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The Significance of Disciplinary Differences

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ABSTRACT *Although it is evident that disciplines have their distinctive cultural characteristics, this consideration tends to be largely overlooked in research into, as well as policy-making within, higher education. The paper aims to draw attention to some of the resulting inadequacies in analysis and to explore their consequences. After offering an overview of the various disciplinary cultures, it examines different facets of academic activity at the macro, meso and micro levels and suggests that in each case the differences between disciplines are important enough to merit general recognition. The author concludes with a brief speculation on why the issue is so widely neglected.*

Introduction

The central concern of this paper is to explore some of the key distinctions between different disciplines, and the implications of such distinctions for higher education research, policy and practice. It is arguable that disciplines are the life-blood of higher education: alongside academic institutions, they provide its main organising base (Clark, 1983) and its main social framework. This makes it the more puzzling that they figure so modestly in much higher education research. There are notable exceptions, some of which will shortly be mentioned. The arguments in this paper, however, derive mainly from two long-term empirical investigations undertaken by the author. The first, which occupied most of the period from 1980 to 1988 (Becher, 1989), involved a study of research norms and practices in 12 contrasting disciplinary fields (biology, chemistry, economics, engineering, geography, history, law, mathematics, modern languages, pharmacy, physics and sociology). The second, which began in 1988 and was completed in 1993, focused specifically on the issue of graduate education in six of the same fields. Altogether, some 350 in-depth, semi-structured interviews with academics and research students provided the main data for the two studies.

The outcomes of these enquiries suggest, among other things, that knowledge communities can usefully be categorised at four different levels of generality. First, there is the broad level of the academic profession as a whole. Even though, as Bailey (1977) notes, universities are composed of different tribes, they nevertheless operate as "a community culture":

Each tribe has a name and a territory, settles its own affairs, goes to war with others, has a distinct language or at least a distinct dialect and a variety of symbolic ways of demonstrating its apartness from others. Nevertheless the whole set of tribes possess a common culture: their ways of construing the world and the people who live in it are sufficiently similar for them to be able to understand, more or less, each other's culture and even, when necessary, to communicate with members of other tribes. Universities possess a single culture which directs interaction between the many distinct and often mutually hostile groups.

TABLE I. Broad disciplinary groupings

Biglan	Kolb	Disciplinary areas
Hard pure	Abstract reflective	Natural sciences
Soft pure	Concrete reflective	Humanities and social sciences
Hard applied	Abstract active	Science-based professions
Soft applied	Concrete active	Social professions

Harman (1990), too, notes in her cultural study of the University of Melbourne that “Detected from an emerging babel of conflicting voices, divergent interests and divided loyalties, were aspects of a common culture which encapsulated a deeply entrenched, ‘unwritten’ occupational ethos”.

But if one examines this community in more detail, it is possible to discern with Biglan (1973) and Kolb (1981), four main intellectual clusters, which Biglan labels hard pure, soft pure, hard applied and soft applied, and Kolb describes as abstract reflective, concrete reflective, abstract active and concrete active. In each case these divisions are identified respectively with the natural sciences, the humanities and social sciences, the science-based professions and the social professions (see Table 1). The coincidence of their analyses is significant, given that Biglan’s initial concern was with the nature of the subject-matter of research, while Kolb’s was with styles of intellectual enquiry.

Within this fourfold typology one can further distinguish the separate disciplines and professional groupings. Here, though there are some tricky borderline cases, there is also a very significant consensus about what counts as a discipline and what does not. While some analysts (e.g. Toulmin, 1972) focus on epistemological considerations, presenting disciplines as each characterised by its body of concepts, methods and fundamental aims, and others such as Whitley (1984) define them as organised social groupings, most agree with Price (1970) in seeing both elements as essential—“we cannot and should not artificially separate the matter of substantive content from that of social behaviour”.

Below the level of the discipline, there remains the important category of subdisciplinary specialisms, with their own more closely-knit but constantly shifting communities. Bucher & Strauss (1961) characterise them as “loose amalgamations ... pursuing different objectives in different manners and more or less delicately held together under a common name at a particular period in history”. It is at least arguable (Becher, 1990) that an understanding of the characteristics of such subspecialisms is essential to an appreciation not only of their parent disciplines but also of interdisciplinarity and of the phenomena of intellectual change and development.

However, the discussion which follows will be limited to the second and third levels of analysis—namely the four broad intellectual groupings mentioned earlier and the separate disciplines and professional fields of which they are comprised. Before embarking on the detail of the argument, it may be useful to make a further preliminary comment on the concept of culture and the notion of a discipline.

In its technical sense, culture is to the anthropologist a fundamental concept. It embodies the traditional and social heritage of a people; their customs and practices; their transmitted knowledge, beliefs, law and morals; their linguistic and symbolic forms of communication and the meanings they share. As Bailey (1992) puts it, “a culture ... is a set of mental constructs that may serve to guide or justify conduct between people, and to tell them how to use things ... it may also tell them how to get from what is to what should be; that is, in one of its aspects culture is a plan for coping with the world”.

This rich notion has necessarily to be weakened into metaphor when the subject of study is one part of the way of life of a group of twentieth century academics, rather than the total world view of a relatively isolated primitive community. However, the concept of culture as developed in social anthropology does have considerable relevance to the understanding of higher education. As the well-known American anthropologist Clifford Geertz (1976) pointed out, "to be a Shakespearean scholar, absorb oneself in black holes, or attempt to measure the effect of schooling on economic achievement—is not just to take up a technical task but to place oneself inside a cultural frame that defines and even determines a very great part of one's life". I have argued at some length elsewhere (Becher, 1989) that disciplinary groups can usefully be regarded as academic tribes, each with their own set of intellectual values and their own patch of cognitive territory. Anthropologists commonly make a distinction between cultural and structural elements, the latter including status differences, relationships and boundaries—but in what follows the term 'culture' will be used in its broader, more everyday sense to include both culture and structure.

Knowledge Fields and Cognitive Communities

The cultural aspects of disciplines and their cognitive aspects are inseparably intertwined. The pattern of relationships is complex, and few of the connections are unconditional. Both individual and group behaviour can be affected by factors outside the field of knowledge itself. In certain cases, moreover, a cultural phenomenon may best be understood in terms of an arbitrary convention. But in very many instances, disciplinary practices can be closely matched with the relevant characteristics of their associated domains of enquiry. Simply to illustrate the point, Table II offers a sketch, within the framework of broad disciplinary groupings, of the kind of correlation one might expect to find between the nature of knowledge domains and the nature of the associated disciplinary cultures.

The linkage becomes noticeably close at the level of individual disciplines and closer still when the analysis is in terms of subdisciplinary specialisms. Thus, for example, the close-knit epistemological structure of high energy physics research is mirrored by the fast-moving, competitive, densely populated—one might say urban—research community associated with that field. Equally, the loosely-structured intellectual arenas of modern languages are reflected in the leisurely uncompetitive pace and scattered rural societies of the related specialist groups.

However, this isomorphism between knowledge fields and knowledge communities is not the only significant feature of the study of disciplinary cultures. Another important characteristic is their high degree of universality. Disciplinary cultures, in virtually all fields, transcend the institutional boundaries within any given system. In many, but not all, instances they also span national boundaries. That this is the case can be seen through the existence of national, and often international, subject associations which embody collective norms and exercise an informal control on undergraduate and graduate curricula, as well as providing a shared context for research. It can also be observed in the easy mobility of academic staff from one institution to another; the common readership of academic texts (whether books or journals); the frequent informal communication between individuals in different geographical locations; the existence of international conferences; and the incidence of collaborative enquiry which involves researchers in more than one university (and often more than one country).

To say this is not to deny that there may be differences in research traditions, profiles of undergraduate programmes and the like between one national system and another, or that some fields (such as law, and to a somewhat lesser extent history) may have a more parochial

TABLE II. Knowledge and culture, by disciplinary grouping

Disciplinary grouping	Nature of knowledge	Nature of disciplinary culture
Pure sciences (e.g. physics): 'hard-pure'	Cumulative; atomistic (crystalline/tree-like); concerned with universals, quantities, simplification; resulting in discovery/explanation.	Competitive, gregarious; politically well-organized; high publication rate; task-oriented.
Humanities (e.g. history) and pure social sciences (e.g. anthropology): 'soft-pure'	Reiterative; holistic (organic/river-like); concerned with particulars, qualities, complication; resulting in understanding/interpretation.	Individualistic, pluralistic; loosely structured; low publication rate; person-oriented.
Technologies (e.g. mechanical engineering): 'hard-applied'	Purposive; pragmatic (know-how via hard knowledge); concerned with mastery of physical environment; resulting in products/techniques.	Entrepreneurial, cosmopolitan; dominated by professional values; patents substitutable for publications; role oriented.
Applied social sciences (e.g. education): 'soft-applied'	Functional; utilitarian (know-how via soft knowledge); concerned with enhancement of [semi-] professional practice; resulting in protocols/procedures.	Outward-looking; uncertain in status; dominated by intellectual fashions; publication rates reduced by consultancies; power-oriented.

Source: Becher (1987).

frame of reference than others. Ruscio (1987) has helpfully illustrated the point by using the biological analogy of a genotype and a phenotype:

the genotype represents the fundamental instructions to the organism and its potential for survival and growth; the phenotype represents the actual manifestation of that potential in a particular physical setting.

His research shows that, even between different institutions in the same system, the phenotypical variations can be substantial, but that one can nonetheless clearly identify genotypical cultures endemic to each discipline.

In what follows, attention will be given to a number of more practical considerations relating to research and policy in higher education which it is the main concern of this paper to adumbrate. These will for convenience be divided between the categories of macro, meso and micro enquiries, relating respectively to system-wide issues, those at the level of the institution, and those focusing on basic units and individuals.

The Macro Level

Comparative studies in higher education tend to focus on macro-level contrasts between the structures of one system and another. Few of them offer the kind of illuminating comparison between particular institutions in different countries which Friedburg & Musselin (1989) provide in their *En Quête d'Université*. Even fewer appear to have penetrated down to the level of individual departments, where a cross-national study can tell us interesting things about the differing patterns in the working lives of the inhabitants of academia in different countries and provide concrete and specific data about the common and contrasting factors which shape research profiles and graduate and undergraduate curricula. Clark (1993) offers one example of such an approach. If anything, enquiries of this kind should be made easier by the existence of a relatively common framework of disciplinary contents and conventions. Much as in the *Annales* school of history—which explores the commonplace of everyday existence, as against the more traditional history of rulers and revolutionaries and of wars between nations—studies of this kind would seem to offer an immediacy that many system-wide comparisons lack.

As in much comparative research, a consideration of disciplinary differences rarely figures in nationally-based macro-level enquiries in higher education. There accordingly remain some important issues to be explored in this arena. For example, the relationship of universities with society at large tends to be discussed in global terms: but such discussion is liable to conceal or overlook significant internal distinctions.

Even at the level of the four broad knowledge fields identified earlier, one can discern certain characteristic features of that relationship which affect the nature of research support. Academic enquiry in hard pure fields is liable to be expensive, giving rise to an effective lobby for fund raising; however, that very dependence on outside money lays any such field open to demands for social relevance and hence to what Elzinga (1985) has termed “epistemic drift”. Hard applied fields show a more diffused pattern of activity, with mainly pragmatic research criteria; but there is also a tendency to aim for increased status by favouring the more theoretical, less instrumental aspects of the domain—a form of “academic drift” (Neave, 1979) which is the counterpart to the epistemic drift already noted in the hard pure domain.

When it comes to soft pure enquiry, the outside world tends to view much scholarly work as lacking any wider social justification, and as neither needing nor deserving any significant financial support. In the more empirical social science disciplines, external factors may well

affect the pattern of research activity, but the impact of research on practice is seldom very direct. Within the soft pure domain as a whole, the tendency is towards individualised work, and subject-based interest groups which form a bridge to outside constituencies are correspondingly weak. The interplay between society and academia here is limited largely to the context of popular and moderately esoteric culture. Finally, soft applied activity presents a different pattern again. Because of their overlapping membership with the academic community, the relevant professional practitioners' associations often have a strong say in determining curricula as well as setting the agenda for research. Client groups may also in some cases seek to exert their influence. In general, perceived relevance is a strong criterion for determining funding support in this group of disciplines, which is thus particularly vulnerable to external pressure.

Such observations are themselves open to refinement, lumping together as they do a number of distinct disciplinary groups. They nevertheless serve to underline the point that interesting contrasts emerge once one explores phenomena below the macro level at which all such variations are homogenised. Leaving aside the temptation to chart in close detail the interrelationship between individual disciplinary groups and their external environment, it may be noted that one interesting dimension of this interrelationship concerns the opportunities for different university departments—the organisational embodiment, one might say, of academic disciplines—to engage in sponsored mid-career vocational training.

It is noticeable that in almost every institution the pace in developing such training is set by the departments of engineering and business studies: an unsurprising phenomenon, given the ready saleability of their wares and the extent of the existing contracts with their practitioner clients. The apparent reluctance of chemists to become involved calls for further investigation, in that they have traditionally quite strong links with industry. It is perhaps predictable that physicists are reticent, though biological scientists are less so; and as one might expect, many professional schools besides engineering contribute either directly or indirectly (through the individual 'moonlighting activities' of their members) to the post-experience training of the relevant practitioner groups. More unexpected examples of what might be called contract education include sponsored courses by philosophers on professional ethics, training in the management of historical sites by a department of economic history and cultural briefing courses provided by a department of oriental languages for businessmen planning to visit Japan (Becher, 1992).

Such non-traditional forms of teaching provision, incidentally, seem likely to have significant financial and curricular implications for the departments concerned—first in earning them surplus funds to enhance their research potential and second in bringing into the undergraduate programme up-to-date illustrations of contemporary professional practices. There is also some evidence to suggest an improvement in teaching techniques and staff motivation.

A comparable contrast can be observed between different disciplinary groups in relation to contract research, where departments in hard applied and soft applied areas are able to earn substantial funds by undertaking sponsored work, while faculty in hard pure areas tend to see this as low-status activity, and others against in soft pure domains seldom have any opportunity to contemplate the choice. The consequences in terms of academic working lives are evident enough. Those who involve themselves in such activities necessarily have closer contacts with the outside world, which they are able to exploit in a variety of ways, including offering their graduates a wider range of job opportunities and using additional earnings to improve departmental resources.

Two widely researched themes at the macro level are access studies and investigations of the labour market. Here again, an awareness of disciplinary distinctions is arguably of key

importance. Gender contrasts in higher education have been the subject of considerable recent attention. Yet leaving aside the useful contributions of Thomas (1990) and Evans (1988), there have been few attempts to examine the relationship between gender preferences and the characteristic cultures of disciplines. The large-scale rejection by women of scientific and technological subjects and their strong preference for the humanities is a source of concern in terms of equal opportunities. The issue might usefully be illuminated by close examination of the underlying cultural factors.

More generally, in systems such as that of the UK, where entry to higher education is to some degree competitive, the admission requirements differ markedly, not only between institutions (with Oxford and Cambridge at the top of the pecking order and some of the newly-designated universities towards the bottom) but also between individual subject fields. Places in business studies, history and English literature departments, for example, are heavily oversubscribed; those in mathematics, physics and engineering tend to have relatively fewer takers. This inevitably means that access to the latter group of subjects is much easier than to the former, in which even quite well-qualified candidates may not get a place. It would be interesting to explore whether the pattern of demand is at all similar in other European countries.

When it comes to graduate employment, the position—again in the UK—is neatly reversed. Physical scientists and mathematicians have relatively little difficulty, even in recession, in finding jobs; graduates in the humanities and even in business studies (which does not seem a greatly attractive degree to employers) may spend some time seeking a suitable post. And of course vocational programmes, such as medicine and law offer a strong guarantee of lifelong professional career. Boys *et al.* (1988) offer one particularly interesting study of how disciplines relate to labour market opportunities and how their epistemological and cultural characteristics affect the development of skills which are transferable into the work place. Research of this kind demonstrates in an effective way the benefits, even in macro-level enquiries, of attending to disciplinary differences.

The Meso Level

Similar benefits can be seen at the meso level, especially in studies of institutional management and in the development of evaluation procedures. There is a tendency—which a proper attention to disciplinary cultures can help to check—for administrators to lay down uniform specifications to be observed across the whole range of departments, even where these are clearly inappropriate. For example, areas for institutional growth and expansion may be identified by reference to high research earnings, even though the opportunities for these are not evenly distributed. Such a criterion would discriminate strongly in favour of expensive areas such as physics and equally strongly against low cost areas such as philosophy.

Again, staff promotions criteria based on numbers of published titles would have a clear bias in favour of chemistry (where it is common to publish several short papers in a year) and against history (where the norm is to produce substantial books rather than journal articles). Professional subjects, too, tend to have a low publication profile, because the academic staff concerned are expected to maintain their credibility through involvement in consultancies, or more directly in practice, at the expense of publishable research. Virtually every performance indicator for both research and teaching can in fact be shown to operate unevenly across the range of disciplines, leaving peer review as the only reasonably fair mechanism for performance evaluation.

The outcomes of managerial policies to enhance the efficiency of teaching and learning

have in the past often proved disappointing. Faculty development programmes, for instance, tend to lose credibility with their potential clients because of their discipline-independent approach. It is of course useful to put across to all academic teachers the basic principles of good lecturing—though even here, there is a world of difference between the techniques needed in, say, an anatomy course and one in literature. But beyond the limited area of common ground, there is a wide variety of different needs: seminar teaching in the humanities, overseeing field-work exercises in geography or biology, planning laboratory-based teaching in physics and chemistry, organising and supervising work placements in engineering, developing project-based activities in architecture and so on. It is difficult to see how faculty development can go beyond the most elementary level without a clear recognition that disciplinary cultures impose their own particular pattern in teaching as in other activities. Yet neither practice nor the evaluation of practice commonly takes account of such variations.

A similar problem arises with study skills programmes for students. Many of these, too, are general in nature and seen as of limited use by participants. As Bazerman (1981) points out, the whole mode of argumentation differs radically between such fields as biochemistry, English literature and the sociology of science. To begin fully to understand the subject, it is necessary to immerse oneself in the structure of its discourse: and that cannot be achieved by a few broadly-based sessions on how to write an essay. Other techniques commonly addressed in such courses include the development of rapid reading methods and the acquisition of bibliographical skills. Yet the former—rapid reading—is of notably less use to students of mathematics and philosophy than it is to prospective historians and sociologists, while the latter—bibliographical skills—are of much greater demand in the humanities than they are in professional subjects such as accountancy or nursing.

Curriculum design in its turn encounters quite distinctive needs across the range of subjects. There are certain principles in common, but—to take one instance—an objectives-based approach is much more easy to implement in a professional subject with clear-cut requirements than in a course which depends on an integrative understanding of complex interrelationships. Similarly, courses with a high factual content—as in certain areas of law—may appropriately be assessed by multiple choice tests; but the latter are entirely unsuitable for subjects such as sociology, where the emphasis tends to be on the need to decide between competing theories and to justify that decision. Again, pure and applied research on the topic tends to overlook these distinctions.

The Micro Level

At the micro level of activities within individual departments, there are also noticeable contrasts in the modes of both research and teaching. To take only a few examples, research in chemistry tends to involve teams comprising tenured staff, post-doctoral staff, doctoral students and technicians, and is of course heavily dependent on laboratory apparatus and accommodation. At the other end of the spectrum, research in mathematics typically involves a solitary researcher armed with no more than a desk, paper and pencil, and perhaps blackboard and chalk. Effective research training should necessarily take such differences into account. So should general studies of the nature of academic enquiry.

Similarly—as has already been implied in relation to study skills—patterns of student activity span a continuum from the heavily didactic in subjects such as law, engineering and medicine to the determinedly participative in modern languages and the creative arts. Students in the first group of subjects are liable to have full lecture timetables and to work long hours, but with relatively few individual assignments; in the second group, the pace is more leisurely, with relatively less timetabled time and more personal study commitments.

Such differences can be related partly to the social aspects of the discipline concerned ('we've always done it that way') and partly to their epistemological characteristics ('that's how it has to be—you can't understand it otherwise').

Graduate education in its turn clearly reflects such differentiation. Recent research (Clark, 1993) has shown that—at least the USA and the UK, though the pattern is somewhat different in some European countries—while doctoral students share many problems, there are also a number of subject-specific features of their programmes. Thesis topics in science are typically specified by the supervisor; in the humanities, there is a strong insistence on students making their own choice. When things go wrong in the sciences it may be because of difficulties with apparatus or because a particular technique does not work; in the humanities, the most common failings are lack of adequate definition of the research issue or an excess of data to analyse. Loneliness and a lack of adequate supervisory support are typical concerns of humanities graduate students; being used as a 'general dogsbody' is the main source of dissatisfaction for their counterparts in the sciences.

Another current area of interest at the micro level—an important component in the study of institutional management—is the role of the head of department. In the analysis of this issue too, it would seem impossible to overlook or brush aside disciplinary differences. There is a very significant contrast in both range and scale between the responsibilities on the one side of the head of a philosophy department of eight academics and a secretary and on the other of the head of a chemistry department of 30 or more academics and probably a comparable number of technical and secretarial staff, who is accountable for the equipment, provision and running of a number of teaching and research laboratories. It is perhaps understandable that, in the UK at least (Taylor, 1992), the choice of vice-chancellor or rector is increasingly made from science or technology, rather than the humanities or social sciences, on the grounds of relevant previous managerial experience.

If macro and meso research display a tendency to overlook the significance of disciplinary cultures, enquiries at the micro level would appear less prone to this limitation. The reason is simple enough; many such enquiries are focused on an individual department, and those who conduct them do not overtly make the assumption that there is no significant cultural or operational difference between one department and another. However, the specificity of their findings is not always acknowledged, and this encourages other researchers to draw wider conclusions from their work than the evidence should allow. An effective way of avoiding this difficulty is to extend the research base to cover more than one discipline, so that useful contrasts can be drawn. Ference Marton and his associates provide an excellent model for this approach, investigating student learning in settings as different as economics and engineering (See, for example, Marton *et al.*, 1984).

The Case of Discipline-focused Research

The arguments so far have attempted to show that an awareness of disciplinary cultures is helpful, and even in some cases essential, to the conduct of research and the development of policy in higher education. That is so at the macro level, which could be said to include comparative studies as well as studies, for instance, focusing on the relationships between universities and their external environment, on access problems, and on the labour market for graduates. At the meso level differences between disciplines, it was suggested, are relevant to enquiries into, and the development of, such themes as institutional management, staff evaluation, faculty development, study skills programmes and curriculum design. At the micro level, attention was drawn to variations in departmental practice in research and

teaching, including graduate education, and to the contrasting roles of heads of departments in different subject areas.

Given what could be claimed to be the pervasiveness of this theme of disciplinary cultures across the whole range of enquiry into higher education, it is tempting to make an even bolder assertion. If more researches were to take a disciplinary perspective fully into account, one could see the scope for better cross-fertilisation and a better sense of unity between them. What could be discovered, say, about the physics community as an international phenomenon at the macro level might well have direct relevance to micro level research in a single physics department. Similarly, micro level enquiries into patterns of teaching and learning in, say, modern languages, political science and social work could have a direct bearing on the development of performance indicators or of study skills programmes at the meso level of the institution. Seen in this light, disciplinary-focused research could provide an element of mutual coherence that is currently lacking in much of the work in this field.

It may be relevant, finally, to address the puzzling question which lies behind the apparent neglect so far among higher education researchers of the characteristic features of individual disciplines: features which distinguish them one from another, and—it could be claimed—play a significant part in the business of understanding what higher education is about. Let me put forward three rival hypotheses to explain the phenomenon.

The first is that, because higher education is a field of study, but not a discipline in its own right, researchers in that field are not naturally conscious of disciplinary issues. Moreover, like expatriates, most of them have abandoned their original context and cut themselves off from its characteristic way of life. It might be said that they lack a culture and therefore fail to discern one in others. A second hypothesis is that the kind of ethnographic detail implicit in studies of disciplines involves hard, painstaking work, and that many people find it easier to avoid this by keeping to a level of comfortable generality. The third is to do with the basic human need to rationalise and make orderly what look like messy phenomena.

Allison (1971) caught the latter tendency very well in his masterly study of the Cuban missile crisis: the common approach, as he showed, was to ascribe highly rational behaviour to all the key figures involved, even though alternative explanations based on bureaucratic action and micropolitical behaviour could be seen to be more appropriate. In the case of higher education, it is awkward to acknowledge that academic behaviour fails to conform to neat and consistent patterns—so those concerned may subconsciously tidy it up to represent a respectably neat field of study.

I offer no prediction about which, if any, of these hypotheses is correct, or about whether a quite different one would offer the best explanation. If other findings about higher education are anything to go by, the truth will be more complex than any straightforward correlation would allow. In any case, the question seems a fruitful one for investigation by higher education researchers currently looking for a topic. For others already actively engaged in research activity, it is to be hoped that the thesis advanced in this paper may at least suggest a possible added dimension to their work.

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