing schemas, and a schema actually changes to better fit the data. This is the process of accommodation. Academics often joke that if the data don't fit the theory, so much the worse for the data. The schemas are kept in tact. However, during development exciting things happen when schemas do change, when they undergo accommodation. They become more complex or they are replaced by new or highly revised schemas.   Then the person views the world differently. This process takes place very rapidly during cognitive development in childhood, but it continues throughout the life span. It is this

process that professors strive to effect. Get students to think in different ways. Get them to pay attention to different things. Peers who can provide new information or ideas that challenges existing schemas, or who can directly model different ways of thinking or problem solving can also have the effect of changing our conceptions or mental models of the world and its workings.

In the first instance then, peers provide us with new information to expand our data base, or the way we organize and deploy that data base to further understand the world. Psychologists make the important distinction between crystallized and fluid intelligence, simply put, what we know from absorbing and processing information, vs. the mental horsepower we use to make sense of new data and plan adaptive behavior. Talk is one of the activities that can enhance both. While there are most likely limits on the levels of both crystallized and fluid intelligence that people reach, input from books, mass media, life experiences, professors, and peers can increase those levels.

Talk is a two-way street. It has more effect than merely providing input to increase knowledge or change modes of thinking. When people talk rather than listen they have to switch their "cognitive tuning" (Zajonc, 1960). They move from the "reception" mode where they simply take information in to the "transmission" mode where they have to organize their thoughts into a coherent story that makes sense to others. Doing so requires lots of cognitive work, sometimes at the expense of remembering and transmitting everything in detail. However, this "teaching" function generates a great deal of learning and understanding -- in the teacher! So, there is benefit from being on either side of the talking table. It helps to hear what others have to say, and simply to absorb or complexly to process and organize what one hears, and it helps to speak to others, and organize our own knowledge and ideas in ways that communicate effectively.

Can all of this be done by letter, telephone, or email? Perhaps some of it can. But the richness of human communication lies in more than the words exchanged. Face-to-face interaction conveys a wealth of nonverbal information that qualifies and amplifies the spoken

word. It provides a relational and emotional context for talk that provides the potential for greatly enhanced learning. This learning won't always be fun and easy. But there is lots to be gained from it.

SOCIAL INTERACTION AND ITS PERSONAL CONSEQUENCES

Students of human communication argue that communication always takes place on two levels simultaneously, the content level and the relationship level (Watzlawick, Beavin, & Jackson, 1967). At the content level communication concerns the world at large -- ideas, events, people, objects, tasks, problems, and values. At the relationship level communication concerns the people talking -- what each one thinks of himself or herself, what he or she thinks of the other person, and what he or she thinks of their relationship. Most often communication at the content level is done in words. Communication at the relationship level is done nonverbally, through gesture, tone of voice, facial expression, etc. In his book on presidential character, James David Barber (1992) notes that any presidential decision is the story of a rational man calculating and an emotional man feeling (p. 7). Conversation similarly has its rational and emotional elements. The relational and emotional aspects make talk much more complicated and introduce a range of considerations which affects how the process of peer education unfolds. These relational issues can greatly enhance, but also reduce, the educational impact of peers.

Interaction and social comparison. Psychologists have noted that a great deal of self-evaluation takes place through social comparison (Festinger, 1954; Wood, 1997). We evaluate our opinions and abilities by comparing them with other people. This process is not always objective. We want to find out whether our opinions are correct and our abilities are good, but we also want to find out that they are indeed correct and good. When students discuss an important issue with their peers there are complex comparison and influence processes that push toward consensus within the group, either through opinion change or the rejection from the group of people with deviant views. There are also likely to be implicit ability evaluations. Am I smarter

or morally superior to my peers? These ability evaluation processes produce competition, sometimes the formation of coalitions, sometimes the attempt to undermine other people's performance, but generally the attempt to improve one's own. But there may also be rejection of people with discrepant ability levels, just as there is rejection of those with deviant opinions.

One specific and highly important consequence of the social comparison of abilities is the setting of levels of aspiration. In general, there is a strong motive to perform as well as possible and to develop abilities as fully as possible. But when people cease comparing with others, there are important adjustments to their levels of aspiration. When they cease comparing with others who are less able, their level of aspiration rises. When they cease comparing with others who are more able, their level of aspiration drops. Levels of aspiration have important impacts on academic engagement and performance. We will return to this issue below.

What do these processes imply for peer education? Interacting people will engage in frequent discussions in sorting out their views on important issues. They will try to clarify and influence each other's values in an effort to reach consensus. These influence processes may serve the goals of either self-evaluation or self-validation, but one way or another they will provide a spur to discussion, the clarifying of position, the exchange of information, the setting of priorities etc. These overtly content level communications are energized by concerns with self and relationship. Cognitive development, the enhancement of both crystallized and fluid intelligence, can be motivated by the comparison processes that take place in conversation.

Group polarization effects. When people engage in the social comparison of values, the expression of a group's values often becomes more extreme. Colleges need to be aware of the values that various campus groups adopt and accentuate.

When people compare opinions and judgments that are related to important values, the comparison process resembles ability comparison more than ordinary opinion comparison. When important values are involved people compare how well they exemplify or support those values, and doing that well may be as important as having a high level of an important ability. Thus

rather than reaching some kind of middling consensus or compromise, as often happens with ordinary opinion comparison, people compete to support the value at least as much, or a little bit more, than their peers, and thus the group polarizes, and expresses the value more extremely. One common example is a group making judgments about the appropriate level of risk. Often the group will make a "risky shift" and take action that is riskier than the course of action proposed by the average individual. In this way important values get highlighted or exaggerated in the group.

In the college setting, if the value that is exaggerated in this way is one that a college wants to support and emphasize, a happy result has been achieved for the college. But if the polarized value is counter to the overarching educational values and goals of the institution, there's trouble. Again, colleges need to be alive to the groups that form, the values that guide them, and how those values can become polarized, for good or bad.

Self-definition and identification. In our society, college is often a time for identity seeking and self-definition. People attempt to construct an identity in numerous ways. They try out a variety of behaviors and roles until they find a self-defining set that fits both their deep sense of self and other people's perceptions and expectations. One important way of adopting roles is through the process of identification. If we perceive others who are admirable in important ways, we will imitate them and try to be as much like them as possible. They serve as important role models. To the extent that a college values intellectual achievement and academic success, perhaps because of recognition by the institution's faculty or administration, students may try to emulate those who are successful. In identifying with those who succeed, they will identify with the activities that make them successful. They will develop interests and adopt behaviors which make them similar and can lead to similar successes.

Our capacity to perceive that we are or can be similar to very talented others is extraordinary. It can be self-deceptive, in that we may never be or come to be as able as many of those we emulate. Still, the effort may bring success and development that would not happen

otherwise. Sometimes however, we may decide that we have very little chance of being like others who are highly successful and seem highly admirable. We may cease comparing with them and cease identifying with them. Individuals can be influenced most positively if there are role models who seem attainable and admirable, and in fact behave in ways that enhance intellectual development. Sometimes students do not choose the role models college administrators would choose for them. There are a variety of reasons for this. One is that their estimation of their chances of successfully identifying is low. Another is that peer group values do not make emulating them very attractive. We will return to this problem below.

Observational learning. Closely related to the notion of identification is the idea that people will adopt behaviors that they observe others perform if the behavior leads to some kind of reward or reinforcement. While this process may have relatively little to do with emotion or relationship, it is true that students learn not only from listening to their peers but also from watching them. We can learn from others about effective ways to manage time, resolve conflicts, solve problems, and succeed academically. For example, learning how to take notes, plan exam answers, compile references, etc. can be accomplished through watching peers. Again, this kind of learning doesn't depend on admiration for or emulation of a peer, just the perception that imitating his or her behavior is likely to lead to a good result. It obviously makes an important difference how students are influenced to judge what is and is not a good result.

GROUP FORMATION AND PEER EFFECTS IN COLLEGE

There seems little doubt that students will influence each other. They will have direct effects on cognitive capacity through talk, both as speakers and as audience. They become sources of information for evaluating opinions and abilities, and thereby affect judgment, belief, value, level of aspiration, and, ultimately, ability. They can serve as models for identification and observational learning. Given the enormous effects peers can have, it is crucial to ask the question, what peers. Within the larger group of undergraduates, students form smaller peer

groups. These groupings will be largely based on students' choices (self-selection), and those choices are largely based on similarity. However, they are also based on proximity. Proximity is something over which colleges can exert some control. The ways they arrange housing and dining, the ways they control or influence course choice, and the ways they influence the amount of time students spend interacting in curricular groups, such as lab sessions and discussions groups, and in extracurricular groups, such as athletic teams, ethnically-based social groups, music groups, fraternities etc. all an have an important impact on peer groupings and therefore peer influences.

There are a number of important issues here. First, there is almost certainly going to be some degree of hostility between groups. This need not be open warfare, but there are probably inescapable tendencies toward ingroup favoritism and outgroup derogation. Therefore, the groups that form have enormous impact. If left to their own devices students will join groups that are comfortable and familiar, based on the similarity of group members. What actions should colleges take to foster or impose uncomfortable interactions and groupings? Second, each group will develop its own set of norms and values. Those values will vary in their consistency with the norms and values of the institution. They will have a crucial effect on the extent to which students identify with the educational mission of the college. How should colleges act to influence their students' definitions of appropriate groupings? Will a better result come from trying to define groups in larger, diverse units or by encouraging smaller more homogenous groupings? The groupings that result will have profound effects on the extent to which students identify with the academic mission, how they set their level of aspiration, what images they build into their self-concepts, how well they perform in the classroom, and their broader social values. It probably makes sense for colleges to think about how they can affect these groupings.

V. How Do We Propose to Find Out?

The framing that's proving useful, so far, looks at (a) an *individual* and (b) his/her *peers* and (c) their *characteristics* and (d) his/her *behavior*. Agent-environment-input-output. Clearly, there's lots of room for expansion on each of these. Which individuals? What peers? Which peer characteristics? What individual behaviors? In what setting?

Briefly, we're taking two broad approaches:

A. Experiments in the psychology lab

One approach is to study live groups interacting in the laboratory. We have begun a series of studies where we look at the impact of two peers on one fellow student. All three students read and discuss articles from the New York Times "News of the Week in Review."   We hope to explore the benefits of interaction itself. What do students get from discussion and interaction compared to a solo environment where interaction with peers is limited or nonexistent? What are the effects of substitutes for face-to-face interaction? Does e-mail have the same beneficial effects? What about conference calls, or teleconferencing? Our hypothesis is that face- to-face interaction with live peers will produce measurable increases in learning and in motivation for learning. We will attempt to find out by observing students in a series of experiments where they interact to varying degrees with their peers.

Some preliminary results indicate that students benefit from three different kinds of discussion. Compared to issues that they have simply read about but not discussed, students they report more interest in pursuing issues that they have 1) both read about and discussed, 2) issues that they have not read about but have discussed with peers who have read about them, and 3) issues that they have read about and explained to peers who have not read about them.   These findings are extremely preliminary. But they suggest the promise of studying peer effects in the laboratory, and learning how peers can enhance the educational experience.

B. Observation and econometric analysis of behavior

Once we move from an experimental setting we must be very careful to avoid the issues generated by the *selection problem* discussed above. We have two possible approaches. Either we must find a situation that simulates an experiment vis-à-vis the random assignment of different peer environments (i.e. a "natural" or "quasi-experiment"). Or, we must control for other factors that are linked with both achievement and peer associations. Our preference is to use *natural experiments* whenever possible.

One plausible place to look for such a natural experiment is in student housing assignments. Suppose we identify situations where students are randomly assigned a room during their first (or subsequent) years of study. They will, in effect, inherit a roommate by virtue of the housing lottery. Such an assignment will also (randomly) place them in a particular entry – part of a particular residence. In short, they will have been assigned a particular (roommate/entry/house) peer environment. Students with different racial or socioeconomic or academic backgrounds are roomed together. This random assignment eliminates the selection problems that plague many peer studies. We might ask, for example, whether students tend to over or under perform conditional upon the SAT scores of their roommate. That is, would knowing the SAT scores of a person's roommate help us to forecast their GPA – once we've controlled for their own SAT scores? We can ask whether the effect is nonlinear. We can also see if the over or underperformance depends on either the students own SAT score or on the gap in SAT scores between the roommates. We can measure the presence or absence of peer environment effects at the house, entry, and roommate level of proximity. A possible extension of this approach would involve designing freshman room assignment strategies to improve the generation of meaningful peer evidence. We might also merge to this data information on any "junior advisors" that are associated with the various entries associated with the student houses.

The College and Beyond database – created by the Andrew W. Mellon Foundation -- provides an extraordinarily rich data set for the study of such peer effects. It supplies detailed

information on the college experiences of a total of approximately 90,000 undergraduate students from thirty four selective colleges and universities in cohorts entering in 1951, 1976, and 1989. Matching housing data with this database allows the application of the empirical approach described above. It also allows the exciting possibility of using a broad range of educational outputs and peer characteristics in the analyses. The large sample sizes are also likely to allow a precise analysis of students at the top and bottom of the SAT distribution. It also allows an investigation of factors that facilitate or discourage peer influences.

Another promising application of the College and Beyond data involves the use of information provided by Alexander Astin and his colleagues on student's pre-collegiate aspirations during 1976 and 1989. This data allows for several interesting question to be studied. First, student aspirations – aggregated to the level of the school – might be used to provide a measure of the institutions "ethos." Along these lines, we might ask whether a student's stated pre-collegiate aspirations are more or less likely to be borne out under different institutional environments. To what extent, for example, are students choice of major affected by the aspirations of their classmates (after controlling for the students prior aspirations).

VI. Conclusion

Hopefully we have provided a convincing case that peer effects are worthy of systematic study. The notion that students educate students is central to a diverse set of issues including selective admissions, affirmative action, distance learning, and the economic anomaly of college tuition being well below cost. We have attempted to frame the questions researchers must confront in contemplating peer effects. We have also suggested an empirical strategy – employing both experimental and observational methods -- for measuring such effects. Our intention, in taking this first step, is to frame the issues in a way that will be productive, to us and to others, in thinking about peer effects.

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APPENDIX

An analytical framework for studying peer effects can be developed using a pretty straightforward microeconomic analysis – post-Becker – but it's worth briefly repeating for economists and describing for others.

The firm (college) and customer (student) are seen as separate entities.

The firm uses various inputs in making its product, including materials, labor, and capital services – heating oil, faculty time and effort, and labs and buildings. The possibilities for combining inputs to make the product are limited and specific to a product – those possibilities describe the firm's production technology (a production function). All firms in an industry are assumed to have pretty much the same technological choices.

So peer effects on learning are described as a 'customer-input technology' in the important sense that one of the inputs to the firm's production can be bought only from the same customers who buy its product. That's seen as a fact built into the technology of making the product (educational services). (If the product were more concrete, we'd refer to this is an "engineering" fact, but that's a stretch when the product is education.) So with peer effects, a student both buys educational services from the college and, simultaneously, provides his own services (in the form of an educational interaction with other students) to the college. Rothschild and White (1995) and Winston (1996) have developed some of the implications of this technology and the resulting markets and prices.

For the customer, its formal representation as consumer/household is even more useful in thinking about peer effects since it generates a list of the ways an individual student's behavior (his choice of activities) can be influenced by others (peers).

In the Becker "household production" framework (Winston, 1987), an individual customer is seen to combine purchased inputs (like groceries or educational services) with his own time and effort to produce the things he really wants (nutrition, learning…). Since all these activities are set within a 24 hour day, he's got to make choices on what to do (hence what not to do) and how to do it, choices that determine what he'll buy, how much he'll work, what he'll earn, and how much satisfaction he'll get out of life. Like the firm, his household production choices are constrained by his understanding of appropriate production technologies – how to cook, how to study,… and shaped by his particular, individual preferences. Some people will do things (produce household activities) more efficiently than others, simply because they use a better production technology (they're smarter, more disciplined, more practiced, stronger, younger,…). Some people will do different things simply because they prefer them over other activities.

So the college is seen to produce educational services that it sells to student-customers at the same time that it gets peer quality from those same students (in different amounts according to the individual student's abilities). The student, in turn, is seen to take those educational services it got from the college and combine them (efficiently or not) with his own time and energy to produce, finally, learning.

Peer effects, then, are the influences that other students will have on his learning (for better or for worse).

The formal representation of all this as an optimization problem for the student generates a surprisingly rich and useful list of ways those peer influences might work. Most basic is the fact that, within a twenty-four hour day, doing more of one thing means doing less of something else, so all activity choice is based on the relative attractiveness of activities – something can be very satisfying but still not be chosen to do simply because it's trumped by something that's even more satisfying to do (with some further complications like costs that needn't detain us here).

So a student's learning can be affected by his peers by their changing:

1 – How much he likes learning – his utility function

2 – How much he likes doing other things – ditto

3 – How efficiently he learns – his household production function

4 – How efficiently he does other things – ditto

5 – What he has to pay for inputs used in learning – prices

6 – What he has to pay for inputs used in other activities – ditto

7 – How hard studying is for him – its use of his limited energy (a specific

      component of No. 3)

8 – How hard other activities are for him – ditto

9 – How much he earns or expects to earn from studying – its wage rate

10 – How much he earns or expects from other activities – ditto

11 – When the satisfactions of studying accrue to him – immediately or with a

      delay.

12 – When the satisfactions of other activities accrue – ditto

13 – How he feels about the present and the future – his discount rate and/or "impatience" or "delayed gratification" and any myopia that will induce problems of self-discipline.

14 – Whether the satisfactions of studying are intrinsic – the pleasure of

      learning, per se, ("the life of the mind") -- or extrinsic and instrumental.

15 – Whether learning is seen as an "investment" activity that affects the production of other activities (like making it easier to read a magazine or enjoy an opera).

16 – Whether the satisfactions of the activity are those of <u>doing</u> <u>it</u> (process utility) or of <u>having</u> <u>done it</u> (goal utility) and, if those are in conflict (as in struggling with an addiction), his ability at self-control.

17 – His total (exogenous) endowments of energy and unearned income (high-energy people and wealthy people and sick people and financial aid people).

Finally, it seems useful that in generating a description of the generic "activity a," the model forces attention to <u>which</u> activities we expect to see influenced by "an academic peer effect." Some are obvious (studying) while some aren't (late night bull sessions). But most basic would seem to be whether we are thinking of outcomes as activities, like studying, or outcomes as results, like grades or the accumulation of human capital and skills for future use. If it's the latter, we need a bit more complicated model that includes an "investment function" that describes how the individual turns the learning activity into human capital and how that human capital is to be measured or observed. Models of this sort have been used to analyze addiction and self-control with that investment/outcomes feature.