Curriculum Integration

J. A. GIBBONS
Adelaide College of the Arts and Education, Australia

To integrate, logically speaking, is to unify parts so that the result is more than the sum of these parts. In this sense, integration may be applied to many things, from racial integration to the integration of a school's administrative system. The application of integration with which this essay is concerned is that connected with the transformation of knowledge. This particular application has found its way into curriculum literature. "Even a cursory glance at contemporary proposals for curriculum reform serves to show that ideas of curriculum integration are immensely popular" (Hirst 1974, p. 132). The connection between curriculum integration and curriculum reform is significant. To reform is to improve, to change to a worthwhile or more worthwhile state. Where curriculum integration is part of the proposed curriculum reform, then, what is to be reformed is usually the traditional, discrete subject-oriented curriculum. Curriculum integration, as a worthwhile state of affairs, is contrasted with a curriculum that is seen as fragmented and divided by arbitrary subject barriers.

The impetus to integrate, and thus reform, has produced in the schools a rash of interdisciplinary curriculum proposals. These proposals go under various names: "In view of the support generated by the new ideological climate for the already noticed growth of, for example, General and Social Studies in Australian schools, the nature and basis of integration would seem a fundamental problem for curriculum theory..." (Musgrave 1974, p. 6). But whatever the courses are called, central to their conception of learning and teaching is the concept of integration. Given this situation, one would expect that a careful analysis of the concept of integration would have already been done, at least at some stage of proposed curriculum reform. I am not suggesting that it should have been done in advance of curricula proposals, though I have some sympathy for rational curriculum planning; rather it should have been attempted at some earlier stage than the present. Such analysis becomes a necessity if educators are to know how to construct integrated courses.

Richard Pring (1973) distinguishes five uses of integration and their attendant presuppositions and, hence, has clarified the situation sufficiently for educators to know what they are assuming. But it is evident that he sets for himself the task of attempting to identify the epistemological presuppositions that lie behind various uses of integration. The results of his analysis can be summarized best in his own words:

- they [the proponents of curriculum integration] are therefore claiming either that knowledge has some overall unity—a coherence, a synthesis—such that the meaning of any one proposition cannot be fully grasped without an implicit reference to an entire system of propositions;
- or that knowledge has some sort of coherence or synthesis within certain broad fields of experience (e.g., the humanities);
- or that, in order to answer particular problems it is necessary to focus different sorts of modes of knowledge and inquiry upon a particular topic (this, as such, not necessarily committing one to integration, though integration is an expression frequently but misleadingly used);
- or that any development of knowledge has built into it some reference to inquiry or problems for which it makes possible a practical solution and which therefore are the source of integration;
- or that the different disciplines, though incorporating distinct conceptual structures and modes of inquiry, do interrelate and that this interrelation needs to be made explicit in the teaching of the disciplines and the curriculum as a whole. [p. 148]

Although Pring's analysis may enable educators to identify and consider the epistemological presuppositions that lie behind the curriculum proposals they espouse, it does not attempt to give any explicit account of the nature of integration. As Pring (1973) remarks at the end of his essay:

> This then is the foremost philosophical question to be asked about curriculum integration—viz. what it could mean, and what assumptions are being made about knowledge, the forms of knowledge, the interrelationships between these forms, and the structural unity of language. It may be of course that one is chasing a chimera—that there is no real philosophical problem here, that curriculum integration is but a grandiose way of talking about inter-disciplinary enquiry which as such, entails no necessary synthesis; that synthesis is neither necessary nor possible between different disciplines. [pp. 148-149]

Lately, it appears that educators have taken Pring's suggestion that integration is a chimera, and they have argued that curriculum reformers and developers should concentrate their attention on multidisciplinary enquiry.[1] Others, however, have proceeded with a notion of integration as a synthesis in which the whole is more than the sum of its parts.[2] Such an account says so little that it is worse than useless.

This essay addresses the problem of the nature of integration, and an attempt will be made to lay the basis for a theory of integration, its nature and purpose, that will help with attempts to integrate in the curriculum.[3] Its main purpose, then, is practical in the sense that it is concerned with the problems of teachers and others who wish to produce integrated courses but lack some clear hypothesis of the nature and purpose of integration.

The question is, What, logically, happens when concepts and propositions from different disciplines are brought together in a synthesis? If the concepts and propositions about the same object were allowed to lie side by side without any attempt to synthesize, this would be called multidisciplinary study; alternatively, in attempting synthesis, one is attempting integration. If one attempts to analyze integration, then a suitable starting place would seem to be with a specific case. The objection to this method might be that it prejudges the issue. Although this objection has some merit, it is best treated as a cautionary note about conclusions one might reach from the analysis of particular cases. With this in mind, I propose to look at an aspect of the relationship between mathematics and physics, for this is one case that is consistently mentioned in reference to integration. At the outset, I shall assume that mathematics (pure) and physics are two distinct disciplines and allow the subsequent argument to reveal the justification for this assumption.

Dirac (1947), a theoretical physicist, talks about the relationship between mathematics and physics in the production of new ideas in physics:

> The new scheme becomes a precise physical theory when all the axioms and rules of manipulation governing the mathematical quantities are specified and when in addition certain laws are laid down connecting physical facts with the mathematical formalism, so that from any physical conditions equations between the mathematical quantities may be inferred and vice versa. In an application of the theory one would be given certain physical information which one would proceed to express by equations between the mathematical quantities. One would then deduce new equations with the help of the axioms and rules of manipulation and would conclude by interpreting these new equations as physical conditions. The justification for the whole scheme depends, apart from internal consistency, on the agreement of the final results with experiment.[4]

It is clear that Dirac sees the physicist moving from physics to mathematics and back again, using laws and interpretation during this process. The need for laws and interpretation probably lies in the nature of mathematics vis-à-vis the nature of physics. In particular, integrating mathematics and physics is a problem of integrating concepts and propositions from different domains so that they work together in an argument.

What is it, then, about the nature of mathematics and the nature of physics that produces a problem? "In the last resort all mathematics can be presented in terms of two notions, that of a set or range of *exact* concepts (propositional functions, etc.) and that of a function (mapping, etc.) defined in terms of a 'set'" (Körner 1968, p. 168). What is an exact concept? It is one that doesn't permit a neutral case; that is, a case in which both the assigning of the concept and a refusal to assign conform to the concept-governing rules. To put it another way, a circle is either a circle or it is not. In mathematics one can state unequivocally whether or not this or that is a triangle, circle, rectangle, or whatever. There is no such thing as a borderline case. "Every perceptual characteristic on the other hand is internally inexact, which, we recall means that each species of it is either inexact or if exact has an inexact subspecies" (Körner 1968, p. 169). Perceptual characteristics refer to aspects of physical objects, physical processes, and so on. Here, an inexact concept is one that does permit a neutral case; that is, it is possible to both assign and refuse to assign the concept and still be in accord with the concept-governing rules. For instance, it is not always possible to state unequivocally whether or not an object is red; it is possible to agree than an object could be either hot or cold at one and the same time. Perceptual characteristics are inexact because here one is dealing with the vagaries of the physical world and our discrimination of it. For every physical object, there is an infinity of characteristics and that physical object cannot be totally discriminated by a finite set of descriptions. The domain of physics is necessarily tied to inexact perceptual characteristics. Although there might be exact concepts in physics, these exact concepts have inexact subspecies. Physics is necessarily tied to concepts that allow the borderline (neutral) case. The domain of mathematics, on the other hand, is the domain of exact concepts.

In mathematics it is not contradictory to say in two mathematical theories that "an Euclidean point exists" and "an Euclidean point does not exist," for the notion of an Euclidean point is an arbitrary construct that leaves one free to construct other concepts whose existence, on the face of it, would be incompatible with the existence of an Euclidean point. So, in mathematics, it is possible to postulate the existence of something independent of the physical universe. Why is this so? One has noted that mathematics is the domain of exact concepts and the physical universe is the realm of inexact concepts. It is evident that the sets of exact and inexact concepts are mutually exclusive in that no exact concept can be a member of the set of inexact concepts and vice versa. Thus, mathematics is disconnected, logically, from perception and the physical universe.

In physics, on the other hand, in two physical theories one cannot say without contradiction that "all copper conducts electricity" and "this piece of copper does not conduct electricity," for the existence of a piece of copper that does not conduct electricity is incompatible with the original claim that all copper that exists conducts electricity. Physics is tied to the physical world, and concepts and propositions in physics must exhibit some correspondence with that world.

The problem, then, in the attempt to integrate mathematics and physics, is one of how to bring together a domain that is tied to the physical world and whose concepts are inexact, or have inexact subspecies, with the domain that is disconnected from the physical world and whose concepts are exact. There are only three possibilities:

1. The concepts of physics are modified in some manner so that mathematics can do some work.
2. The concepts of mathematics are modified in some manner so that physics can make use of them.
3. The concepts of both physics and mathematics are modified so that they can work together.

In order to decide between these possibilities, it is necessary to examine the role that the physicist wants mathematics to play. The physicist seeks to use mathematics because it is a precise domain in which exact concepts are connected by deductive logic. If either (2) or (3) are put into effect, then the very thing that the physicist prizes, the precision of mathematics, will be lost. Consequently, the first possibility is the only workable one.

How, then, are the concepts of physics to be modified? If the linking of exact concepts by means of deduction is prized, then the concepts and propositions of physics must be modified to become exact, and in doing so, one disconnects those concepts and propositions from the physical world. For instance, in producing the formula for the period of a simple pendulum, $T = 2\pi\sqrt{l/g}$, one starts by saying that one will ignore the constitution of the support for the bob, air pressure, and the like and asserts that the arc of swing will not exceed fifteen degrees. One deliberately idealizes the physical situation so that it becomes exact or, more properly, translatable into the exact concepts of mathematics. Mathematics can enter into this exact situation and, by deduction, link various propositions so that a formula is established. After arriving at a formula for the ideal, exact system, the problem is to reconnect it with the physical world, for only then can it be applied to the real world.

In general, this analysis agrees with:

> the "application" to perception of pure mathematics which is logically disconnected from perception, consists in a more or less regulated activity involving (i) the replacement of empirical concepts and propositions with mathematical, (ii) the deduction of consequences from the mathematical premises so provided and (iii) the replacement of some of the deduced mathematical propositions by empirical. One might add (iv) the experimental confirmation of the last-mentioned propositions . . . [Körner 1968, p. 182]

Integration occurs between mathematics and physics, and its logic is the idealization (modification) of physics to allow for the inclusion of mathematics, followed by the de-idealization (demodification) of mathematics. This is integration by metamorphosis.[5] In fact, physics is normally taught in full recognition of the logic of integration between physics and mathematics, though I doubt if physics teachers bother to call it that. Yet, it is a clear-cut case of the combination of two disparate domains in the service of argument, that is, integration.

From the example of the integration of mathematics and physics, it is possible to propose a hypothesis about the nature of integration. For integration to take place between the concepts and propositions of two disparate domains:

(a) One domain must be the domain in which the enquiry is set.

(b) The concepts and propositions in the domain of enquiry are idealized so that they combine in argument with the concepts and propositions of a different domain, the instrumental domain.

(c) When a conclusion has been reached in the instrumental domain, the de-idealization process takes place.[6]

This, of course, is only a hypothesis suggested by one example. It is possible to argue that the example is unique in the sense that mathematics is a most peculiar domain, and integration, when mathematics is one of the domains to integrate, is unique in form. But this objection, itself, raises another hypothesis: One cannot make generalizations about integration. Given that there are several domains, then, it could be argued that the integration between domains always poses peculiar problems because their nature is necessarily unique. Consequently, if this were the case, integration would be the combination in argument of concepts and propositions from two disparate domains, but the logic of integration would vary, depending upon the nature of the domains that are being integrated.

Can the preceding argument be considered as progress or is one merely retracing arguments already conceived and published?

> In Schools Council Working Paper No. 12 Professor Hirst says, apropos of the autonomous forms of knowledge, that we must hang on to two things, viz., "There are distinct schemes; the concepts of maths, say, are not of the same logical kind as those of morals or even of science. Yet the sciences use mathematical concepts, moral judgements can depend upon scientific evidence, and so on. We must, therefore, also hang on to the complex connections between different domains." The view one has of curriculum integration depends upon the meaning one is to write into such phrases as "hang on to the complex connections between different domains." [Pring 1973, p. 146]

To my knowledge, there has been little effective progress in examining the "complex connections" since this view. I feel that the argument so far is a beginning toward a better understanding of Hirst's complex connections and toward a more explicit view of integration. The interesting question now is whether or not the analysis of another example will follow the pattern of one or other of the above hypotheses.

Let us consider another example, using history and sociology. In looking at this example, one must be careful to note that if history and sociology exhibit the same pattern of integration as mathematics and physics, this does not confirm that integration follows a general pattern. Nonrefutation is suggestive, but not conclusive. On the other hand, if it were possible to argue on logical grounds that there is an established pattern, then this would be conclusive. At this stage, it is unclear to me how one would argue on logical grounds, though one would suspect that it is a possibility if one uses the Wittgensteinian concepts of "form of life," "tacit presuppositions," and the "language game." However, for the present, I shall content myself with an empirical hypothesis.

Homans (1973) gives the following sociological explanation of the technical innovation in cotton manufacturing in Britain during the Industrial Revolution:

(1) Men are more likely to perform an activity, the more valuable they perceive the reward of that activity to be.

(2) Men are more likely to perform an activity, the more successful they perceive the activity to be in getting that reward.

(3) The high demand for cotton textiles and the low productivity of labour led men concerned with cotton manufacturing to perceive the development of labour-saving machinery as rewarding in increased profits.

(4) The existing state of technology led them to perceive the effort to develop labour-saving machinery as likely to be successful.

(5) Therefore, by both (1) and (2) such men were highly likely to try to develop labour-saving machinery.

(6) Since their perceptions of the technology were accurate, their efforts were likely to meet with success, and some of them did meet with success.[7]

For my purposes, this explanation is interesting because of its anonymous nature. Reference is always made to "men," not one "particular man." It is an impersonal explanation, and moreover, it occurs as part of an essay in which Homans attacks sociologists for disregarding humankind and concentrating on social systems. So, "This meant, in effect, that the general propositions of sociology were not to be propositions about the behaviour of 'individual consciousness'—or, as I should say, about men, but propositions about the characteristics of societies or other social groups as such" (Homans 1973, p. 52). On the other hand, some sociologists would attack Homans because he is too little concerned with personal action as opposed to human behavior. As Wright Mills (1959) remarked, "The most fruitful distinction with which the sociological imagination works is between 'personal troubles of the milieu' and 'the public issues of social structure'" (p. 8).

Sociology cannot be categorized as falling at any particular point between the personal and impersonal. Theorists, such as Parsons, are concerned with the production of covering laws of grand scope and abstractness. Methodologists, such as Berelson, are concerned with applying the most stringent, impersonal methodology. In debate the theorists and methodologists are accused of so depersonalizing sociology that it loses contact with what should be its prime source—personal action. With regard to persons, sociology seems to exist on a continuum from the personal to the impersonal. The level of impersonality is a matter for debate, and I have not the temerity to attempt to adjudicate in the argument.

Traditionally, there is a long-standing belief that history is concerned with the personal as opposed to the impersonal. Thus, it is argued that one cannot produce a historical explanation without taking into account the idiosyncrasies of the individuals concerned. Watkins (1973), in writing about diplomatic history, says, "Here the premises of an historical explanation must be the specific dispositions, beliefs and relationships of actual people" (Watkins 1973, p. 98). Watkins's view about diplomatic history is commonly held about all history, for as Collingwood remarked, "history is re-thinking the thoughts of dead men." On this view history cannot produce an impersonal explanation.

On the other hand, Thucydides, Spengler, Toynbee, and Marx would not agree. History for them is the search for the covering laws that enable one to give an impersonal explanation. At this point it seems appropriate to indicate what is meant by *person.* Peters (1966) offers us an accurate analysis of this term. He says, "The notion is much more that of an assertive point of view; of judgements, appraisals, intentions, and decisions that shape events, their characteristic stamp being determined by previous ones that have given rise to permanent or semi-permanent dispositions" (p. 210). Consequently, *impersonal* refers to the absence of the above; that is, to the absence of an assertive point of view and to the individual's judgments, appraisals, and intentions. To treat someone as impersonal is to ignore their interests in this matter. Thucydides, Spengler, Toynbee, and Marx—all eschew the incorporation of such personal items in their attempts at historical explanation. For them the dispositions of humankind are the most that can be mentioned. Thus, historians pursuing a covering law account of history are very akin to those sociologists like Homans, and in fact, there is some difficulty in distinguishing the two.

Just as I had no wish to enter the debate about the direction of sociology as a discipline, I have no wish to enter the debate about the direction of history as a discipline. The point I wish to make can be made simply enough without getting embroiled in other issues. I can suggest that there seems to be a continuum stretching from the totally impersonal to the totally personal and that the study of sociology falls somewhere in the range from the totally impersonal towards the personal, while the study of history falls somewhere in the range from the totally personal towards the impersonal. At some point on the continuum, history and sociology overlap and, from the point of view of the continuum, cannot be distinguished.[8]

To see that history and sociology integrate, one has merely to look at the practice of sociologists and historians. Historians use sociological concepts and ideas in their explanations; similarly, sociologists use history. How then does the integration occur?

Firstly, let us ignore the occasions where sociology and history overlap on the continuum from the personal to the impersonal, for here there is no distinction. If there is to be a distinction, it must be made on other grounds. Where sociology and history do not overlap, the problem for historians using sociology is either that the sociological constructs and ideas that they wish to make use of are impersonal, relative to their wish to couch their explanations in personal terms or that the reverse is true. Thus, a Collingwood using Parsonian ideas has problems with the impersonality of the sociological ideas: a Thucydides using the ideas of Beger and Luckman has the reverse problem.

Take Homans's example. In seeking to explain, historically, the advance of technical innovation centered around cotton manufacturing in the Industrial Revolution, historians (working toward the personal end of the continuum) will demarcate the area of concern in broad terms. Then, they may turn to the sociologists (toward the impersonal end) and request some sociological analysis of the problem in which they are interested.

The sociologists, before they can begin to construct an explanation, must strip the particular situation of, for them, inessentials. That is, they must render the situation amenable to impersonal investigation. To do this they, in a sense, idealize the situation and then bring to bear whatever theories, models, and ideas from sociology that seem appropriate. The explanation that the sociologist constructs is an impersonal one that is couched in, and governed by, sociological thinking. As such, this explanation is not historical. The historian's problem is to remove the impersonality of the explanation and, by reference to the idiosyncrasy of the situation being studied, personalize the explanation so that it is now historical.[9] The same form of methodology is applicable when the historian and sociologist occupy different relative positions on the personal/impersonal continuum.

This particular pattern of integration is, in general terms, the same as that to be found between physics and mathematics when physics is using mathematics. But one cannot conclude from this that it represents the general pattern of integration for any two domains. When, for instance, the sociologist uses history then the pattern must be reversed. However, if idealization/de-idealization is not the general pattern, then modification/demodification certainly may be on the evidence so far.

Consequently, it now seems possible to suggest that the general pattern of integration may be:

1. One domain is the domain in which the enquiry is set.

2. The concepts and propositions of the domain of enquiry are suitably modified so that they are of the same logical type as the other domain, the instrumental domain, and thus, can combine in argument.

3. When a conclusion is reached in the instrumental domain, then this is modified so as to change it into the same type of the domain of enquiry.

Certain ideas can be added to the above as a result of the argument so far.

4. The domain of enquiry governs the significance and status of the argument from the instrumental domain when it is incorporated in the argument of the domain of enquiry.

5. The argument in the instrumental domain is an argument true to the canons of that domain. If it were not, then the point of turning to that domain for aid would be lost. Only the conclusion is suitably modified to return it to the domain of enquiry.

6. It is only possible to integrate between two domains at any one time. This follows from the modification thesis, modification cannot take place in two directions at once. Consequently, when seeking to integrate the fruits of interdisciplinary enquiry in which four domains have taken part, the integration must proceed two by two. This is not to suggest that one domain must be the domain of enquiry but rather that, at any one time, only two domains can enter a process of integration.

It would be interesting at this point to look at pursuits like geography, for there is some argument as to whether or not it is a domain. If it is a domain, then given the previous analysis of integration, one would expect to find a particular pattern to the integration of concepts and propositions from biology, economics, physics, etc., into a distinctive geographical argument. It would also be interesting to look at the production of propositions about the conduct of education. It is normal to hear that educational decisions are reached by bringing to bear concepts and propositions from the relevant disciplines, e.g., history, philosophy, psychology, and sociology. However, if an educational decision is to be reached, one would surmise that the concepts and propositions from these different domains would be integrated into some form of argument whose conclusion was a decision about the conduct of education. If the preceding argument about the logic of integration is correct, then the course of the argument could be analyzed. But both geography and educational decision making are beyond the scope of a short essay, as are social studies, general studies, and all the other types of courses in which it is said integration is pursued.

In this essay I have argued that:

1. The integration of knowledge from different domains is not only possible but a normal feature of the pursuit of knowledge.
2. Integration may be hypothesized to exhibit a particular logic.
3. The hypothesis is a practical one to those constructing and teaching integrated courses.

In conclusion I would suggest that there is an urgent need for more examples to be studied, for as it stands one simply does not know enough about what one is doing when one seeks to integrate. If the preceding argument on integration is correct, then teachers and students pursuing integrated studies need to ask themselves two initial questions:

(a) What is the domain of enquiry?
(b) Which is the instrumental domain?

and two subsequent questions:

(c) What is the nature of the concepts and propositions in the domain of enquiry?
(d) What is the nature of the concepts and propositions in the instrumental domain?

For without answers to these questions, integrated studies must proceed without conscious awareness of what is being done.

NOTES

1. "Multidisciplinary" is used here to refer to the pursuit of disciplinary perspectives of either the same or different objects in which no attempt is made to synthesize or draw together the different perspectives. "Interdisciplinary," on

the other hand, implies some form of synthesis of the disciplinary enquiries. To some extent, these meanings are now common parlance.

2. For a typical use of this notion, see Musgrave (1975).

3. For an initial argument in this area, see Petrie (1976).

4. See Dirac (1947, p. 15) as quoted in Körner (1968, p. 177). The argument that follows owes a great deal to Körner.

5. There are, of course, a number of problems connected with such a terse description. In the main, they center around the "more or less regulated activity" of de-idealization and experimental investigation. For instance, in the case of the simple pendulum, one arrives at the mathematical description of an ideal system, $T = 2\pi\sqrt{l/g}$. From this formula, it can be inferred that if one measures various values of T corresponding to a series of values of l, then, the plot of T^2 against l should give a straight line passing through the origin. But such inferences only hold for the ideal system. The real system must diverge from the ideal, and the experimental results will not yield values of T^2 and l, all of which lie on a straight line passing through the origin. But there must be some minimum level of correspondence between the ideal and the real if the mathematical description is to be physically acceptable. The expected range of divergence can be worked out by estimating the degree of error inherent in both the production of the formula and the testing of it. Strictly speaking, it is not the degree of error but the degree of divergence between the real and the ideal.

In the case of the simple pendulum, two factors loom large in creating this divergence: the finite mass of the string or thread and the lack of definiteness about its effective length. Without changing the system, these factors place a limit on the amount to which divergence, theoretically, can be limited to 0.1 percent. With this in mind, the experiment can be conducted and the "curve of the best fit" is drawn. This curve is then altered to "the best straight line through the origin." In doing this, one is selecting two characteristics of the ideal description to carry over into the real situation: a straight line and a fixed point. This procedure raises a number of interesting questions: (a) On what basis does the physicist decide which characteristic of the ideal system shall be carried over into the real system? (b) On what basis does the physicist work out the level of tolerance he/she is prepared to extend to divergence between the real and the ideal? (c) If the description of the real system incorporates characteristics of an ideal system, then what is the truth status of the description of the real system?

6. It is, of course, possible to generalize the hypothesis still further by substituting "modification" and "demodification" for "idealization" and "de-idealization." But, for the moment, I shall stay with the more specific hypothesis.

7. See Homans (1973, pp. 61–62). Homans is attempting to frame a deductive version of the explanation given by Smelser (1959, pp. 10–11).

8. This is not to suggest that they might not be distinguished by other means.

9. I must emphasize that I am not interested in giving a detailed account of either historical or sociological explanation. I merely wish to highlight an aspect of each type of explanation. A detailed account of the intricacies of integration between history and sociology would require a more detailed analysis. For the moment, I am after a possible general account of integration.

REFERENCES

DIRAC, P.A.M. *The principles of quantum mechanics.* London: Oxford University Press, 1947.

HIRST, PAUL H., ed. "Curriculum integration." In *Knowledge and the curriculum.* London: Routledge & Kegan Paul, 1974.

HOMANS, GEORGE S. "Bringing men back in." In *The philosophy of social explanation,* edited by Alan Ryan. London: Oxford University Press, 1973.

KÖRNER, STEPHAN. *The philosophy of mathematics.* London: Hutchinson University Library, 1968.

MILLS, CHARLES W. *The sociological imagination.* London: Oxford University Press, 1959.

MUSGRAVE, PETER W. *Contemporary studies in the curriculum.* Sydney: Angus & Robertson, 1974.

______. "'Integration' and social science." *Educational Philosophy and Theory* 7, no. 1 (March 1975): 27–40.

PETERS, RICHARD S. *Ethics and education.* London: Allen & Unwin, 1966.

PETRIE, HUGH G. "Do you see what I see? The epistemology of interdisciplinary inquiry." *Journal of Aesthetic Education* 10, no. 1 (January 1976): 29–43.

PRING, RICHARD. "Curriculum integration." In *The philosophy of education,* edited by Richard S. Peters. London: Oxford University Press, 1973.

SMELSER, NEIL J. *Social change in the industrial revolution.* Chicago: University of Chicago Press, 1959.

WATKINS, J.W.N. "Ideal types and historical explanation." In *The philosophy of social explanation,* edited by Alan Ryan. London: Oxford University Press, 1973.