

# **A New Role for the Concept of Information in the Development of Liberal Arts Curriculum**

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## **Abstract**

The Liberal Arts curriculum, understood here as a programmatic standard for the first parts of a university education, rather than a more general philosophy of the entire scope of education, is usually structured through the distinction of different “forms of knowledge,” or different “ways of knowing.” In this article, the concept of information, in a very broad understanding of this term, is proposed as a factor integrating the Liberal Arts curriculum. The advantages of the diversification of the curriculum achieved by developing in students an awareness of different ways of knowing are lost when such diversification actually produces dissociation of the acquired knowledge. There are several themes which are often effectively used to integrate what students are learning such as intercultural communication, globalization, computer technology, etc. However, the limited universality of even these general themes creates limits for integration. Information however, through its manifestations in almost all domains of the university curriculum, and because of its relation to the concept of knowledge in general, is of special interest as a potential factor in curriculum integration. But before it can be effectively used in educational practice, information must acquire a firm philosophical foundation.

## **Introduction**

The present paper presents a proposal to use information as a cross-curricular concept and theme integrating the university Liberal Arts curriculum.

Information Science, as well as its multiple XX Century antecedents, has had important functions in the academic life of universities for quite a long time. But until recently, the concept of information has been usually identified in the context of curriculum development only either within the specialized, technical domains of information theory (information communication) and computer science (information processing) whose high level of specialization precluded them from being given a substantial role in the Liberal Arts curriculum. Otherwise information has been identified with the basic skills necessary for scholars or professionals in operation of computers or accessing bibliographic resources or public records. In the latter cases, information

education for the majority of students has been limited to orientation sessions or workshops, and at best limited to one-credit courses in microcomputer applications.

There have been some changes since internet resources have gained wide recognition. More and more educators have started to understand the need to shift attention away from the ability to access information and to focus most intently upon its selection. With this understanding many universities and colleges accepted “information literacy” as a part of their general education requirements for all students. These new standards require that all students must learn not only how to handle information using the rapidly developing technology and resources, but also how to evaluate that information, how to use it in a secure, legal, and ethical ways. However, information education has not yet come out of its subservient role in the Liberal Arts curriculum. Its role can, and should become central for university education today. After all, there is no single other concept of greater importance for modern life and scholarship. In this paper, I would like to share my vision of information as a theme integrating Liberal Arts curricula.

In the currently most popular approach to structuring the Liberal Arts curriculum another concept actually plays the fundamental role, the concept of knowledge. Thus, the structure of the curriculum is often developed around Paul Hirst’s celebrated multiple “forms of knowledge”, with each form playing an appropriate role in university education (Hirst 1974). Other approaches to the Liberal Arts curriculum, although sometimes differ in terminology, result in roughly equivalent structures.

Although, there is no more successful model of general education than that of the Liberal Arts in current practice, and it is undoubtedly true that the diversification of the curriculum achieved through making the distinction between different ways in which human subjects learn about their natural and social environment and about themselves has emerged as one of the main reasons for the success of the curriculum. However, the approach based on the core concept of knowledge has some weak features when considered from a more general, global perspective, or when we realize the limitations inherent in the approach via the concept of knowledge.

As it is used in Hirst’s approach, the general concept of knowledge is an abstraction from the psychological category of knowing, and as such has an inherently subjective character.

The problem of objectivisation of the concept of knowledge has been discussed for centuries in epistemology, and no matter how much we feel satisfied by the results of such discussions, there is no doubt that in intercultural interactions problems arise and persist in relation to the subjective character of knowledge. Indeed, sometimes they become even more prominent. Since the typical epistemological answer to the question “What does it mean to know something?” requires that we believe in what we know, there is no way to avoid reference to the cultural

context in discussing knowledge. In the case of education this dependence on the cultural context becomes a source of major problems, including such cases as those which had place in Tennessee or Kansas science classrooms, or those in schools and universities located in even more isolated or exotic regions of the world.

The concept of information has the advantage of being more universal, less culture-dependent, and in at least some contexts completely objective. It can be held to be a subject to which all possible “ways of knowing” are applicable, and that means it can be included in courses belonging to a wide range of disciplines in the sciences, mathematics, the social sciences, and the humanities.

The most important consequence of these favorable characteristics of information is the possibility to utilize information in two different capacities, (1) for organizing the curriculum and (2) as a universal, but diverse in its manifestations subject of study. In the former capacity information can be used to develop criteria for the classification of courses in the curriculum in a consistent, rational way and for developing the internal structure of the curriculum (e.g. through prerequisites, required courses, restricted electives, etc.) In the latter capacity information can serve as a unifying motif present in many courses of the curriculum demonstrating the mutual interdependence of various disciplines and providing the best evidence for the necessity of using multiple perspectives, as advocated by the principles of Liberal Arts education. Moreover, when many courses are saturated with topics related to the general concept of information, students will have ample opportunity to discover that the models developed in one discipline can be useful in the comprehension of other disciplines. It is truly an exceptional feature of information that studying the Second Law of Thermodynamics in physics can be related in a meaningful way to the study of the fundamental characteristics of living organisms, the evolution of life, human communication, organization of societies, or even to understanding of aesthetic judgments in different cultures. Of course, this does not mean that every idea can be described in terms of information or that every problem can be solved using methods developed in the study of information. But the fact that information can be identified in so many different contexts, means that there is no need to convince anybody about its importance for all domains of life, and that it naturally belongs to the general conceptual framework of education. This fact gives strong supporting arguments to the theses of this paper.

My opinion about the advantages of an approach to curriculum analysis based on information should not be understood as a call for abandoning all traditional conceptual frameworks and analyses for educational studies based on the concept of knowledge. I will be referring frequently to Hirst’s forms of knowledge throughout this paper. All I am proposing is to interpret the

classical terminology and structures using the concept of information, and to utilize the fact that this concept, in contrast to the concept of knowledge, can be used not only as a tool for education analysis, but also as a subject matter within the curriculum.

Also, it should be stressed that the concept of information, as I understand it, is used in the very general context of information science. Thus, my views and opinions should not be identified with any specific cognitive theory of education, in particular it should not be identified with the approach to education based on so-called information processing (IP) model of mind (Beriter and Scardamalia 1992).

### **Liberal Arts Curriculum**

My main objective in this paper is to present the idea of a special role for the concept of information in the integration of the Liberal Arts curriculum. However, there are at least three questions which should be answered before we enter discussion of this role:

1. What exactly is the meaning of Liberal Arts education to which I am referring in my paper?
2. Why should we be concerned with the Liberal Arts curriculum?
3. Is there any need for integration of the Liberal Arts curriculum?

The first question may seem trivial, especially in the context of American higher education. Almost all American colleges and universities have Liberal Arts requirements, although not all use this terminology. In response to negative attitudes taken towards old terminology considered sometimes too elitist, other names have been introduced for this same type of curriculum. No matter what name is used, Liberal Arts, Liberal Studies, or General Education, the ideals are similar. Therefore, the answer to the first question may seem straightforward.

On the other hand, those involved in the continuing discussion of the optimal forms of education may object that the controversies in the subject have not been eliminated, and the question still remains: what is Liberal Arts education, or rather what should be the desired form of Liberal Arts education? This key question has not been answered yet, and therefore every description of the general Liberal Arts curriculum has to be considered as only an expression of individual opinion.

Since my objective in this paper is not to analyze the philosophy of Liberal Arts education or to evaluate its role, but to present some ideas related to its structure and content, I will focus on the basic characteristics of the Liberal Arts curriculum, in particular those which are

common in actual educational practice and which are minimally influenced by the philosophical controversies just mentioned. Also, in answering the second question, I will not try to advocate for Liberal Arts education, but my answer will refer to the reasons why its value has been recognized, and why it is being adopted by many education policy makers in many areas of the contemporary world.

The main goal of Liberal Arts education is the development of an autonomous individual whose intellectual skills and knowledge are cultivated not as instruments for specific, practical activities, but as characteristics of a mature member of liberal minded and democratic society; the individual who has acquired the ability to understand his or her natural, social, and cultural environment, his or her own needs and obligations, and who has formed on the basis of understanding capability to make right judgments and evaluations.

The stress on the autonomy of the individual, placing the goals of education above preparation for practical activities, and the conviction that the understanding is a condition for right judgments are the elements defining Liberal Arts education which are most frequently criticized by its opponents. However, the real issue is more about the degree in which these elements are important for education, since advocating their complete rejection is quite rare. Some educators demand that social adaptation should be equally important to education as personal autonomy, others object that education dissociated from praxis is a luxury for the leisured elite and is of little value for working class people. Finally, some educators of a religious orientation object that right judgments cannot be made without commitment to the true religious faith, and that such faith does not have to be conditioned by rational understanding.

The objections to Liberal Arts education can be easily answered within its own pedagogical principles. In the modern formulation of the Liberal Arts, following Paul Hirst's ideas, the disciplines are interpreted as "forms of knowledge" or "ways of knowing." Each has distinct patterns of reasoning and imagining. Typical forms include mathematics, physical/natural sciences, humanities, history, philosophy, literature, fine arts, moral knowledge, and so on. Social adaptation is developed within several of those disciplines, but nothing prevents us from introducing a separate "form of knowledge" without the characteristics of a theoretical discipline, but which has focus on group cooperation and the identity of an individual as a member of the social group. To satisfy those who see in over-rationalization a threat to the strong moral foundations provided by religion, the "way of knowing" through metaphysical experience of the faith could be added in principle.

The objections mentioned above are less serious than the more practical arguments coming from policy makers in education. Because in several European educational traditions

Liberal Arts education has been traditionally placed within secondary education, its presence in the university curriculum has been frequently considered time lost which more suitably would be used for more specialized education. In Europe, as well as in Japan students are usually recruited for university programs with a definite area specialization specified at the beginning. The candidates have been already tested at the end of their secondary education for their qualifications to be mature members of the society. The university is supposed to provide education to those who want to enter small elite groups of specialists with their own ethos and culture. For those committed to this approach any form of uniform curriculum would be considered a step back towards secondary education and diverting students from achieving their actual goals in university education.

Anticipating our further development of ideas on the curriculum, we may observe that the information revolution has changed the conditions which have served this type of view. There are now many more common elements in the university specialized programs due to the more universal methods of information handling necessary for all university graduates. Also, there is not enough time in secondary education to acquaint students with these methods. But, even without the information revolution, the need for some form of Liberal Arts curriculum at the university level has been recognized for a very long time. There were two, closely related reasons for such a recognition. One was identified as the growing separation of “The Two Cultures,” to quote the title of the famous article published by Charles Percy Snow in 1956 in *The New Statesman and The Nation* which were later developed into two books (Snow 1959, 1969). The separation of the scientific-technological culture from the humanities threatened the unity of modern civilization just at the time when belief in civilized world had been weakened by the fresh memories of the tragic strife of Second World War. The war experience was also a source for the second reason for the need of the Liberal Arts. In close relation to the first reason, it has been recognized that the only way to prevent the atrocities of the war is the democratic control of ideology. It is too easy to control, corrupt, or to eliminate the elites who in the past were entrusted with this function. If the general public is supposed to use its own judgment for such controls, the prevention of premature specialization in education has become a necessity.

Thus, the need for the revival or, in the case of some educational systems, for the introduction of a Liberal Arts curriculum at the university level had been clearly recognized more than fifty years ago, but the issue of the most desirable shape for such a curriculum still seems controversial.

We now have the answers to the first two questions about Liberal Arts education. Now, why should we be concerned with integration of the Liberal Arts curriculum? The answer will be

only slightly different in the context of the educational systems in which students have the right to build their own individual study plans selecting courses from a relatively wide range of course offerings, and in alternative educational systems where students have very limited choices, or where the only choice is between different specialized programs before applying to the university.

In the first case, which is typical for American colleges and universities, students are limited in their choices only by the set of general education requirements specifying the minimum number of credits in each category they must complete, and by the system of prerequisites. This freedom of choice is a blessing for the student's autonomous development, so dear by the spirit of the Liberal Arts. But there is a price to pay. Usually, course descriptions are developed within departments responsible for teaching in a given discipline, and course syllabi are developed by individual faculty members sometimes with a certain amount of departmental consultation. Cross-disciplinary coordination of the curriculum has more often had an administrative character, and rarely goes beyond a general review. Thus, the system supports diversity in education very well, but there is not much effort given to helping students to achieve a common perspective on the various subjects they study. In effect, students frequently are not able to build connections between the domains of knowledge and between the skills that they acquire. The human being as covered in the biology course focused on morphology and physiology of the human species seems completely different from the individual capable of thinking, loving, and hating, and so on as studied from the perspective of psychology. And likewise it seems that the same human being comes to be seen in anthropology courses as a puppet completely controlled by the cultural mechanisms of the family and other social groups.

It is only an illusion to think that the fact of using the same terminology automatically gives unity to a student's perception of the subjects studied. Even more, it is not always so that the terminology in different disciplines is uniform. Pedagogical practice shows that division into separate courses across the disciplines, or within the same discipline, dissociates knowledge. In such a case, clearly a lot of effort must be exerted to place these various pieces of the mosaic into a uniform whole.

The ideal of many "ways of knowing" in fact becomes meaningless when we cannot identify the common subject of the study. The diversity of methods of inquiry must be accompanied by effort to delineate the integrating factors which demonstrate the unity of reality in the diversity of human experience.

The second case of educational systems in which students follow predesigned "running course" has the "advantage" of giving the student only a small number of choices. But it only shifts the responsibility to the curriculum developers. The issue of preventing dissociation of

different disciplines is equally difficult to resolve in this case. The real disadvantage is in a threat to the ideals of diversity, if the curriculum is designed without adaptation to the individual needs of students, together with the increased difficulty caused by resolving the problem of integration in a manner which brings the association with the slogan of mass production “one size fits all.”

Thus, no matter what the educational system, there is a real need for factors integrating the curriculum. They have to be universal in order not to jeopardize the Liberal Arts ideals of the diversity in ways of knowing, but they have to be uniform enough to bring together multiple experiences into one picture of reality.

### **Integration of Curriculum**

There are two levels at which integration of curriculum can be considered. The first level concerns the subject matter of the courses and is directly related to the concepts introduced for the comprehension of these subjects. The second level is more concerned with the ways in which we organize our manner of comprehension or experience.

The two levels of integration are in close correspondence with the two levels of curriculum differentiation. In the first level we have division of curriculum into traditional disciplines such as psychology, anthropology, physics, chemistry, and so on. This division is based on the distinctions of the subjects of study and of the traditional methods developed for studying them. The second level of differentiation, related more to the mutual relations of the traditional disciplines, consists in the division into different ways of knowing. Thus we can distinguish knowledge based on empirical methods, inductive and deductive disciplines of analytical reasoning, disciplines of introspective reflection on the human condition, of supra-individual objectivization of human experience, of human communication, including expressive communication, axiology, deontology, etc.

The differentiation at the first level may seem finer than that of the second, but actually there is some degree of independence between them. We can have two traditional disciplines within one category of the second level, such as physics and chemistry as disciplines governed by empirical methods, or we may distinguish within human communication between speech communication and composition. But, on the other hand sociobiology can be considered an empirical discipline attempting to achieve supra-individual objectivization of human experience, or we may find that a course in psychology may address issues of introspection in terms of empirical methods.

The distinction of the two levels can be interpreted as a reflection of the distinction between *what* we experience or study, and *how* we experience or study. With the additional

distinction of experience and study in an inward or outward direction, or in the level of our activity adopted in acquiring knowledge.

When we have a dual system of divisions of the curriculum, we should consider a dual system of integration, which, to recall our earlier discussion, is to be understood as providing the student with a view of reality as a whole, not as a pile of fragmented, dissociated pieces of knowledge. This unified perspective, in the context of the mechanisms giving human mind the ability to achieve it, has been the origin of the idea of “Common Sense,” corrupted later into the modern understanding as knowledge without education. Development of the unified perspective is a process which requires some serious engagement with issues of method. There are two basic methods used for this purpose. One is based on the conviction that students can achieve association of their knowledge and skills when they are solving a major problem whose solution requires such an association. The other approach, in some sense similar, is that the association can be achieved through focusing students’ attention on some important, meaningful concept or theme which can be studied using multiple forms of inquiry. The difference between the two approaches is in the belief, or disbelief, in the importance of the active engagement of students in goal-oriented activity. Definitely, the first approach is not consistent with the philosophy of Liberal Arts, if the problem has to be of practical importance. Otherwise, every type of study can be understood as goal-oriented activity, and the difference becomes inessential. I will focus on the second approach.

In the past, several different themes have been used to build connections between different disciplines. Their success was dependent on the level of their generality and on how meaningful they were for students. This issue is more critical than it is sometimes recognized. The following example is not related to integration of curriculum, but to building motivation for study. In spite of being taken from a different context, it can illustrate well the danger of misunderstanding what is meaningful for the learner.

There is an old problem in education which consists basically of a common lack of motivation for studying mathematics. To make mathematics more attractive, some textbook authors reformulated old problems of the type “In how many ways can we order ten different cans of paint on the shelf” as “In how many ways can we order ten different compact disks with music on the shelf.” Of course, the new problem is as boring for the younger generation as is the old one. Young people are more interested in compact disks than in cans of paint, but the problem of ordering them is equally meaningless. They will be bored with counting the number of arrangements of CD’s or Porsches as much as of cans of paint. So, it is not so important what the particular objects involved in problems are, but what is of crucial importance is how much the

problem itself is meaningful. The same point applies to our task of finding concepts suitable to serve as bridges between the disciplines. The concepts being meaningful is dependent on how much the problems related to them are meaningful for students.

In this respect, there are some examples of concepts which have served well in the integration. From my own experience I recall how the concept of culture when considered in the contexts of cultural diversity and intercultural communication has been effective in structuring and integrating curriculum at one of the universities where I was formerly employed. The concept of culture can be used to bring together the social sciences, philosophy, psychology and the humanities, even sports, health and recreation. But its universality was not wide enough to fully incorporate mathematics and the physical and natural sciences. Another theme definitely meaningful for students is globalization. Hot discussions of its positive and negative influences, the violent demonstrations against the World Trade Organization activities at the sites of WTO meetings, its relationship with the development of the Internet, its consequences in the forms of terrorism and war have made globalization a theme of high interest. In the case of exploring globalization, it becomes possible to expand the scope of integration to include environmental science, and therefore to incorporate topics related to chemistry and physics. But there is probably no more universal and meaningful theme than information. I believe it makes a perfect candidate for integrating all of the Liberal Arts curriculum as I shall now explain.

### **The Role of Information in Curriculum Integration**

I have written above about the universality of the concept of information and how meaningful this concept is for everyone, but both statements deserve some further justification. That the concept itself is meaningful, seems obvious. But, can we be sure that the problems in which this concept is involved will be meaningful to students? Can we always avoid mistaken expectations similar to the example above in which textbook authors assumed that young people must be fascinated by the big number of arrangements of even a small collection of CD's on the shelf?

We do not have to worry about boring students with any topic involving information more than with any other theme. But the fact that information is definitely a symbol of our present age makes it very likely that reference to the concept of information will increase students' interest. Of course, there is some danger that somebody who does not know much about information can be intimidated by its (false) identification with computer science. Those whose orientation is more humanistic and who have developed in their earlier education math-science anxiety can come to think about information science as the antithesis of their own

orientation. But these fears can be easily dispersed with the explanation of the wide range of the different ways information can be understood or studied, and of the large variety of manifestations in which information can be found outside of science and technology.

On the other hand, there is no doubt that the attractiveness of the concept of information is a result of the invention of the computer, the development of computer technology, and its role in creating the new medium of communication, the internet. We can capitalize on this interest in computers in order to develop interests in less fashionable, but not less important, aspects of information. While students are not enthusiastic about counting the number of arrangements of CD's on the shelf, they are interested in the methods of encoding music and the physical processes of recording this code on the disk, retrieval of the code and transforming this form of information into music. They become excited when they realize that when they buy a disk, they actually purchase just infinitely reproducible information, so instead of focusing on the actual physical object of the disk, they learn they equally well can just get a password (also information) giving them access to the code over the internet. Soon there comes the discovery, that there is no difference between stealing the disk in the music store ("it's bad"), and illegal sharing of files with music ("well, I didn't know that"). And with this comes the new problems of information ownership, the economic value of information, the rights to access information, etc. It is only the beginning of a long chain of topics which belong to several different traditional domains. Such threads can be woven together starting from thousands of different points of common, popular interest.

The universality of information may be regarded as a more controversial issue. The word "information" is present everywhere, but its meaning, it can be argued, is built on the context, and with the rich variety of contexts to be found, we have a variety of unrelated meanings. Thus, the universality of information can be seen to be purely formal.

The issue has a quite long and convoluted history. Of course, I mean long in relation to the age of the modern concept of information. There have been many lines of division drawn by the opponents of the uniform theory of information. But in time, more and more lines are being erased. The earliest division was caused by the controversy over entropy as measure of information. It has been argued that Shannon's entropy introduced to measure information in his communication theory is only incidentally similar to Boltzmann's entropy which measures some physical, thermodynamical magnitude which only through mistaken and abused terminology is identified with physical information. To substantiate this point it is observed that Boltzmann's formula involves the constant  $k$  (Boltzmann's constant,) which is completely absent in Shannon's entropy. This position was supported by various authorities including Rudolph Carnap, David

MacKay and other great contributors to information theory (Bar-Hillel 1963; MacKay 1983). Claude Shannon himself expressed his own doubts about the relationship of his theory to the physical phenomena studied by Boltzmann and others, including the more modern research of the developing discipline of information physics. However, further development of information physics, in particular the contributions of Ralph Landauer have made the position separating information from physics obsolete (Landauer 1991).

Thus, today the title of Landauer's article announcing "Information is Physical" does not sound rebellious at all. But, there have been other aspects of the "naturalization" of information, where controversies persist. In particular, the issue of the role of information in human consciousness remains a subject of hot debate. The arguments of the opponents to the view that information in the context of knowledge is essentially the same as information studied in other disciplines (although the way it is processed in the brain may be different from all known forms of information processing) have clearly become weaker and weaker. Thus, the topic-neutrality of information has become more and more plausible.

There is one more division of greater importance, which although having been postulated in the very beginnings of modern information theory, has never been completely eliminated. I refer to Shannon's information theory. This theory programmatically disregarded the meaning of information. Based on that fact, and on the failure of attempts to develop an analogous semantic information theory, it has been frequently concluded that semantic information, and therefore knowledge, is essentially different from the other forms of information. Even now, there is no commonly accepted form of semantic information theory, but the division is fading. More typical is the position that it will be only a matter of time until such a theory is developed in a quite plausible form. I remain unconvinced that such an expectation is reasonable while holding the present views on the nature of information and insisting on measuring information by entropy. Indeed, the main source of difficulties in developing a semantic theory of information, or even in defining information is in the choice of entropy as measure. Entropy serves well the aim of measuring the amount of information that can be transmitted by a given medium, i.e. the difference between the amount of information in two points of space, or in two moments of time, but it is not suitable for measuring information in an absolute way, i.e. the actual amount of information in the system (Schroeder, 2004a).

Thus, there is definitely progress towards a uniform theory of information. We do not have to share the extreme views of some information physicists that all that is, is information (Wheeler, 1999) in order to believe that information has a universal nature shared across disciplines. But this belief is not a *sine qua non* condition for acceptance of the program

presented here to use the concept of information for integration of the Liberal Arts curriculum. Even if information is not completely uniform and we have to qualify its different manifestations into the categories of physical information, semantic information, etc., there is enough in common for all these forms to be used to build conceptual bridges between the disciplines of study.

Before I start my presentation of the model for such integration of the curriculum, I wish to provide a few points of explanation for the reader. First, it is necessary to clarify the meaning of one expression related to information which I will be using, but which has become a source of confusion. It has especially been a source of confusion in the debates on cognitive aspects of education. The expression is “information processing” and it is very often identified either with the functioning of the computer, or with functional models of phenomena based on analogy with the computer. On the other hand, it has been also used as a convenient substitute for more specific (but sometimes difficult to express in concise form) description of any process in which information is transformed (including the analysis of information as a special case.) Thus, when someone associates cognitive processes with information processing, many different interpretations become possible. It can be interpreted as the view that the human brain works in a way similar to, or identical to the functioning of a computer. But such an interpretation is only one of the possibilities. As every process involves something that is changed or transformed, in cognitive processes we thus have something transformed. The statement that cognitive processes consist of information processing can mean that what is transformed is information. There is no further specification of the resemblance of such a transformation to any other processes, in particular to the internal processes of the computer. In the following, I will be using expression the “information processing” in this very general, and somewhat natural sense.

One more terminological explanation may prevent misunderstandings. I will refer to the concept of human communication as formulated independently from the concept of information transmission or communication. Thus, human communication is any behavior of the members of a group which has a regulatory function for the collective behavior of the group (Abe, Schroeder 2001). The group can consist of two people, a large population, or can be only an imaginary set of persons, as in the case of expressive communication. Information transmission is involved in typical instances of human communication, but its role is more often related to the mechanism of communication than to its functions.

In the following, I will use some other terms related to information such as “organization” or “structure” that may not be fully defined. However, their connection with

information appears to be quite obvious, and the explanation of their specific meanings is beyond the objectives of the present paper.

Now we can return to the presentation of the model of the Liberal Arts curriculum. Its general structure (to which in the context of integration we referred as “the second level”) can be described as consisting of categories formulated in information-related terms. The primary division consists of:

1. Organization of introspective reflection;
2. Organization of supraindividual objectivization of human experience.

The category which could be placed in the intersection of these two categories, or as a bridge between them is communication. Formally, it is clearly a fundamental feature of the second category, but it would not be completely revealed without noting its bridging function. The other fundamental feature of the second category is information processing, which in turn can be divided further into several subdivisions: empirical methods, deductive, inductive, or algorithmic processing of information, methods of recording, documenting and retrieval of information, and methods of information evaluation.

The division of the outlined curriculum into the traditional disciplines is definitely different from the categorization above, although some parallels can be found. Thus communication includes themes traditionally included in courses such as Fundamentals of Speech Communication, Writing & Composition, Intercultural Communication. The connection between the two primary categories also includes Fine Arts, Music, Literature, Drama. The first primary category includes themes of Psychology. Empirical methods traditionally are associated with Physical/Natural Sciences, deductive methods of information processing are found within Mathematics; inductive methods within Statistics; algorithmic methods within Computer Science. But the contents of the categories can be distributed in the curriculum in several different ways, and the traditional divisions are clearly not adequate.

How can categorizations of this type, which of course is a form of division, be helpful in integration of the curriculum? The division brought about by the categorization outlined and using the relationship with information is different from the traditional division made according to the subjects of study. The same courses can, and typically do include themes or methods from several different categories or subcategories. For instance, a course in Psychology can include elements from the first primary category, from communication, from empirical methods, from inductive reasoning, and so on. The role of the categorization fundamentally is to distribute themes and methods in the curriculum with which students can find connections across traditional academic divisions. Thus, through the wider spread of the contents of the categories bigger

number of combinations of courses come to satisfy the fundamental educational requirements of the Liberal Arts.

There is also a special role for information at the first level referred to in our earlier considerations. In the first level, there are two possible ways to implement integration using information as a topic of study. One way, probably the more effective but much more difficult to implement, is to saturate all courses with information-related themes. Thus, for instance, in Physics courses students should learn about the foundations of information science through study of topics such as the Second Law of Thermodynamics in its kinematic interpretation, the metaphor of Maxwell's Demon, the physics of computer hardware, the idea of the quantum computer. In courses in Biology, students would learn about genetics, evolution, control functions of the nerve and hormonal systems, the use of information in non-human populations, including such phenomena as the emergent behavior of ant colonies and in slime molds. In the Social Sciences topics could include the history of information processing and distribution in human societies (the histories of the development of language, writing, printing, telecommunication), information as commodity, means of production, as an element of power relations, the economics of information, the role of information networks in the past and in the process of globalization. In the Humanities, students can learn about information analysis of aesthetic judgment, experiments with the use of randomness in the creative arts, information as a theme in philosophy, and so on.

To achieve saturation of the curriculum with information themes requires a group effort of faculty who have appropriate knowledge and background, and who share the philosophy of the task at hand. Much easier is to introduce one or more courses in Information Science which include a wide range of themes as listed above. Even in this case it is necessary to establish cooperation among faculty teaching courses in traditional disciplines so as to have the foundations set for topics within the information-specific courses. However, it is not necessary in this case to share the same educational philosophy, and what is even more important is that, this approach does not rely on advanced knowledge of information on the part of all faculty.

### **Philosophical Issues Involved in Integration**

As I wrote above, the use of information in the integration of the Liberal Arts curriculum does not require the assumption that all forms of information are just different manifestations of one uniform concept of information. We have only to assume that the connections between different forms of information are not purely arbitrary, that they have some objective basis. However, the controversy over the unity of information is a reflection of much more fundamental, unresolved problem which actually can threaten the objectives outlined in this paper. How can we

use the concept of information in designing, analyzing, or integrating the Liberal Arts curriculum when we do not yet know what information itself is? On the list of the eighteen outstanding questions in the philosophy of information presented by Luciano Floridi, the question “What is information?” is placed as the first and most important (Floridi 2004). The other questions on Floridi’s list, those about semantics of information, relationship of information with truth and with values, its “naturalization” and other related topics are all relevant for our discussion. However lacking an answer to the first question poses a real problem. Many answers have been attempted in the past, but none yet seems acceptable. There are two typical answers which, in absence of more convincing solution, have been usually used in the literature. The first and most popular that “information is a resolution or reduction of uncertainty” can be objected to on many grounds. First of all, this definition is based on a clear logical error. Either we know what we mean by “uncertainty,” and then the definition is circular as uncertainty has its generic meaning lack or deficiency of information, or we do not know what “uncertainty” means, and then we have the error of using undefined terms in the definition. The second popular answer, ascribed to Gregory Bateson (1979), but according to Floridi (2004) earlier given by David MacKay, is that “information is a difference which makes difference.” Of course, this answer is not necessarily better than the first one, at least if we are asking for the definition of the concept.

My own solution to the problem of the definition of information is to seek a formulation of the definition not in terms of the common sense understanding of information (uncertainty, difference, etc.) but in reference to concepts emerging from the long philosophical tradition (Schroeder 2004b). One such concept is the opposition of one and many, whose roots are as old as philosophy itself. Philosophers of all cultures and all epochs have been preoccupied with the one-many relation in the context of being and the context of knowledge.

Information can be defined as the identification of a variety. The word “variety” is understood in very general way as synonymous with the words “plurality,” “multiplicity,” “set.” Identification of a variety is understood as that which gives unity to the variety. There are two basic ways this “one-ness” can be realized, by the selection of one element of the variety out of the many, or by the internal structure of the variety which binds the elements into unity. Therefore, we can consider two different forms or manifestations of information related to these two forms of identification: *selective information* and *structural information*. They are interdependent as one form is always coexistent with the other. Information leading to the selection of an element from the variety requires that the element is distinguishable from other elements, and therefore it has to have its own internal structure. On the other hand, the structure

of variety can be identified by the selection of the particular configuration out of many other configurations.

In the context of this definition of information, the use of the terms “organization” or “structure” in the categorization of the Liberal Arts curriculum becomes even more natural. Also, the general idea of integration of the curriculum becomes a natural subject for information studies.

## **Conclusion**

Liberal Arts curriculum needs to have integrating factors, as otherwise its ideals of the diverse ways of knowing lead to dissociation of knowledge. The concepts which have been used for the purpose of integrating different forms of study, such as culture, globalization, and so on, lack the generality needed to bring together various subjects. On the other hand, information, due to its generality, importance and its close relationship with the concept of knowledge itself has great potential to become such an integrating factor. In this case integration can be achieved not only through exploration of cross-disciplinary themes related to information, but also through the internal organization of the curriculum in terms of information. The success of this program however, depends in the longer run on further progress in the study of philosophical aspects of information.

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