

Citation Patterns in Instructional Development Literature

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Abstract. The field of instructional development is diverse in both its foundations and practice. Within the field there are a number of different approaches. This article reports on a study of the citations in the ID literature that identifies patterns among those citations. Those patterns, referred to as invisible colleges, represent groups of individuals who are linked by a common set of ideas or a common approach. Authors who are repeatedly cited together form the hub of these invisible college networks and exert the most influence. This particular study found eight invisible colleges in the ID field and ten authors who seem to dominate the literature. As a whole, the ID literature was weakly based on previous work and included a great many reports from developers working on their own ideas with little regard for the work of others that had gone on before.

Introduction

Instructional development has a reputation as a diverse field. Its foundations are drawn from educational psychology, instructional technology, communication, curriculum, systems development, and many other disciplines. Its applications are equally diverse. There is development for higher education, for medical education, for industry, and for the military. There are one-person instructional development units and service agencies staffed with instructional designers, instructional developers, faculty developers, and evaluators. All of this diversity comes together under the label of instructional development.

Given such diversity, it would be reasonable to expect a variety of foci, "schools of thought," lines of research, or approaches to the practice of ID. There would be groups or clusters of developers whose common link would be that their work or approach is based on particular seminal ideas. These groups, and the networks linking the individuals, have been referred to as "invisible colleges" (Crane, 1972). Within such invisible colleges there is a high degree of indirect linkage through the most productive members. The common ideas or approaches followed by group members are defined and refined in the writings of these productive members. So, while all members may not be sharing information directly with each other, they are linked by the information appearing in print. Therefore, the members who publish exert the most influence on the network. It is not unlike the process by which graduate students are influenced by their major professors. This article reports on a study redesigned to identify the invisible colleges in the instructional development field.

The Importance of Invisible Colleges

The invisible colleges within a discipline are very important in the dissemination of new knowledge and the development of the discipline. Crane (p. 54) reports tentative findings that the absence of an effective invisible college can inhibit development of a field due to lack of theoretical emphasis, lack of ties with other work, and lack of replication. Lindquist (1978) also stresses the importance of linkages in the spread and adoption of new ideas and innovations. In fact, the role of opinion leaders and significant others is well established in the literature on change, dissemination of innovations, and knowledge utilization.

Though there have been quite a few efforts at reviewing the instructional development literature in terms of

theoretical or practical foundations (e.g., Braden 1981; Durzo, Diamond, & Doughty, 1979; Reigeluth, 1983; Sachs & Braden, 1984), none of these works have studied the linkage between the key authors or the seminal ideas. Typically, these literature reviews have represented their authors' viewpoints of what could or should be of importance. The exception is the research by Sachs and Braden, but that work was limited to several studies involving only books in the field.

If instructional development is more than just an art—more than just the practiced judgment of its developers—there should be evidence of this in its journals. Articles should build upon each other. Useful theories should be developed into successful models and strategies. The better ideas and authors should be cited in the literature most frequently, and over the longest period of time. Invisible colleges should exist around the works published by these authors. If, in fact, invisible colleges do not exist in the instructional development field and there is no linkage among authors through their ideas, then the literature on the field would represent little more than piecemeal reports from developers working on their own ideas with little regard for the previous work of others.

Identifying Invisible Colleges

One method of identifying the invisible colleges that exist in the field is to identify the authors of the seminal ideas or common threads that link groups of developers. Authors of the most useful theories and approaches would be cited most often in the reference lists of published articles.

Though it cannot be determined from the citation alone whether a particular reference is being used to support a particular line of work or whether the work is attempting to refute the cited reference, recurring patterns of citations (particular authors being cited together in several different reference lists) would

suggest that some group with a common link exists. This pattern of citations would be an artifact or indicator of an invisible college. Identifying invisible colleges in this way would not provide a list of all the group "members." Instead, it would provide a list of those authors whose works provide the theoretical underpinnings influencing that group of developers. These authors would be at the hub of the particular invisible college's network; they would be the ones exerting the most influence. It is not the quantity of work that is important. It is the number of different articles in which a person is cited that indicates the amount of influence.

The Study

To identify the invisible colleges within the ID field, a study was designed to answer four questions:

1. Are there patterns among the citations in ID journals that would suggest the existence of invisible colleges?

2. Who are the most cited authors? (Their work would represent the most useful ideas and they would most likely be at the hub of the invisible college networks.)

3. What invisible colleges exist in the ID field? (What are the patterns?)

4. Is the literature of the field well connected and developing in a systematic way? (Do articles build on previous work?)

To answer these questions, citations were examined from the *Journal of Instructional Development (JID)* and *Performance and Instruction Journal (P&I)*.

JID and *P&I* were chosen because they are the products of the two major professional organizations serving developers, the Division for Instructional Development of the Association for Educational Communications and Technology (AECT) and the National Society for Performance and Instruction (NSPI) respectively. Also, the journals are somewhat different in approach and readership. There are differences in the percentage of articles with citations; and, as shown in Figure 1, the authors of articles that appear in each journal tend to be from different kinds of settings. Three years of each journal were analyzed. Since *JID* publishes quarterly and *P&I* ten times a year, the number of issues of each in the study is different. The number of articles and the overall frequency of citations are shown in Figure 2.

Figure 1

Most Frequent Institutional/Organizational Employers of ID Article Authors

Journal of Instructional Development

Rank	Employer	Articles	Reviews
1	Syracuse University	7	
2	Florida State Univ.	5	
3	Indiana University	4	
	Michigan State Univ.	4	
4	San Diego State Univ.	3	
5	Brigham Young Univ.	3	
6	Governors State Univ.	2	
7	Arizona State Univ.	2	
	Bell System Center	2	1
	U.S. Navy	2	1
	Rochester Inst. of Tech.	2	1
8	GTE Automatic Electric	2	
	McDonnell Douglas	2	
	U of NC at Wilmington	2	
	Univ. of Illinois	2	
	Univ. of Minnesota	2	
9	Virginia Tech Univ.	1	2
10	East Texas State Univ.	1	1
	Harmon Associates	1	1
	Univ. of So. Calif.	1	1
	(Independent consultants)	0	0

Performance and Instruction Journal

Rank	Employer	Articles	Reviews
1	Indiana University	12	13
2	Univ. de Montreal	9	
3	Advanced Systems, Inc.	6	3
4	Bell System Center	6	2
5	C & P Telephone Co.	6	
	The American College	6	
6	Florida State Univ.	5	
7	New England Telephone	4	1
8	A T & T	4	
	Brigham Young Univ.	4	
	Operants, Inc.	4	
	San Diego State Univ.	4	
	Texas Tech Univ.	4	
9	Arthur Andersen Co.	3	2
10	Univ. of Georgia	3	1
	(Independent consultants)	31	1

Every individual cited in a footnote, reference note or reference list was entered into a computer file each time their name appeared. Where a cited work was authored by more than one individual, each co-author was entered separately. Editorial columns or introductions, association news and brief letters to the editor were excluded unless they contained a reference list. The authors of the articles in these journals were not added to the list unless they appeared as a citation. When all the citations had been entered for each journal, the file was sorted to produce an alphabetical listing of all the citations. To correct for editorial or author errors, names with similar initials or spelling were checked to be sure each individual cited was given appropriate credit for all the times citation was intended. From this corrected list, frequency of citation was calculated for each individual.

To identify patterns among the cited individuals, a network analysis was conducted for each journal using those individuals cited in at least five different articles in that journal. Five was chosen as the cutoff number for several reasons. This number represented the top end of the citation distribution; and, since these individuals were the most frequently cited, they were the most likely to be at the hub of any networks (invisible colleges).

To test whether these patterns were meaningful, rather than just coincidental, the citations of those cited in four articles were analyzed in the same way as those more frequently cited to determine how well they fit the existing patterns. A good fit, in terms of invisible colleges, would find these less frequently cited individuals loosely connected to the existing networks rather than forming any new networks.

The Network Analysis Procedure

Traditional network analysis is based on reports of reciprocated two-way communication from the subjects in the network under study (Farace, Monge, & Russell, 1977; Richards, 1976; Rogers & Agarwala-Rogers, 1976). Since this type of report was not possible in the present study and since the intent was to establish patterns of citation (which is really one-way communication) rather than reciprocated or two-way communication, a slightly different approach was taken. In this study, the network analysis was based on the number of times each of the frequently cited individuals was cited with another of the

frequently cited individuals in the same article. This is not meant to imply that these two individuals communicated with each other. It only means that both communicated through the cited materials with the author of the article. If the two appear linked over and over, it would represent a pattern of influence that would suggest the existence of an invisible college.

The numbers of times individuals were cited in the same article were displayed in matrix form. By manipulating the positions of each individual in the matrix it was possible to arrive at a final matrix in which groups of individuals frequently cited together clustered along the diagonal. It took a number of manipulations to reach a final "best" matrix where the number of off-diagonal contacts was at a minimum. For a discussion of the matrix manipulation process, see Richards (1976).

The exact membership of each group that appears in the final matrix for each journal was determined by applying criteria from the literature on organizational communication and network analysis (Farace et al., 1977, p. 185-186).

1. Some minimum of communication with others in the group (usually more than 50% so that individuals can only be members of one group—though may have direct links to others).
2. All members can be reached directly or indirectly.
3. No single individual can be removed and cause the group to break into smaller groups.
4. Small number of members in each group.
5. At least three members in each group.

After groups were identified using these criteria, individuals serving as bridges, liaisons, and isolates were identified. Bridges are individuals who belong to one group and who have contacts with another group. Liaisons are individuals who do not belong to any one group, but who have contacts with two or more groups. Bridges and liaisons are essential in a network of groups to make sure information flows among the groups. Isolates are those not part of a group and who do not function as bridges or liaisons.

The networks of each journal's citations were also compared by examining how well members of groups and how well groups themselves were linked to each other, and how much one or more members or groups dominated the network.

Findings

The most frequently cited individuals in each journal are shown in Figure 3. Of the 42 individuals frequently cited, 10 were cited in at least 5 articles of both journals during the three year period under study. The frequently cited individuals for each journal are shown in matrix form in Figures 4 and 5. Each matrix has been arranged so that groups of individuals frequently cited in the same reference list are clustered along the diagonal. While the matrices show the actual number of different reference lists in which each pair of individuals were cited together, only when that pair was cited together two or more times was it considered significant. Each group is listed in Figure 6 and is circled on the matrix along with bridge and liaison linkages.

Each journal's frequently cited individuals form four groups or invisible colleges. The groups in *JID* are somewhat more weakly defined than in *P&I*. Though Group A from *JID* appears too weak or too small to meet the criteria for a group, it is included because its membership increases when those cited in four articles are included. *JID* groups B and C could be considered as sub-groups of Group D. However, there are significant differences in the patterns that differentiate Groups B and C, so the three are treated as discrete groups.

The individuals in Group D are so widely cited or dominant, that they serve as bridges between Groups D and B, and between Groups D and C. In addition, all the members of Group C have at least one contact each with Group B; and, from Group B, Andrews, Wager, Briggs, and Glaser have at least one contact each with Group C. So, there are many possible channels for ideas and information to flow among these three groups. Within the groups, with only a few exception, there is a great deal of direct linkage among individuals. Group A, on the other hand, is not as well connected to the network. Gilbert and Glaser are bridges between Groups B and A; there is no link between Groups A and C; and Dick the only bridge between Groups D and A.

The analysis for *P&I* is much easier. The differentiation among groups is much clearer and all the groups are strong enough to stand on their own. One reason for this clearer picture is that the groups are less well connected. The bridges form weak links, having few contacts outside their own group. Gagne and Ausubel are the only bridges between Groups F and H. Gagne, Briggs, Dick, and P. Merrill are the only bridges between Groups G and H. Gilbert is the only bridge between Groups F and G. Group E is not linked to the other groups at all. None of the members of Group E are among those individuals cited in *JID*. Three individuals are somewhat isolated in this network: Toffler, Knowles, and Swanson. All have one significant link to a group, but that is hardly enough to really qualify for group membership, given the high degree of direct linkage among all the other individuals in each group. Four individuals are totally isolated: Dodge, Hartley, Kirkpatrick, and Skinner. Each exerts influence, but not in conjunction with any of the other frequently cited individuals.

In the subsequent analysis of individuals cited in four articles, the findings supported the patterns found in the analysis of the more frequently cited authors. No new groups emerged. All of the less frequently cited individuals fit within the existing networks or had no links at all.

Of the 24 individuals cited in 4 *JID* articles, 10 had strong links to the existing groups, 7 had weak links, and 7 were isolates. Of the 25 individuals cited in 4 *P&I* articles, 5 had strong links to the existing groups, 5 had weak links, 14 were isolates, and 1 was a liaison between existing groups. This data supports the existence of invisible colleges where the more influential members are at the hub of the network and are more strongly connected to the other members than those who are less influential.

Discussion

Based on the patterns that exist among the citations in the two journals studied, it appears that there are invisible colleges within the ID field. While it is hard to say how many of these colleges there should be due to the diversity of the field, the relatively small number of groups and the differences between the groups found in the two journals suggest a very weakly connected field. In *JID* there were more than 1,000 different individuals cited among the 1,917 total names cited; yet, only 25 in-

Figure 2
Number of Articles and Overall Frequency
of Citations in Selected ID Journals

	JID	P&I Journal
Dates of issues included in study	Sp 80—W 83	June 80—May 83
Total number of issues included	12	30
Total number of articles	72	321
Total number of reviews	18	34
Number of articles with citations (% of total articles)	58 (81%)	182 (57%)
Number of reviews with citations	3	0
Total number of names cited (includes duplications)	1,917	2,205
Number of individuals cited in five or more articles	25	27
Number of articles that cite at least one of the individuals cited in five or more articles	39	86
(% of total articles with citations)	(67%)	(47%)

Figure 3
Frequently Cited Individuals Ranked by
Journal and Number of Articles
in Which Cited

Journal of Instructional Development		Performance and Instruction Journal	
Individual	No. of Articles		
R.M. Gagne*	15	R.M. Gagne*	14
M.D. Merrill*	13	T.F. Gilbert*	13
R.A. Kaufman*	10	R.F. Mager*	10
L.J. Briggs*	9	L.J. Briggs*	10
R.D. Tennyson	9	R.A. Kaufman*	9
J.S. Bruner	8	D.P. Ausubel*	8
R.F. Mager*	7	M.S. Knowles	8
F. Glaser	7	J. Hartley	7
S.M. Markle	7	B.F. Skinner	7
D.P. Ausubel*	7	I.K. Davies*	7
R.M. Diamond	6	P.F. Merrill*	7
L.A. Goodson	6	M.E. Smith	6
J.J. Durzo	5	J.P. Campbell	6
T.F. Gilbert*	5	M.D. Dunnette	6
P. Pipe	5	M.D. Merrill*	6
D. H. Andrews	5	M.L. Fleming	6
W.W. Wager	5	W.H. Levie	6
R.K. Branson	5	A. Toffler	6
P.F. Merrill*	5	H.D. Stolovitch	6
L.B. Resnick	5	J.H. Harless	6
I.K. Davies*	5	R.E. Snow	6
N.D. Wood	5	R.A. Swanson	6
B.G. Wilson	5	B.J. Dodge	5
W. Dick*	5	D.L. Kirkpatrick	5
E.L. Baker	5	E.E. Lawler	5
(30 others)	4	C.M. Reigeluth	5
		W. Dick*	5
		(26 others)	4

* Frequently cited in both journals

Figure 4
 Number of *Journal of Instructional Development* articles in which frequently cited individuals are cited in the same reference list

Cited Person	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1. J.J. Durzo	8	3	2		1				1			1			1					1				1	
2. R.M. Diamond	3	11	2						1			2			1	1		1		1	1		2		
3. T.F. Gilbert	2	2	11	3	4				3	1	1	1								1	1		1	1	
4. P. Pipe		3	14	5			1	1	3	1	2	1							1	2	1	1	2	1	
5. R.F. Mager	1		4	5	17			2	3	1	3	1		1				1	1	2	1	1	4	2	
6. D.H. Andrews						18	2	2		5	1	1	1	1	1	1	2	1	1	2	2	1	2	3	1
7. W.W. Wager				1		2	18	3	2	3	3	3	1	1	1	2		1	1	3	4	3	3	3	
8. R.K. Branson				1	2	2	3	18	2	3	3	2	2	1	1	1		2	2	3	2	3	3	3	
9. R.A. Kaufman	1	1	3	3	3		2	2	21	1	3	2	1	1	1				2	3	3	4	3	1	
10. L.A. Goodson				1	1	5	3	3	1	20	2	2	1	1	1	1	1	1	2	2	2	2	2	3	1
11. L.J. Briggs				1	2	3	1	3	3	3	2	20	2	2	1	1	1		2	4	5	2	9	4	1
12. R. Glaser	1	2	1	1	3	1	3	2	2	2	2	24	2	2	3	2	4	1	3	5	6	4	5	3	1
13. P.F. Merrill					1	1	1	2	1	1	2	2	2	2	2	3	2		4	5	4	3	4	2	
14. L.B. Resnick					1	1	1	1	1	1	1	3	2	18	1	3	2		2	2	3	2	3	4	1
15. I.K. Davies	1	1			1	1	1	1	1	1	1	2	2	1	11	2	1		3	2	2	2	2	1	
16. N.D. Wood		1					2	1	1	1	1	4	3	3	2	20	2		1	4	5	2	4	3	1
17. B.G. Wilson						2					1	1	2	2	1	2	13		1	3	4	1	2	2	
18. S.M. Markle		1			1	1	1			1	3			2	1	1			16	1	5	1	2	2	1
19. D.P. Ausubel				1	1	1	1	2	2	2	2	5	4	2	3	4	3		1	20	5	5	5	2	
20. M.D. Merrill		1	1	2	2	2	3	2	3	2	4	6	5	3	2	5	4		5	5	23	7	6	9	3
21. R.D. Tennyson	1	1	1	1	1	2	4	3	3	2	5	4	4	2	2	2	1		1	5	7	18	4	7	1
22. J.S. Bruner				1	1	1	3	2	3	2	2	5	3	3	2	4	2		2	5	6	4	21	4	1
23. R.M. Gagne				1	2	4	2	3	3	4	2	9	5	4	4	2	3	2		2	5	9	7	4	1
24. W. Dick	1	2	1	1	2	3	3	3	3	3	4	3	2	1	1	2			1	2	3	4	2	4	2
25. E.L. Baker		1				1			1	1	1	1				1			1	3	1	1	1	2	13

Note: Total individuals from matrix that each individual is cited with is shown along the diagonal.

Figure 5
 Number of *Performance and Instruction Journal* articles in which frequently cited individuals are cited in the same reference list

Cited Person	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
1. B.J. Dodge	4																		1						1	1	1	
2. J. Hartley		2										1	1															
3. D.L. Kirkpatrick			5				1	1	1									1	1									
4. B.F. Skinner				8	1		1	1								1				1		1	1	1				
5. E.E. Lawler				1	10	1	4	4						1		1			1		1			1			1	
6. M.E. Smith				1	1	8	2	2							1			1		1			1					
7. J.P. Campbell				1	1	4	2	11	6					1		1			1		1			1			1	
8. M.D. Dunnette				1	1	4	2	6	10					1		1			1		1			1				
9. I.K. Davies										13	1	1	2	2	1	2	1	1	1	1	1	1		1			1	
10. C.M. Reigeluth										1	10	4	2	2				1		2	1	1	1					
11. M.D. Merrill										1	4	12	2	2			1		1	2	1	1	1	1				
12. M.L. Fleming										1	2	1	11	5				1		1	1	1		2			1	
13. W.H. Levie										1	2	2	5	11				1		1	1	1		2			1	
14. A. Toffler					1		1	1	1	1				8		2	1	1	1									
15. H.D. Stolovitch															4	2	1	1	2	1								
16. T.F. Gilbert				1	1	1	1	1	2			1		2	15	2	4	2	2		1				1			
17. J.H. Harless									1					1	2	7	4	3	2		1							
18. R.A. Kaufman				1						1	1	1	1	1	1	4	4	15	2	4	2	1		1				
19. R.F. Mager				1		1	1	1	1					1	2	2	3	2	16	1	3	1	2	1	1			
20. P.F. Merrill				1						1	1	1	1	1	1	2	2	4	1	15	4	2	1	2				
21. R.M. Gagne				1	1	1	1	1	1	2	2				1	1	1	3	4		20	4	9	5	2		1	
22. W. Dick										1	1	1	1	1				1	2		11	3	2					
23. L.J. Briggs				1						1	1							2	1		9	3	10	4	4		2	
24. D.P. Ausubel				1						1	1	1	2	2				1	1	2	5	2	4	16	3		2	
25. R.E. Snow				1	1	1	1	1	1						1				1		2	4	3	13			1	
26. M.S. Knowles										1		1	1													2	6	1
27. R.A. Swanson					1		1														1	2		1	1	1	7	

Note: Total individuals from matrix that each individual is cited with is shown along the diagonal.

Figure 6
Groups of individuals frequently cited
together in reference lists

Journal of Instructional Development	Performance and Instruction Journal
<i>Group A</i> J.J. Durzo R.M. Diamond T.F. Gilbert*	<i>Group E</i> E.E. Lawler M.E. Smith J.P. Campbell M.D. Dunnette
<i>Group B</i> T.F. Gilbert* P. Pipe R.F. Mager* D.H. Andrews W.W. Wager R.K. Branson R.A. Kaufman* L.A. Goodson L.J. Briggs* R. Glaser	<i>Group F</i> I.K. Davies* C.M. Reigeluth M.D. Merrill* M.L. Fleming W.H. Levie
<i>Group C</i> P.F. Merrill* L.B. Resnick I.K. Davies* N.D. Wood B.G. Wilson	<i>Group G</i> H.D. Stolovitch T.F. Gilbert* J.H. Harless R.A. Kaufman* R.F. Mager* P.F. Merrill*
<i>Group D</i> S.M. Markle D.P. Ausubel* M.D. Merrill* R.D. Tennyson J.S. Bruner R.M. Gagne* W. Dick* E.L. Baker	<i>Group H</i> F.M. Gagne* W. Dick* L.J. Briggs* D.P. Ausubel* R.E. Snow
	<i>(Isolates)</i> B.J. Dodge J. Hartley D.L. Kirkpatrick M.S. Knowles B.F. Skinner R.A. Swanson A. Toffler

* Frequently cited in both journals

dividuals were cited in 5 or more articles (and only another 24 were cited in 4 articles). That means that less than five percent of all those cited appeared more than two times. In *P&I* there were more than 1,400 different individuals cited among the 2,205 total names cited. Of these, only 27 were cited in 5 or more articles (and only another 25 were cited in 4 articles). That represents less than four percent of all those cited. Furthermore, more than 30% of the articles in *JID* and more than 50% of the articles in *P&I* did not cite any of the most frequently cited individuals.

In spite of the rather poor linkage in the field as a whole, the patterns which do exist are important. The invisible colleges that were identified exert an influence on a sizeable number of developers. At least one of those individuals cited in 5 or more articles was cited in 67% of the *JID* articles with citations and 47% of the *P&I* articles with citations. Of the 47 individuals cited in 5 or

more articles, 10 seem to dominate both lists (see Figure 3). These are key individuals in the field, and if there is a core of theory or accepted practice, it probably exists in their work.

Another way in which the patterns of citation found in this study are important is in the differences found between the two journals. While there is overlap of some individuals, the groups and amount of linkage are very different. The groups in *P&I* are very loosely connected and of the 27 frequently cited individuals, 7 (26%) are isolated from the groups. One of the groups identified in *P&I* was composed completely of members never cited in *JID*. These findings suggest that the *P&I* audience—more weighted toward developers in business and industry—finds the work of different people or different parts of those people's work useful. The theories, paradigms, or models of most interest or use in higher education may not adequately cover all the conditions faced in

other settings, and vice versa. A closer look at the exact nature of the citations involved is necessary to explain the differences and their implications.

While the invisible colleges exert an influence on directions in which the field is moving, there are a great many others influencing the field in piecemeal fashion. Many developers seem to work on their own ideas without benefit of work that has gone on before. Perhaps it is as Shrock and Coscarelli (1981) suggest that instructional development is an art, a craft, and a science. ID is somewhere in between art and science; and the interactions of the human elements of developer and client, the setting, the subject matter, and the student may always leave a gap that cannot be fully covered by scientific principles. If this is the case, then individual initiative and creativity will always be present in the literature. Based on the findings from this study, the literature in *JID* and *P&I* are reporting more of the art and less of the science of instructional development. Where the field is advancing systematically, it seems to be primarily following the directions set by the 8 invisible colleges identified in this study, and perhaps to a lesser extent, the other frequently cited individuals.

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