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Bruce G Charlton* and Peter Andras**

*From the *Division of Psychology and the *School of Computing Science,
University of Newcastle upon Tyne*

Correspondence to:
Bruce G Charlton MD
Reader in Evolutionary Psychiatry
Henry Wellcome Building
Medical School
University of Newcastle upon Tyne
NE2 4HH

Tel - 0191 222 6247
Fax - 0191 222 5622
e-mail - bruce.charlton@ncl.ac.uk

Summary

The multi-disciplinary modular (MDM) undergraduate degree — developed in the USA and now the norm in the UK - is well-adapted to the needs of modernizing societies. Modernising societies are characterised by increasing complexity and modularity of social organisation (Pokol, 1991; Luhmann, 1995; Charlton & Andras, 2003). This entails the need for increasing cognitive flexibility among the population. It is suggested that the main educational aim of university undergraduate study should be increasing students cognitive aptitude in flexible abstraction.

Flexible abstraction is defined as the ability to understand and reason according to the rules of many abstract systems, and the ability to switch flexibly between qualitatively different abstract systems. This is inculcated by requiring undergraduate students rapidly to master several dissimilar abstract academic systems sequentially and in parallel by means of MDM degrees. Flexible abstraction is increasingly necessary in modernizing societies which require people to switch frequently between modular social systems with different abstract structures (the family, the economy, politics, the legal system, education, health service etc.); and within the economy to undergo several enforced career changes or re-skilling during their working lives (Charlton & Andras, 2003).

There is a profound change involved in shifting from the educational ideals of the traditional single-discipline undergraduate degree to a university system based on MDM degrees. In particular, there are major implications for the curriculum such as the requirement that the module becomes the basic unit of academic discourse, and the principle that each module be designed and taught so as to inculcate abstract systematic knowledge. In simple terms, this means each module should typically be structured around a *theory* - the exposition and exemplification of this theory provides the coherence of the module and the basis for examining student attainment.

The essential difference between a traditional single disciplinary degree and an MDM degree is that the traditional degree provides a vocational systematic education in understanding a specific *subject*, while the MDM degree provides pre-vocational training in the *process* of understanding systems.

Introduction

The following essay views the undergraduate degree from a perspective of the needs of a modernising society - that is, a society based upon continuous growth, including continuous growth of knowledge and capability (Pokol, 1991; Luhmann, 1995; Charlton & Andras, 2003). We are therefore considering the 'social function' of undergraduate education: the function of the undergraduate degree as seen by an observer *external* to the education system. The social function of undergraduate education is different from the function as perceived by such insiders of the educational system as the university teacher or the student.

Multi-disciplinary modular (MDM) degrees in mass higher education

Most UK, especially English, university graduates throughout the twentieth century studied either for single-discipline degrees such as Mathematics, History, English or Biology; or else professional degrees such as Medicine, Law or Engineering. But it was the single-discipline degree, aiming to provide 3 years of cumulative and integrated specialist knowledge, which provided the ideal of what a university education ought to be. These traditional degrees were sometimes used as general educational qualifications, but were essentially vocational qualifications — in the sense that university funding arrangements and graduate career expectations indicate that their function was providing a specialist preparation for grammar school teaching (Charlton & Andras, 2002). In other words, single discipline degrees mainly functioned to prepare university graduates who were able to educate school pupils up to the standard required for undergraduate entrance.

However, the need for school teachers was long ago outstripped by the supply of graduates, and for some decades the ideal of an integrated specialist undergraduate degree has been under mounting pressure in the UK. With the advent of mass higher education there are now few undergraduate courses which approximate to the organisation of a single-discipline three year degree. Many universities organise their degrees in a modular fashion, with each module being a more-or-less self-contained unit that is studied by students aiming for a variety of degree qualifications. And

although many students still graduate with traditional degree titles such as History or Biology, these seldom signify an integrated program of study extending across three years. There are also a large number of obviously multi-disciplinary degrees with titles such as Media-, Health-, Business- or Management-Studies.

In essence, the UK system of undergraduate education now closely resembles the US system in which the undergraduate degree is fundamentally multi-disciplinary and only secondarily thematic (Menand, 2001). The title of a UK degree may be the same as fifty years ago, but the reality is that the modern student is 'majoring' in a subject by accumulating modules more-or-less relating to a theme.

Evolution of the MDM degree

From the perspective of the ideal of a traditional single honours degree the change to multi-disciplinary modular degrees represents a significant reduction of academic standards. MDM degrees entail a reduction in the age-specific academic attainment in the specific subjects in which the student is specializing. This occurs by the curriculum including several subjects instead of one (lowering the level of expertise in any one of the subjects) and reducing the systematic coherence of the degree (because integration is reduced by modular organization).

The theoretical justification of MDM degrees at present seems to be very weak. It is our impression that UK university teachers almost universally regard MDM degrees as educationally inferior to single discipline degrees. This arises from the fact that MDM organization has been externally imposed (by governments and central university administrations) with a purely pragmatic (rather than educational) rationale. Curricula have become ever more fragmented, easier and less rigorous versions of the traditional degree. This has had benefits in terms of student recruitment and retention — but there do not appear to be any specifically *educational* advantages. MDM degrees seem to be offering merely a superficial level of knowledge across a broad but undefined range. This kind of educational experience is increasingly difficult to defend in an age of unparalleled access to information via the mass media including the internet. The morale of teachers has been eroded by an awareness that, when judged by the criteria of the traditional degree, they are now offering an inferior education. If a smattering of knowledge in a random collection of subjects really is all that a modern university education has to offer, then this is inadequate justification for such elaborate and expensive institutions.

Even if a superficial survey of knowledge were judged to be a valuable aim, this would at most justify a 'core curriculum' undergraduate degree in which all students were exposed to a specified and standardised body of information considered to be central to their cultural and employment needs. But to the contrary, the current trend is for students to 'pick and mix' modules in an almost unconstrained way. Far from studying a core curriculum the situation more closely resembles one in which each student graduates with an unique curricular experience. Likewise, if the undergraduate degree was intended to be a vehicle for providing key skills and specified desirable attitudes, this

would also imply a standard and compulsory curriculum. What seems entirely lacking at present is a justification of an undergraduate degree of the kind that has long dominated in the USA and is increasingly the norm in the UK — namely an MDM degree in which students can study pretty much any subject they want, in pretty much any combination that suits them.

It is the contention of this essay that, contrary to common academic belief, MDM degrees are not only academically justifiable, but can be seen as probably the *best* type of undergraduate degree for the majority of graduates in a mass higher education system. The fact that the US higher education system is generally regarded as overall the best in the world (Trow, 1991 & 1991a) makes it unlikely that the typical MDM degree can be quite such a waste of time as is often supposed. We will argue that there are distinctive qualities of multi-disciplinary modular undergraduate degrees which render them especially well-suited to the social and individual needs of modernising societies (Charlton & Andras, 2003).

The traditional, vocational, integrated, single-discipline degree

The ideal of the traditional UK (especially English) single-discipline degree was that the student undertook a three year course of integrated study which built them into an expert in that subject. The level of expertise was partly a consequence of the focused and integrated nature of the degree, which enabled a very complex structure of knowledge to be inculcated over three years; and partly a consequence of the fact that the English school system was characterised by early academic specialisation leading to a very high (albeit narrow) level of academic attainment at the pre-university A-level (or Higher School Certificate) qualification.

The main advantages of early specialisation are cheapness (narrowness of the curriculum means that fewer years are required to reach a given level of expertise), and that a high level of attainment may be reached while young. Also, some types of learning tend to be more rapid and long-lasting during childhood and adolescence, such that higher absolute levels of attainment may be reached by early specialization. For example, attaining mastery of music, mathematics, languages and some sports seems to require training from an early age.

Early specialisation also requires commensurately deep and narrow motivation in young people, which does not come spontaneously to them and implies the need for a 'hot-house' environment of single-minded academic dedication (eg. the highly-selective traditional grammar school). This kind of deep and narrow education implicitly leads towards a *vocation* - the student is intending to dedicate his or her entire working life to a restricted area of specialised study, attaining ever deeper mastery over several decades.

Although the traditional single honours degree was highly vocational it was not just a matter of training people to perform a job. A traditional vocation was conceptualized as the life-long focus of a person's identity and self-respect - perhaps their major source of fulfillment. This emotional aspect to vocational education - seen in academics, teachers and other professionals; and also the skilled crafts and trades - is described by terms such as the 'love' of one's

subject, and includes a commitment to stick by that subject through thick and thin.

However, early specialization for a lifetime vocation only makes sense as a strategy in a relatively stable society, a society in which it is reasonable to expect that graduates can get and keep a high status job until retirement (Gellner, 1988). If the job disappears, or the subject studied at degree level loses its prestige or becomes superseded, then the vocational single-honours graduate may be destined for a life of frustration, impoverishment or regret.

Growth of multi-disciplinary degrees

As the higher education system has expanded, single-discipline integrated degrees have become rarer, and even where they still exist they have been 'diluted' by the ever lower standard of A-level attainment, a more diverse disciplinary background of degree entrants, the practice of allowing undergraduates to take optional courses remote from their primary discipline, and by the modular organisation of degrees. Of these factors, modularity is the most fundamental challenge to the integrative ideal of single-disciplinarity. Implicitly, modular degrees are no longer pursuing a three year unit of knowledge as their primary objective, but are built from more-or-less free-standing units, several of which are studied during each academic year. As described above, a modern UK degree would better be described in terms of 'majoring', since the subject matter derives from studying modules clustered (if at all) by *theme*, rather than by virtue of possessing significant conceptual integration across three years of study.

Modular degrees can, of course, be pursued within a single academic discipline even though the modularity entails a loss of integration. *Multi-disciplinarity* refers to the principle of compiling degrees from dissimilarly-themed modules. The subject matter of modules in an MDM degree may be completely unrelated (eg. a degree combining study of a foreign language, a science, literature, statistics and art). In a modern multi-disciplinary degree there is no conceptual synthesis of the modules studied. (This contrasts with multi-disciplinary degrees in medieval universities or the pre-twentieth century Scottish ordinary degree, in which a diversity of subjects studied in the early years were later integrated by a over-arching theological/ philosophical perspective).

The take-over of UK universities by what are, in practice, multi-disciplinary modular degrees is compatible with graduating with a very specific degree title, since the requirements for such titles may in practice be minimal. Furthermore, the trend has been disguised by the proliferation of highly specific, indeed absurdly specific, degree titles. The fact that a modern university may award scores or hundreds of very specific degree titles does not imply that it is organised into scores or hundreds of conceptually integrated three year units of study. It merely implies that the criteria for single-discipline degree titles have become very relaxed. There are now many more degree titles than there are systematically coherent academic disciplines.

Whether officially modularised or not, and regardless of their titles; the great majority of UK undergraduate degrees are now *de facto* significantly multi-

disciplinary and modular. It is the educational function of such degrees that requires elucidation.

Benefits of MDM degrees

Multi-disciplinary modular (MDM) degrees are a common feature of mass higher education systems, and it may be that mass higher education actually entails such a system in order to function effectively. Consequently MDM degrees were pioneered in the first mass HE system, namely the universities and colleges of the USA (Trow 1991, 1991a).

Modular degrees in the US are associated with a very 'open' and flexible degree structure, allowing the accumulation of credits towards a degree over a flexible timescale, and transfer of these credits between institutions. Credits may, in principle, be awarded not just for modules but for almost any unit of study (eg for a term's study, or a semester's study) - but the principle of accumulation between institutions and towards different degree qualifications does imply that such units of study be autonomous, and valuable in their own right (and not just valuable in terms of a specific three year degree at a specific institution). This flexibility tends to make the university system more 'open' and inclusive, in that it allows a larger proportion of the population to study for degrees - and not only those who are able to devote several consecutive years in a single institutional setting.

Other justifications for the rise of MDM degrees in the USA have suggested that single disciplinary degrees are too demanding or difficult, or require from the student too narrow an aptitude and interest. By contrast, MDM degrees can be broken down into a wide variety of bite-sized chunks constituted by smaller, more comprehensible and digestible modular units. Given a wide range of subjects and the freedom to choose between them, even modestly-motivated students can find enough modules that interest them and in which they are sufficiently competent, such that they can compile sufficient credits to achieve a degree. Such factors presumably make MDM degrees more attractive to the majority of undergraduates in a modern mass higher education system who lack that powerful sense of vocation usual in undergraduates of traditional elite university systems.

Modular organisation may therefore be justified as a concession to the lower average quality and commitment of students in a mass higher education system. However, while this kind of logistical flexibility and user-friendliness is certainly practical, it is attained only at the cost of lowering age-specific educational standards, and the maximization of such standards is the aim of traditional single-discipline degrees. This pragmatic rationale for MDM degrees therefore still leaves unanswered the question of what should be the educational ideal of an MDM undergraduate degree.

The pre-vocational function of MDM degrees

One clear advantage of MDM degrees is that they delay specialisation. By studying a wide range of subjects instead of a single integrated discipline, the student delays the decision to specialise, and retains career flexibility until they are older. But such delay may be achieved at the cost of making

education more prolonged and expensive, and reducing the productive working life of individuals.

On the other hand, it is typical of modernizing societies that a broad general education with delayed specialisation tends to be combined with a shorter period of specialist training (Gellner, 1988). The implication is that higher education has a generic educational quality, such that it prepares graduates for more rapid vocational specialization. The years of general education tend to expand and progressively replace the early years of specialized education; while the specialized education which prepared people for a vocation becomes shorter, narrower and more focused as befits a society in which most jobs and other social functions are becoming ever-more specialized (Charlton & Andras 2002, 2003).

For example, in the UK a physician is typically trained by 5 years at medical school, 1 year as a pre-registration House Officer, then about 7 plus years in specialist medical training - total 13 years. In the USA, by contrast, medicine is a postgraduate subject, and students must spend 4 years at college before attending medical school for another 4 years, then 1 year as an intern. However, the specialist medical training may be concentrated into 3 years of highly-focused work, giving a total of only 12 years training. The final medical product of the two systems is not strikingly different in terms of functionality in the respective health systems. The main difference is that the NHS is a less evolved, less specialized (and less effective) health service which arguably requires a broader but shallower competence from its physicians.

This analysis stands in contradiction to the frequent calls for higher education to become more vocational. Such an interpretation is precisely wrong. In future higher education will become less vocational and more explicitly pre-vocational. The undergraduate degree should not itself be specialized, but should be a preparation for as wide as possible a range of *later* specialization. The means by which a multi-disciplinary modular undergraduate university education can act in this pre-vocational way is our next topic.

Inculcating flexible abstraction

It is suggested that the positive educational function of MDM undergraduate degrees is to provide a cognitive training in flexible abstract systematic thinking (Charlton, 2003). Abstract thinking itself enables flexibility, because knowledge systems are detached from their concrete and practical manifestations such that schemata may be generally applied. Further to this, the MDM degree encourages flexibility in abstraction by teaching students *many* abstract systems, simultaneously and in sequence. The essential difference between a traditional single-discipline degree and an MDM degree is that the traditional degree provides training in a single large and complex abstract system of thought (eg. mathematics, biology, Latin, classical music), while the MDM degree provides a training in the rapid acquisition of knowledge in numerous smaller, less complex and theoretically-dissimilar abstract systems. In a nutshell, the traditional degree provides systematic training in understanding a specific *subject*, while the MDM degree provides training in the *process* of learning to understand systems.

Modernising societies are characterised by increasingly 'rational', explicit and abstract forms of organisation (Charlton and Andras, in the press). For example, small firms are often managed by force of personality and using implicit, simple rules and procedures. By contrast, the ever-larger corporations that characterise the modernising world can only function when individual differences between employees are minimised, and replaced by explicit rules and regulations (ie. bureaucratic mechanisms of control, in which the individual's main job is to fulfil a pre-determined function). In order to make outcomes predictable and controllable, bureaucratic mechanisms of organisation aim to be rational and logical, hence modern management is concerned with understanding and implementing abstract systems (for example the flow charts characteristic of 'quality assurance' methods). An increasing proportion of the employees of large corporations need to be able to function in these abstract systems, especially as the old heavy industrial and agricultural jobs for unskilled and semi-skilled workers (which used large numbers of humans for heavy, repetitive physical work, as if they were machines or beasts of burden) are eliminated or replaced by means of technological advances in mechanisation and computerisation (Charlton & Andras, 2002).

What is true for modern management is true generally of modern life. Society is increasingly systematic and abstract (Charlton and Andras, 2003). Yet the ability to think abstractly and systematically does not come naturally to humans, since we evolved in a context of small hunter gatherer societies. This means that formal education is increasingly important for individuals to be able to participate in, and contribute to, mainstream social functioning. Functional differentiation in society entails that social institutions are characterised by specialised and systematic informational 'languages' - for example the mathematical modelling of economics or doctors' concise and precise technical 'jargon' of medicine. Such professional languages evolve over time, some growing and increasing in complexity while others disappear as their functions become less important or are replaced (for example the professional language of theology was of central importance in the Middle ages, but is much less important now).

The majority of university graduates are destined to work in the world of professional systematic languages; but whereas in the past, social organisation was stable over decades and university graduates learned one of these languages to a high level, nowadays it is assumed that the graduate will need to learn several such professional languages over the course of a career. So, on the one hand, modern graduates need to be specialists in abstract systematic thinking; while on the other hand they need to be equipped to move between abstract systems and rapidly to learn new systems.

This implies that each module should train students to think in a formal abstract and systematic fashion. It is of little value for modules to provide a smattering of superficial knowledge, but neither should they aim for rigour by asking for memorization of large quantities of unsystematic factual information. To fulfil the educational objective of systematic knowledge, each module needs to reach sufficient depth to reveal the distinctive cognitive structure of its subject. If this structural level of understanding cannot be

achieved in the time available, then the subject should not be taught to undergraduates.

The need to provide training in cognitive flexibility implies that a variety of qualitatively different modules should be studied simultaneously and sequentially over the course of the degree. This is the rationale for multi-disciplinarity — and by this rationale the specific nature of the subjects studied is irrelevant, so long as they differ from each other qualitatively. The aim of MDM undergraduate degrees is that the student will be encouraged to develop cognitive aptitudes of learning new abstract systems and switching-between different abstract systems. In the MDM degree (as in life afterwards) the student is required to keep starting from scratch, again and again, rapidly ascending a learning curve, and developing an open, exploratory and flexible attitude to knowledge.

Systematic understanding

Since the development of the mass media and — especially — the internet, a very broad range of shallow factual information is widely and inexpensively available, without the need to attend college or university. The mass media provides a large amount of attractively-packaged superficial information on a huge range of subjects, especially since the advent of multi-channel TV. The internet has made now made available even specialist information, at very little cost and without geographical barriers. This strongly implies that there is now no place for universities that merely offer a factually-based education comprising superficial information which is readily available elsewhere. But, while factual information is now easily accessible, abstract systematic understanding remains as difficult to attain as ever; and future universities will therefore need to specialize in this.

The contrast between factually-based and systematic academic study can be illustrated by comparing two biomedical sciences: anatomy and physiology. One of the authors (BGC) has experience of teaching both of these to medical, dental and science students. Anatomy and physiology have traditionally been regarded as academically rigorous (difficult) subjects of undergraduate study — so are similar in that respect, but the subjects differ profoundly in their internal organization.

Anatomy is concerned with the structure of animals, while physiology is concerned with their functioning. Anatomy was a major element in the traditional pre-clinical training of doctors: indeed passing the anatomy exams was probably the biggest hurdle for a medical student in their first two years. The difficulty of anatomy stems from its unsystematic nature, so that learning detailed anatomy is substantially an exercise in memorizing random data. It involves learning not just the names of all the body parts and their sub-components, but the three-dimensional relationships between these elements. At the level to which the subject is studied in a medical degree, anatomy has no internal logic or system — but must be crammed by multiple repetition, mnemonics and frequent catechism. Of course, there is a very complex deep structure to human anatomy, which derives from evolutionary history. But this principle of organization cannot be grasped in the time available; and indeed,

the accidents of evolution mean that it is, anyway, not a very systematic mode of understanding.

Because physiology is the study of functions, it is presented to medical students in a systematic way. The human body is broken down into systems (such as the cardiovascular-, respiratory-, gastrointestinal- and urinary-systems); then these systems are described in terms of homeostatic control mechanisms (eg. negative feedback loops) which maintain functionality in the face of stresses. Educationally speaking, the most significant difference between the rigour of anatomy and physiology is that traditional anatomy can be learned only by massive factual memorization; while physiology is learned primarily by understanding the logic of each physiological system, and factual information is slotted into this organizational framework. Anatomy examinations tend to test factual recognition and recall, while physiological exams can be framed to examine the exposition of systematic understanding.

BGC was faced with the challenge of teaching anatomy to students who were allocated only a short time for the subject - about a quarter of the time allocated to medical students. This is the same problem which confronts the university teacher of a single-discipline degree when preparing a module for an MDM degree. To fit the prescribed subject (ie. the structure of the whole human body) into the time available, two alternative possibilities presented themselves. The first possibility was that anatomy could be continue to be taught as a factual subject (as it was with medical students), but with fewer facts. There would be less to remember, and this would make the exams easier so that they could be passed by students studying for only a small fraction of the time traditionally allocated to the subject. But this strategy would neither be rigorous nor of much educational value, since a superficial acquaintance with human anatomical facts can be attained without formal teaching. When many versions of the ABC of the human body are available on the web, why teach these simple facts at a university? And why pay from them to be taught by the possessors of advanced degrees and lengthy CVs?

The second alternative was to teach anatomy as systematically as possible, by discussing the structures in terms of their function: which amounts to converting anatomy into physiology. This was, in fact, the strategy adopted. The decision has some important pedagogic consequences. Teaching anatomy more briefly but more systematically entailed accepting that the necessary systematic logic could be achieved only by accepting a degree of factual approximation. (At the same time, the students were also warned that such approximation was going on.) Traditionally it has been the case that many academics (especially anatomists) regard any compromising of the requirement for literal, point-by-point factual accuracy as sloppy at best and unethical at worst. After all, the subject derives its rigour (hence self-respect) from the cognitive difficulty of large-scale and accurate memorization. But the requirement for exact factual accuracy was a feature of traditional undergraduate degrees only because these single-discipline degrees were implicitly vocational. Modern MDM degrees are pre-vocational, and multi-disciplinary modules cannot and do not provide a vocational training. Further specialist vocational study is both needed and assumed before knowledge can be applied in practice.

BGC's pre-vocational anatomy course clearly did not provide the anatomical knowledge required for a hand surgeon, or anyone else who required mastery of a specific and exact body of information for practical purposes. Some subjects of specific study (such as the anatomy of the human hand) are unsystematic yet necessary for certain specialized jobs. But if a subject is to be studied at undergraduate level it should be made systematic — where necessary by approximation. And if an area of study *cannot* be made systematic in the curricular time available except by significantly misleading or otherwise unacceptable factual distortion, then that subject should not be part of undergraduate study. In a modern university system factually-based but unsystematic study should be delayed until after the undergraduate degree — to be covered either in specialist postgraduate education or on-the-job vocational training.

The nature of modules

To prepare undergraduates for the modern world, a module in an educationally-valuable multi-disciplinary degree must have the character of abstract systematic knowledge. In practice, this means that a good module will usually be based around a theory. Typically, a module will describe and explain a theory, and explore (with varying degrees of depth and thoroughness) the implications of that theory through examples. Finally, the students are examined on this systematic body of theory-based knowledge.

Each modular subject should form a distinct system, in the sense that each subject will have a coherent theoretical structure, expressed in the form of a specialist 'language'. This language must be taught to the students, and through the educational process their aptitude in this language needs to be practiced, encouraged, criticised and examined. The fact that teaching of a module should be conducted using the appropriate system-language implies that university teaching requires specialist experts who are themselves insiders of the systems that they are teaching. The teacher needs to be a competent and confident user of the systems language in order that they can transmit the language. In practical terms, this translates into the general requirement that undergraduate teachers need postgraduate training: they need to be specialists.

The fact that modular teaching ought to be based on theories may help explain some trends in academic discourse over recent decades, for example the fragmentation of academic subjects into sub-specialities each of which is suited to being taught in free-standing module-sized chunks. Of course, the fragmented, nature of academic discourse has been the subject of much cogent criticism; and from the perspective of specialist scholarship the story has indeed been one of decline (Menand, 2001). However, from the broad social perspective on undergraduate education, the primary consideration is whether a specific academic subject (whether large or small) possesses the necessary systematic qualities that render it suitable for modular teaching.

Since the function of a module is to present a self-consistent and coherent abstract scheme of knowledge over a necessarily limited time-span, too much emphasis on scholarly uncertainties and disagreements may simply serve to block systematic understanding the subject (especially for some of the less

able students that are necessarily included in a mass system of higher education). Consequently, subjects that have not attained a minimal level of internal logic and scholarly consensus will be unsuitable for MDM undergraduate study.

MDM degrees also have implications for curricular organisation. The traditional curricular constraint of single-disciplinary degrees was thematic - based on organising degrees around a core of compulsory components and allowing a limited range of options. But with MDM degrees there is more likely to be compulsory *diversity*, with limitations placed on the degree of thematic specialisation. A further consideration is that, in order to maximise the benefits of learning new systems, the modules should be unfamiliar to students since there is no point in universities merely recapitulating what most students have learned at school.

Although there is room for exceptions to be made in the case of a minority of highly vocationally-committed individuals, the majority of students should be encouraged to take a wide range of dissimilar modules (eg. from arts, science, social sciences, languages etc.), and to take only a few modules clustered around a specific theme. The climate of academic advisory opinion in future will be one that warns against the dangers of excessive early specialisation, and emphasises the value of cognitive flexibility and multi-disciplinarity.

The future of UK universities

The above argument concerning the proper aims of a modern undergraduate degree may be plausible, but it remains theoretical. Since this is — we believe — a novel rationale for MDM undergraduate degrees, empirical evidence that multi-disciplinary modular degrees actually do encourage flexible abstraction is lacking. Also lacking is empirical evidence that the attitudes and aptitudes of flexible abstraction really are helpful in the modern world. However, given the theoretical rationale we have proposed, these are eminently researchable questions.

The UK university system is currently in transition, but the medium-term future can be predicted with some precision. The proportion of the population with higher educational experience will continue to grow, with no obvious limit (Trow, 2000). Vocational and specialist undergraduate degrees will become a rarity, probably persisting only for outstanding undergraduates in subjects that clearly benefit from early specialisation, such as mathematics, music or foreign languages. It seems likely that the vast majority of undergraduate degrees will continue to become more multi-disciplinary, and multi-disciplinarity involving qualitatively dissimilar subjects be encouraged. Specialist vocational education will be done after graduation - either by 'on the job training', or by means of a proliferation of vocationally-orientated Masters and Doctoral degrees. For example, medicine and law will again become postgraduate subjects in the UK (as they always have been in many other countries). Undergraduate degrees which offer professional accreditation (eg. psychology and engineering) will also disappear and be replaced by top-up Diplomas or Masters courses.

Despite their disadvantages, which are particularly obvious to university academics, the overall social benefits of mass higher education by multi-disciplinary modular undergraduate degrees are very considerable (Trow, 1992). We suggest that these benefits make the MDM degree preferable to single-disciplinary degrees in a modernizing society (Charlton & Andras, 2003). Although the greater easiness and logistical flexibility of MDM degrees was probably the original reason for their introduction, it is their potential educational advantages which will prove decisive in the future. But for the educational advantages of MDM degrees fully to be realized requires that they evolve a distinctive type of academic rigour appropriate to their nature. And this depends on an explicit understanding of their proper educational function.

What seems urgently to be needed in current UK universities is a new ideal of what constitutes academic rigour in an undergraduate educational system dominated by MDM degrees. On the basis that flexible abstraction is the proper goal; we suggest that educational effort should now be focused on optimizing qualities of theoretical and systematic rigour in all modules offered for study, and encouraging students to assemble their degrees from modules that are characterized by their qualitative dissimilarity.

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Bruce G Charlton is Reader in Evolutionary Psychiatry at the University of Newcastle upon Tyne, and Editor in Chief of the journal *Medical Hypotheses*. Peter Andras is a lecturer in Computing Science at the University of Newcastle upon Tyne, and from 1992-8 was Director of *Civitas*, the foundation for civil society in Romania.