
Title	The centrality of subject matter in teaching thinking: John dewey's idea of psychologizing the subject matter revisited
Author(s)	Zongyi Deng
Source	<i>Educational Research Journal</i> , 16(2), 193-212
Published by	Hong Kong Institute of Educational Research.

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*The Centrality of Subject Matter in Teaching Thinking: John Dewey's Idea of Psychologizing the Subject Matter Revisited*¹

Zongyi Deng

National Institute of Education

Nanyang Technological University

This paper attempts to reveal the central role of subject matter in teaching thinking, and in so doing, criticise the skill-oriented approach adopted in Singapore. Based upon Dewey's idea of psychologizing the subject matter, this paper introduces the idea-based approach in which subject matter is used as the most important intellectual resource for developing thinking and as a central framework for introducing educative experience. Focusing on the assumptions about subject matter, learning to think, and teaching thinking, a comparison and contrast between the two approaches has been made to reveal the problems inherent in the skill-oriented approach. This paper contends that the skill-oriented approach fails to consider subject matter to be the most important resource in developing thinking. It is grounded in a faulty assumption which separates subject matter and thinking. It creates a tendency of ignoring the concepts, principles, and criteria embodied in subject matter in disciplining and enhancing thinking, of reducing teaching thinking into generic

Correspondence concerning this article should be addressed to Zongyi Deng, National Institute of Education, Nanyang Technological University, 1 Nanyang Walk, Singapore 637616. Email: zydeng@nie.edu.sg

techniques, and of restricting and undermining the impulses, dispositions, and freedom of learners. Further, this paper espouses an approach which combines teaching subject matter for conceptual understanding and developing higher-order thinking together, based upon Dewey's idea and current advances in cognitive psychology.

Key words: thinking; teaching; John Dewey

Introduction

The concept of “thinking school” represents one of the major initiatives for preparing the younger generation of Singaporeans to meet the challenges of the 21st century.² Its basic idea is to make younger Singaporeans better thinkers through cultivating in them the ability to think critically and creatively. To implement this initiative, the curriculum specialists at the Ministry of Education in Singapore has developed a new Thinking Programme (Chua & Leong, 1998).³ At the heart of the programme are eight core thinking skills adopted from Marzano et al.'s (1988) Dimensions of thinking—namely focusing, information-gathering, remembering, organising, analysing, generating, integrating, and evaluating. The eight core thinking skills are incorporated into Marzano's (1992) Dimensions of Learning framework involving: (1) positive attitudes and perception about learning; (2) thinking involved acquiring and integrating knowledge; (3) thinking involved extending and refining knowledge; (4) thinking involved using knowledge meaningfully; and 5) productive habits of mind. Through these dimensions of learning, the core thinking skills are claimed to enable students to acquire and integrate knowledge as well as extend and refine it in its subsequent use. In the spirit of the Thinking Programme, the Ministry of Education has developed training programmes through which all in-service teachers are to be trained in the teaching of thinking skills. The National Institute of Education, the only teacher education institution in Singapore, has embarked on redesigning and conducting teacher education programmes, which equip pre-service teachers to teach thinking skills in schools.

I am concerned that the way of teaching thinking adopted in the Thinking Programme is largely driven by a classification of thinking skills and a concept of learning processes which are generic in essence, independent of the subject matter in the school curriculum. Teaching thinking is primarily a matter of developing thinking skills. I call this way of teaching thinking the skill-oriented approach.⁴ However, at the heart of the curriculum is the highly important concept of subject matter as organised fields of inquiry and study. Resnick (1987) argues that the key to enhancing higher-order thinking depends on linking the general processes with rich domain-specific knowledge. What is the role of subject matter in teaching higher-order thinking? What is the relationship between teaching thinking and teaching the subject matter? These two questions are very crucial and yet largely ignored in the skill-oriented approach.

It is my concern that the current Thinking Programme, with the obsession of thinking skills and their infusion, has obscured the central issues concerning the central role of subject matter in teaching thinking. This paper attempts to recover the central role of subject matter through revisiting John Dewey's idea of psychologizing the subject matter. I will discuss what I believe is implied by Dewey about psychologizing the subject matter, which provides an essential theoretical underpinning for a fundamentally different approach to teaching thinking—namely the idea-based approach—concerned with the development of understanding major ideas in a particular subject matter. This will be followed by an examination of how Lampert taught decimal numbers to 5th graders to illustrate this approach. Then I will compare and contrast the underlying assumptions about subject matter, thinking, learning to think, teaching thinking between the two approaches, and in so doing, unveil some of the endemic problems inherent in the skill-oriented approach. The paper will end with espousing an approach which combines teaching subject matter for conceptual understanding and developing higher-order thinking together, based upon Dewey's idea and current advances in cognitive psychology.

While this paper is about the Thinking Programme in Singapore, it pro-

vides ideas, observations, and comments that are more generally useful for other Asian countries, provided that teaching thinking skills has recently gained strong currency in Asian. As I will argue, the skill-oriented approach is grounded in a faulty assumption which separates subject matter and thinking. It fails to recognize subject matter to be the most important intellectual resource in developing thinking. It creates a tendency of ignoring the concepts, principles, and criteria embodied in subject matter in guiding, disciplining, and enhancing thinking, of reducing teaching thinking into a body of generic techniques and procedures, of restricting and undermining the impulses, interests, dispositions, freedom and initiatives of learners in their growth of thinking. I hope this work will contribute to the current debate about how to cultivate creativity and critical thinking in Asian students.

The Skill-oriented Approach

Two strategies have been employed in the Thinking Programme, both of which epitomize the skill-oriented approach. In the first strategy, students are taught thinking skills explicitly in a non-curricular context. They learn thinking skills through teacher explanation and modelling, and then apply them in everyday situations. In the second strategy, thinking skills are infused into the content of core school subjects—such as mathematics, English, science, and history. Thinking skills are explicitly taught in the context of their use or application to a specific subject matter content. Subject matter provides students the context or some background information for acquiring and exercising thinking skills. For example, the skill “generating” can be taught to secondary students through the topic algebraic expressions. As recommended in the Programme, the teacher first asks students to think of a number and add 3 to the number, and students are led to realize that the result can be written as “ $X + 3$ ”, where X is used to represent the number they think of. Then the teacher guides students to generate algebraic expressions for the situation: choose a number, then multiply it by 3 and add 2

to the product. Further, students are asked to practice generating algebraic expressions for other situations such as,

- Subtract 8 from a number N and halve the result.
- Mary is twice as old as her brother. Her brother is X years old.
- David is 5 cm taller than Ali. Ali is H cm tall.
- Sue spent \$ X for a new blouse and has \$2 left.
- A rectangle has length L cm and breadth B cm.
- The cost of an orange is 40 c less than the cost of a mango. Each mango costs X c (Yee, Lim, Hang, Sin, & Ang, 1999).

Which particular thinking skill students need to develop as a result of learning algebraic expressions represents the central concern in planning the infusion lesson, which does not have a necessary bearing with the subject matter concerned, its particular conceptual and methodological configuration. The teacher needs not to examine what is involved in knowing or reasoning about algebraic expressions mathematically to identify the thinking skills to be taught. Whether skills are taught in a non-curricular context or within the context of a particular subject matter, they nevertheless retain their individual identity, independent of the subject matter. Both strategies place emphasis on discrete thinking skills rather than conceptual understanding of the subject matter content.

Psychologizing the Subject Matter and the Idea-based Approach

Dewey's idea of psychologizing the subject matter provides an important theoretical underpinning of the idea-based approach to teaching thinking. Dewey conceived thinking and subject matter in terms of experience. Thinking is the "method of intelligent experience" which "discovers the specific connections between something which we do and the consequences which result, so that the two become continuous" (Dewey, 1916, p. 145). The experience enacted and undergone by us, on the other hand, would modify and transform our ways of thinking and perceiving (Dewey, 1916). According to Dewey, subject matter is a particular form of human experience which "embodies the cumulative outcome of the efforts, the strivings, and the suc-

cesses of the human race generation after generation” (Dewey, 1902, p. 190). It, therefore, provides the “working capital” and the “indispensable resource” for developing thinking (Dewey, 1916). The key is to introduce educative experiences through psychologizing the subject matter, which entails the following three aspects.

In the first place, subject matter is used to determine criteria, essential elements and features that are desirable for learners. Dewey wrote,

...the significance of subject matter...is to supply definite standards.... The material of school studies translates into concrete and detailed terms the meanings of current social life which it is desirable to transmit. It puts clearly before the instructor the essential ingredients of the culture to be perpetuated, in such an organised form as to protect him from the haphazard efforts he would be likely to indulge in if the meanings had not been standardised. (Dewey, 1916, p. 182)

In the second place, psychologizing the subject matter requires interpreting learners to discern facts, ideas, interests, capabilities, and dispositions “stirring” in their experiences which are the “sign(s) of index” of the potentialities of further growth, using the subject matter as reference. As Dewey (1902) stated,

From the side of the child, it is a question of seeing how his experience already contains within itself elements—facts and truths—of just the same sort as those entering into the formulated study; and, what is of more importance, of how it contains within itself the attitudes, the motives, and the interests which have operated in developing and organizing to the plane which it now occupies. (p. 189)

In the third place, it requires discovering resources and conditions that could foster the learning processes and growth, using the subject matter as guidance:

From the side of the studies, it is a question of interpreting them as outgrowths of forces operating in the child’s life, and of discovering the steps that intervene between the child’s present experience and their richer maturity. (p. 189)

The above three aspects of psychologizing the subject matter outline what it might take for a teacher to carry out the idea-based approach, in which subject matter is used as a central framework for introducing educative experiences. It requires an examination of subject matter to identify

key concepts, principles, criteria, and features that are essential to quality understanding and thinking. It entails an interpretation of learners through the lenses of the subject matter, to discern their impulses, habits of minds, ways of thinking, and prior knowledge that provide a point of departure for further development. Further, it requires that subject matter is used in carrying forward these impulses, habits of mind, and ways of thinking to a significant end defined by the subject matter. In other words, the approach requires a correlation between the attitude, impulses, and experience of learners and the subject matter.

The Case of Magdalene Lampert's Teaching

Some of the points made above can be illustrated by looking at Magdalene Lampert's (1989) description of her teaching the introductory unit on decimal numbers to 5th graders.⁵ Magdalene Lampert was a professor of teacher education at Michigan State University. For a number of years, she assumed responsibility for mathematics teaching from a classroom's full-time teacher, teaching mathematics to a fifth-grade class in a Michigan public elementary school. She collected examples of student work, videotaped many of the classroom interactions, kept journals reflecting on her own practice and assessing the children's understanding, planned the next day's lesson, and then began the process anew. Using all these as the database, she analysed the practice of teaching for conceptual understanding and higher-order thinking. I use her teaching of the introductory unit on decimal numbers as an example because it best illustrates the above three aspects of psychologizing the subject matter, which undergird the idea-based approach to teaching thinking.

The content taught involves comparing two decimal numbers to decide which is larger or if they are equal. Usually, it is taught as an algorithm, a step-by-step prescription: "Add zeros after the digits to the right of the decimal places. Now ignore the decimal point, and see which of the numbers is larger" (p. 225). Pupils need not understand anything about what the num-

bers themselves are meant to represent in order to follow this procedure.

In contrast to this common way of teaching decimal numbers, Lampert's teaching aimed at helping students not only become competent at using the procedure, but also capable of understanding the underlying mathematical principles, and of reasoning about solutions mathematically. It required psychologizing the subject matter in a way that could foster conceptual understanding and higher-order thinking in students.⁶ Lampert's psychologizing first entailed a reasoning of what is involved in knowing mathematically about comparing decimal numbers, with the purpose of identifying the mathematical principles and forms of reasoning that underlie the competence she wished her students to achieve. The reasoning led her to conclude that knowing how to compare decimal numbers mathematically entails more than acquiring procedural competence. It requires conceptual competence and certain ways of mathematical reasoning as well—e.g., how to articulate the underlying mathematical principles, how to weigh evidence, and how to prove, justify, and evaluate conclusions. The reasoning helped her concentrate the subsequent instruction on four mathematical principles that are essential for reasoning about decimal numbers mathematically—namely, (1) geometric progression of the base, (2) the relationship between digit and place, (3) the “two-way” ratio between places, and (4) bounded infinity.

Lampert's interpretation of learners and selection of representational tools were guided by her understanding of what involved in knowing mathematically about comparing decimal numbers. She sought to connect the mathematical principles and ways of reasoning she wanted students to develop with the experiences, impulses, and prior knowledge of students. Acknowledging that students had considerable experience with various denominations of bills and coins which could provide a point of departure for discussing and reasoning about decimals, she decided to use money as a way to represent decimal relationship. After the first lesson, she found out that students' understanding of decimal fractions became more fragile as zeroes were added between the decimal point and the nonzero point. She

saw it as a meaningful opportunity for developing genuine understanding of mathematical principles and mathematical ways of reasoning. Accordingly, she chose fractional parts of a circle and places around a units-based “line of symmetry” as two other representational tools, which were “responsive” to both student thinking and the kinds of mathematical understanding and reasoning she attempted to foster in students.

The subsequent lessons taught students how to use representational tools and then taught them how to choose those tools to reason about comparison among decimals. Her teaching of these lessons is an example of the kind of teaching congruent with idea-base social constructivism—a kind of constructivism which emphasizes both the role of key ideas of the subject matter and social discourse in the constructive processes of learners (Prawat, 1991; 1993). She guided the process of constructing meaning for mathematical symbols and operations so that what students learnt about mathematics was related to the central ideas of the subject matter. Students were introduced not simply to a set of mathematical principles, but also to specific modes of thinking which were informed by the principles. She used the representational tools to convey to students each of the mathematical principles, by making connections, moving back and forth between representations. Dialogue was encouraged between teacher and students and among students themselves. And she continued to assess what students might find difficult about these mathematical principles and reasoning, and take actions accordingly.

As compared to the skill-oriented approach, Lampert’s approach represents a radical change in focus for teaching thinking. Instead of asking, “Which thinking skills should students master in learning a particular topic?”, the teacher asks, “What does it mean to think mathematically about that topic?”. It testifies that a subject matter, if taught beyond a general and superficial level, involves the development of thinking abilities in students—such as analysing, generating hypotheses, making judgement, and justifying—that are peculiar to that subject matter itself as a way of understanding experience. Teaching for higher-order thinking involves, among other things, helping students understand certain

concepts, principles, and criteria, as well as learn to think in a way that is informed and governed by these concepts, principles and criteria. It also requires a teacher to be sensitive of what attitudes, impulses, and tendencies are being created in students, and to judge what attitudes, impulses, and tendencies are actually conducive to continuous growth in their thinking and understanding, through the lens of subject matter.⁷

A Comparison and Contrast: The Idea-based and the Skill-oriented Approaches

The idea-based approach and the skill-oriented approach make strikingly different assumptions about subject matter, thinking, learning to think, and teaching thinking. A comparison and contrast can render problematic certain aspects of the skill-oriented approach.

Subject matter. For the idea-based approach, the subject matter of an academic discipline is a special kind of human experience associated with special modes of insight, ways of thinking, and dispositions of mind. It is an embodiment of critical thought within a particular complex, sophisticated, and important area of inquiry (Dewey, 1916). Subject matter involves a body of concepts and principles, ways of reasoning, as well as well articulated criteria that inform and guide quality thinking within that area (Schwab, 1964). It provides guide to future observations and reasoning, enables anticipations of possible solutions, and economizes the working of mind (Dewey, 1902). In short, subject matter has the potential of guiding, disciplining, expanding, and enhancing thinking, and hence, it is the most important resource in enhancing thinking.

On the contrary, the skill-oriented approach views subject matter as a body of inert, ready-made information, apart from methods of thinking and habits of mind.⁸ Subject matter provides merely necessary background information for thinking, and accordingly, it is used as the medium of teaching thinking. Thinking skills, *not* subject matter, are considered to be the most important tool or resource in promoting thinking. As a result, the approach tends to downplay the role of subject matter, and in so doing, highlights the

importance of thinking skills in the development of higher-order thinking. As one of the key champions for the skill-oriented approach stated,

Bodies of knowledge are important, of course, but they often become outdated. Thinking skills never become outdated. To the contrary, they enable us to acquire knowledge and to reason with it, regardless of the time or place or the kind of knowledge to which they're applied (Sternberg, 1985, in Quinby, 1985 [an interview with Sternberg], p. 53).

Thinking and learning to think. The above two various conceptions of subject matter imply two different sets of assumptions of thinking and learning to think. For the idea-based approach, the capacity to think critically is inextricably intertwined with the subject matter concerned. Learning to think requires understanding not only the key concepts and principles of the subject matter, but also the specific modes of reasoning, criteria, and justification within that subject matter. Thinking is believed to be developed as students understand concepts and principles, and learn to reason in a fashion that is guided by the concepts/principles, in accordance to certain standards and criteria. Through learning to think in a way that is norm governed, according to principles, students eventually are able to create orders in experiences by means of concepts, principles, and norms (Hirst, 1965).

Unlike the idea-based approach, however, the skill-oriented approach conceives thinking in terms of a set of generic skills, which can be learned in themselves, apart from a particular subject matter. Being good at critical thinking is viewed as basically a matter of being proficient at a body of generic mental skills or procedures. Accordingly, learning to think is held as being centred upon this body of thinking skills or procedures, devoid of necessary governing norms and guiding principles. As Facione observes,

This domain-specific knowledge includes understanding methodological principles and competence to engage in norm-regulated practices that are at the core of reasonable judgements in those specific contexts. Too much of value is lost if CT [critical thinking] is conceived of simply as a list of logical operations and domain-specific knowledge is conceived of simply as an aggregation of information. (Facione, 1990, p. 10)

Teaching thinking. Corresponding with the above two distinct sets of

assumptions are two differing beliefs about how thinking should be taught. For the idea-based approach, teaching thinking requires a teacher's reasoning of what it means to know the subject matter as well as what is involved in thinking about that subject matter critically, to determine certain concepts, principles, standards or criteria, and modes of reasoning that are essential for quality understanding and thinking. Teaching critical thinking is largely a matter of helping students understand these concepts, principles, and criteria, and of teaching them to make appropriate use of these concepts, principles, and criteria that "our culture has developed for disciplining thinking and increasing its fruitfulness" (Bailin, Case, Coombs, & Daniels, 1999, p. 297). It entails an unfolding of the subject matter in a way that connects with the experience of learners and fosters their attitudes, impulses, and dispositions of mind. It is an effort to build upon the curiosity, impulses, dispositions, and experience of learners, moving towards achieving the learning goals defined by the subject matter, in terms of quality understanding and thinking. In this sense, teaching thinking is a transformative endeavor, enabled and constrained by the subject matter.

On the contrary, for the skill-oriented approach, teaching thinking is primarily a matter of developing thinking skills. It requires a teacher to command a repertoire of generic pedagogical strategies or techniques—such as questioning, brainstorming, and collaborative learning (see Chua & Leong, 1998)—which have no intricate bearing with the subject matter taught. Thinking skills may be brought to bear upon an independent subject matter, and are taught in the context of that subject matter. However, the subject matter is not used to determine concepts, principles, and criteria that guide and inform quality thinking, nor is it used in interpreting the experience of learners and in carrying forward the impulse and dispositions of learners to certain significant outcomes. It creates the impression that teaching thinking is merely a matter of acquisition and practising of cognitive skills, which are free of governing norms and guiding concepts/principles. Teaching thinking is, accordingly, largely a technical manoeuvre, independent of the subject matter.

The Problems of the Skill-oriented Approach

The problems of the skill-oriented approach are rooted in the conception of the separation of thinking and subject matter. Such a conception, according to Dewey (1916), is “radically false”. Subject matter and thinking are inextricably interconnected. For one thing, thinking is “a directed movement of subject matter to a competing issue” (p. 165). One cannot think without involving a particular kind of subject matter. For another, subject matter is an embodiment of methods, ways of thinking, and habits of mind. Further, Dewey (1916) points out that the separation of thinking and subject matter finds its root in the dualism of mind and world—the idea that mind and the world are two separate and independent realms.

One problem of the skill-oriented approach is the tendency of viewing subject matter as an aggregation of inert information, leading to a pitfall of subject matter as the means and resource of developing thinking to be lost sight of. Because of seeing subject matter as simply as an aggregation of inert, ready-made information, the skill-oriented approach fails to see subject matter as an embodiment of human understanding and thought which has the potential of enhancing, expanding, disciplining and transforming the thinking of the future generation. As a result, it fails to recognise subject matter as the capital and indispensable intellectual resource in the development of higher-order thinking.

Another problem is the tendency of undermining the internal factors (e.g., interest, attitudes, impulses and prior knowledge) contained in the experience of learners in developing thinking. Because of the separation of subject matter from thinking, the skill-oriented approach has great difficulty in perceiving how the internal factors can constitute the signs of index of the potentialities of higher-order thinking in a particular subject matter domain, and how these factors can be used as the “out growth of force” in teaching thinking and understanding (Dewey, 1902). In teaching thinking, the skill-oriented approach has to resort to generic techniques or strategies which have no necessary bearing with

the internal factors inherent in the experience of learners. These techniques or strategies cannot motivate learners intrinsically (Dewey, 1916). Nor can they evoke a certain “quality of response” in learners in their learning of critical thinking (Dewey, 1938).

The third problem is the tendency of reducing teaching thinking into a body of ready-made instructional techniques or procedures. Under the influence of the conception which separates thinking from subject matter, instead of deriving from a teacher’s intellectual observations and analysis of the subject matter in the light of students’ impulses, motivations, prior knowledge and experience, teaching methods are authoritatively recommended to teachers. Methods tend to be reduced to “a cut and dried routine, to following mechanically prescribed steps” (Dewey, 1916, p. 169). They represent a certain form of “external control” which leads to “restriction of freedom” of individual learners (Dewey, 1938). This tendency, along with the two already mentioned, does not create “educative” experience that “arouses curiosity, strengthens initiatives, set up desires and purposes that are sufficiently intense to carry a person over a dead place in the future” (Dewey, 1938, p. 38). Instead, it would lead to “miseducative” experience that “has the effect of arresting or distorting the growth of further experience.” (p. 25)

It is important to point out that the skill-based approach can be traced back to the model of information processing in cognitive psychology of the 1950s and 1960s. In this model, subject matter is treated as a body of inert information, and thinking as the processing of information—its acquisition, its integration, and its application. It fosters an instrumental view of teaching thinking, a view concerning with fixed teaching strategies and generation across subject matters. As a result, this model tends to totally ignore the central role of subject matter in enhancing thinking. It is not surprising that proponents of the skill-oriented approach have devoted so much attention to the cultivation of thinking skills in students (Prawat, 1991). However, without adequately addressing the role of subject matter in teaching thinking, learning outcome will often be the mere mastery of facts and procedures. The absence of good understanding of subject matter will present a barrier

to higher-level thinking. As Prawat (1991) suggests, it is counterproductive to concentrate on the “how to” aspects of thinking without adequately addressing what students are expected to think about.

Discussions

I am concerned that our current preoccupation with thinking skills does not advance us far enough to achieve the goal of preparing the younger generation to become better thinkers. What I have argued, in this paper, is that the skill-oriented approach is based upon a faulty conception of critical thinking which separates subject matter and thinking. This approach fails to consider subject matter to be the most important intellectual resource for developing thinking. It fails to acknowledge the concepts, principles, and criteria embodied in subject matter in disciplining and enhancing thinking. It tends to undermine the interests, impulses, motivations, and dispositions of learners in learning to think critically. And it tends to reduce teaching thinking into ready-made techniques that might stifle and limit the freedom and initiatives of individual learners.

However, it must be recognised that the skill-oriented approach does make a contribution to the teaching of thinking. It highlights certain cognitive skills and processes that are essential for skilful thinkers, which, however, are not explicitly articulated in the idea-based approach. Without attending these skills and processes, the idea-based approach might not suffice for teaching higher-order thinking. On the other hand, we must bear in mind the complexity of the idea-based approach and the demands it places on teachers. In order to teach according to the kind of teaching described in this paper, a teacher needs to have a very sophisticated, profound, and in-depth understanding of the subject matter. He/she needs to be extremely sensitive to learners, and be able to see how their impulses, motivations, and dispositions imply the potentialities of higher-order thinking. Furthermore, he/she needs to be able to create conditions and environment that help learners not only to realise their potentialities, but also to achieve the kind of understanding and thinking characterised by the subject matter.

This kind of teaching is very complex, demanding, and challenging. It might not be a practical approach for most ordinary classroom teachers.⁹

What seems promising is a combination of teaching subject matter for conceptual understanding and developing higher-order thinking together, with attending to certain features of the two approaches. Subject matter should be employed as the most fundamental intellectual resource and tool for developing thinking. Instructions should be concentrated on helping students to understand the key concepts and principles and to develop thinking strategies or skills that are appropriate for working within various subject matter domains. Teachers ought to initiate students to not only the cognitive strategies or skills, but also the key concepts/principles that inform and guide the thinking process, and the relevant standards and criteria that define and characterise quality thinking. Furthermore, the teacher should be sensitive as well as responsive to the impulses, motivations, and habits of learners, and should foster, not restrict, the freedom and initiatives of learners.

Nonetheless, Dewey's idea of psychologizing the subject matter provides an essential theoretical underpinning for the combined approach which considers subject matter as the fundamental intellectual resource and as essential framework for introducing and organizing learning experience. Such a combined approach finds strong support from new developments in cognitive psychology as well. Theoretical advances in cognitive psychology espouse the crucial role of "deep disciplinary content" in enhancing thinking: "one cannot think deeply about trivia; one cannot think in a vacuum" (Brown, 1997, p. 412). Furthermore, current progress in the areas of cognition and instruction leads to the emergence of "psychologies of subject matter"—regarding using subject matters of various scholarly disciplines to introduce meaningful and educative learning experience to children of various ages, which is Deweyan in spirit and is unique to the discipline of educational psychology (Shulman & Quianlan, 1995; Mayer, 1992). Mayer (1992) argues that psychologies of subject matter provides the groundwork for instructional programmes that help students develop domain-specific thinking strategies. He believes that it could open a fruitful area of research on

cognition and higher-order thinking, creating “a promising path to educational reform” in the new decades. We are on the verge of formulating and adopting a new perspective of subject matter, learning to think, and teaching thinking that is very different from the one of the skill-oriented approach.

Notes

1. An earlier version of this article was presented at the First Annual Thinking Qualities Initiative Conference, June 23-24, 2000, Hong Kong Baptist University. The author acknowledged William Wu and S. Gopinathan for their helpful comments on the earlier draft.
2. Two other major initiatives are IT-masterplan and National Education.
3. For background information of this new Thinking Programme, see Han, Tan-Niam, & Mashhadi (1998).
4. I acknowledge that such an approach would be rejected by scholars today given the fact that advances in cognitive psychology over the last two decades have testified the importance of subject matter content for higher-order thinking. However, as I will point out in this paper, the skill-oriented approach in the Thinking Programme is grounded in cognitive psychology of the 1950s and 1960s, *not* cognitive psychology of today. It places emphasis on discrete skills rather than conceptual understanding of subject matter.
5. The characterization of Lampert’s teaching in terms of the idea-based approach to the teaching of thinking is mine; she may or may not endorse this particular characterization.
6. I need to point out that the phrase *psychologizing* was not used in Lampert’s writing. She used the phrase *reasoning*.
7. It is worth pointing out that Lampert’s case reflects many attributes of “best practices” of mathematics teachers documented in the Third International Mathematics and Science Study (TIMSS). One of the attributes is a clear understanding of what is involved in knowing the subject matter in terms of key ideas and interconnections for learners. Another is that the subject matter is taught for in-depth, meaningful

- and conceptual understanding. The third is that students have sufficient opportunities for solving challenging problems and discussing mathematical concepts (Stigler & Hiebert, 1999).
8. As indicated in the subsequent discussion on the problems of the skill-oriented approach, this approach is grounded in the model of information processing in cognitive psychology of the 1950s and 1960s, which viewed subject matter as a body of inert information, and thinking as the processing of information.
 9. The above Lampert's teaching should not be taken as a typical example of how the idea-based approach is carried out by common schoolteachers. Lampert is a very exceptional scholar-practitioner: she is not only an experienced classroom teacher with skills and dispositions to teach for conceptual understanding, but also a university professor who is deeply knowledgeable about the subject matter and principles of teaching and learning.

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