

## The Present Significance of Media Literacy and its Development: Focusing on the Science Education Development

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It is possible to say that the modern society has been developing in order to meet mass production, distribution and consumption of the "objects." It, therefore, goes without saying that the 3 R's (Reading, Writing and Arithmetic) have been functioning as minimum essentials to upkeep this society. By the same logic, the society of today is now developing for the same activities but of the "concepts," such as a mass of information. In this sense, the above 3 R's could be interpreted as "input, output and processing" in the system of information processing devices. However, it is obviously impossible for people to cope with the current social change autonomously unless the perspective and significance of the new processes are sought of creatively.

For example, if we do not initiate reform to the present social structure supported by mass production and consumption, it is obvious that we may mislead our spaceship "the Earth." Highly information-oriented society is considered an essential system to deal with this kind of issue, and this society will be supported by ability to cope with the above information processing with a critical viewpoint, that is, the media literacy. Since both developed and developing countries are on board the same spaceship, the development of the media literacy is a crucial educational issue of today in both kinds of countries.

From the viewpoint of science education, in this paper we mainly took some class activities and then examined their role in developing countries in the development of media literacy from the view of critical literacy. In science education, verification in scientific process was highlighted as a mediator for the confrontation between school knowledge and everyday knowledge. Through the discussion, the process was also examined as an aid to develop the abilities to collect and select information and furthermore to facilitate the transformation of students' worldview.

### 1. Why has media literacy become an issue?

Our society is going to be highly information-oriented whether we like it or not. By just opening a newspaper or looking around town, we realize that our life is almost flooded with large amount of information related to goods and services, entertainment, concerts, traffic, employment, real estate, investment, finance, examinations, and so forth.

Contrary to the above situation whereby the function of information is perceptible, one can argue that we are also increasingly exposed to imperceptible information system, which affects our lives enormously. Such a system may

cause radical change in the basic social structure. For instance, shopping with a credit card means to correspond numerical figures with things when goods are purchased upon desire. And in dealing in commodities and futures, vast profits and losses are made instantly by merely corresponding one set of figures with another set. If we look for a more familiar example, one could think of the transfer of salaries through the bank, where the actual process is merely inputting certain digits into a computer-terminal. A point common to all these examples is that a certain sequence of digits is processed as equivalently as commodities, profits or labor.

These systems are prevailing world-wide

in both advanced and developing countries. Although the development of multimedia differs to a certain degree from country to country, people are or will be confronted with such imperceptible information systems. We think the issue is today's literacy which empowers us to read and write relevantly with the development of multimedia and an information-oriented society. In the wake of the overwhelming increase of information caused by a 'coded society', we should not merely adapt ourselves to the reality or the system behind the information by mastering computer operations, but we should critically keep up within the limits of our capacity to absorb information converting quantity into quality.

#### (1-1) Media literacy as 'viability'

In spite of the flood of information on the future society, what it will be like for the next five or ten years can not be foreseen easily. From a different angle the future promotes large amount of information because of its ambiguity. A hundred years ago a teacher could clearly imagine the prospect of children, and make a list of basic mathematical and scientific skills based on his/her expectation. This kind of literacy which has contributed so far is vulnerable to the criticism that it only contributes to the preservation of educational control system within modern society. It, however, could be said that such regulation necessarily worked under certain historical circumstances.

The conditions which surround education have changed drastically by the emergence of internationalizing and highly information-oriented society. To set the objectives of education may sound meaningless against the continuous change of society. As a result, the priority among problems and the intellectual schema about education comes to be altered and innovated through the new idea such as New View of Learning Ability or New Integrated

Science Literacy. There, however, are many unclear points to address. Until when will these 'New' be new? What kind of thing does the word 'New' imply? Since they are quite ambiguous, the fulfillment of objectives substantially relies on teachers' translation of them into practice and students' activities.

In order to find a clue to get out of this impasse, let's surface and discuss the relation between viability and media literacy. The viability, which is advocated by constructivism, is an important concept that lies at the foundation of problem solving. So, it is also possible to say that the idea of the viability is in the same line with that of 'zest for living', one of the key concepts proposed by the Central Council for Education 1996 in Japan. If we borrow the expression from the Council's first report to the Ministry of Education for the 'new education toward the 21st Century', the viability is explained as follows:

"No matter how the society changes, what is demanded of each child from now on then is the ability to find out his/her problem, to learn and think by himself/ herself, to make decisions and takes actions subjectively, and to solve problem better." (the Central Council of Education, 1996)

It is noticeable that, according to the above explanation, there is the important presupposition that a child is not a 'tabula rasa' just to receive any information uncritically but a subject to create meanings and interpret information (Apple, 1993, p. 146) and more attention is paid to the view of critical learning ability to promote the subjectivity of a learner as much as possible and to innovate on the present situation from the view of grass root.

On the other hand, the promotion of media literacy will be the most timely way of dealing with the coming highly information-oriented society presupposed in the report of the Central Council of Education, because the promotion

aims at developing the ability to have a grasp of the whole figure by setting the problems according to the information available as fragments. In this sense, we think that media literacy could be regarded as the present-day evolution of the viability.

We need to prepare various kinds of literacy according to the different values and manifold life-styles in today's society. There, for example, are computer literacy to indicate the ability of using computer, visual literacy to comprehend meanings from image information, multicultural literacy to understand matter based on heterogeneous cultures existing within a society, ethnic literacy to be accessible to cross cultural activities, and so on. All these support practically the different values and life-styles of today. The development of computer technology which maintains them provides handicapped children with the new means for cognition and description as well. Hence, media literacy not only integrates the various literacies but also cultivate a new potentiality for education.

(1-2) From three R's as functional literacy to 'input, output, and processing' as new literacy

One could argue that the three R's (reading, writing, and arithmetic) which have formed the foundations of recent society, are equivalent of the 'input, output, and processing' of information at the present time from a different angle. It, therefore, would not be necessary to highlight specifically the diffusion of information system unless one would seek for a new perspective in the present literacy of 'input, output, and processing'.

Until quite recently, the information has been understood as knowledge which accompanied with 'object'. But now the information can be regarded further as knowledge with which 'object' accompanied or as knowledge

which has value independent of 'object'. In the present situation, information is generally interpreted as something highly value-added, supported by on-going development of computerized new media, such as high-speed processing, ever-increasing memory, effective search and high-speed communication. Therefore we should adjust the quality of each component and their balance in the three R's according to the requirement of the society. In other words 'input, output, and processing' should be the result of idealistic innovation concerning the three R's: reading, writing, and arithmetic as the functional literacy. If we considered media literacy as a functional one, we could not adapt to the highly information-oriented society because the rapid and intricate expansion of the society will soon go far beyond our capacity to absorb information. If we consider media literacy as a new one for self-education as well as for surroundings, it can function to expand our world (Apple, 1993). This media literacy will be consistent with the idea of 'viability' proposed by the Central Council of Education for the Ministry in Japan.

The media literacy for self-education or viability is important in developing countries as well. They need the literacy in the perspective of problem setting and solving for the innovation. The figure below demonstrates the state of information in both developing and advanced countries.

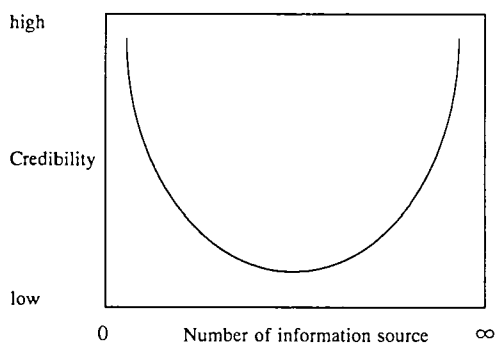


Fig. 1.1 Credibility and Source Information

The vertical axis indicates credibility on information and the horizontal axis shows the number of information sources. Let us plot three points on the plane according to the information systems in tribe society, a developing country, and an advanced country. Tribe society is located top left because the information source is limited to a head and its credibility is authorized by him. An advanced country is top right because there are quite a lot of information sources and its credibility is dependent on the choice of them. In particular a developing country is bottom middle because of conflict between modernization, tradition, and regional culture. Such conflict causes the credibility to go down although the number of information sources increases very much compared with that in tribe society. If other points are plotted between these three points, the graph appears as a U-shaped curve as shown above.

Confusion of information is usually generated at the bottom of Fig. 1.1 because of the low credibility and quite a bit of information. The serious confrontation between new and old value accelerates informational chaos. The problem on information reproduces the economical and social inequality. The media literacy therefore is critical in developing countries rather than in advanced countries to clarify realities to be criticized and figure out ideas to be asked.

## 2. Media literacy in developing countries and science education

As has been noted in the chapter 1, the criticalness in literacy is necessary in developing countries due to the circumstances under which their culture and tradition are confronted with in the process of modernization. Especially, more attention needs to be paid to the initial stage of information processing since the selec-

tion or judgement of information is crucial to such a double-valued situation. From this viewpoint one may say that three abilities, which includes the understanding of information besides these selection and judgement, are very important to surmount the situation.

In this chapter, we firstly discuss the influence of people's cultural codes and preconceptions on the above abilities by using a recent data processing model. Then we examine how science education can contribute to the development of the media literacy, regarding it as the opportunity to verify, to reconcile or to reconstruct pupils' cultural codes and preconceptions.

### (2-1) Role of cultural codes and preconceptions in information processing model

Employing such a recent fruit of the cognitive psychology as the dual storage model, the initial stage of information processing can be schematized like Fig. 2.1 next page.

From the operational point of view, the process of Judgement and selection (II) of Fig. 2.1 is the most important in the whole processing and the media literacy takes an important role during its implementation. A notable point of the process (II) is that, although it is carried out in the short-term memory, existing values and concepts in the long-term memory (schema) control the decision in the process (II). And of course, this literacy is also bound to schema.

Schema is generally defined as the knowledge acquired from the past experiences and the events in the outside world. On the other hand, cultural codes are acquired through the repeated learning of longtime experience and events in each society. The Preconceptions are also acquired individually by networking our own experience and events. It is, thus, possible to say that schema is synonymous with a network of the cultural codes and preconceptions here. This

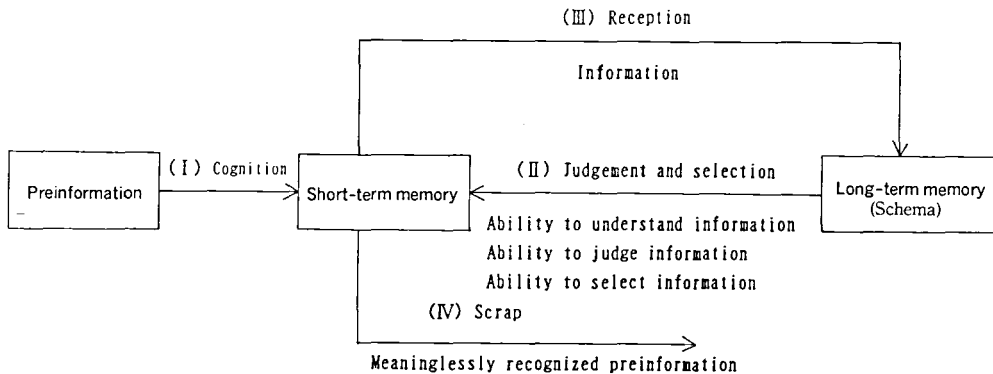


Fig. 2.1 The Initial Stage of Information Processing (Morimoto, 1993, p. 47) modified by author.

conclusion brings about serious consequence to the media literacy in developing countries.

A superfluous amount of information is provided via a number of mass media agents in the developed countries, and this secures the objectivity and diversity of people's schemata, especially preconceptions. On the other hand, there is relatively insufficient source and amount of information in the developing countries. It is likely, therefore, that more heteronomous concepts such as traditions are taken in and occupies a big proportion of their schema without verification. To make matter worse, people are normally wedded to their schema (West & Pine, 1985, p. 14), and no measures can transform them unless they decide to do so (Morimoto, 1993, p. 45). In this situation, more opportunity for verification needs to be intentionally provided in order to enhance objectivity and autonomy in the judgement and selection of information.

#### (2-2) Contribution of science education to the media literacy

In the event of verification of schema, the conflict should be recognized first between the existing schema and the received information. For this attainment the introspective attitude should be cultured to examine one's own schema

critically. Now it is a well-known fact that conflicts often arise between school knowledge and everyday knowledge in the classroom. This can be observed more clearly when an argument breaks out in class. Since the every day knowledge is based on the experience and events of daily life, it inevitably corresponds to schema. Therefore, learning in class can provide a more overt opportunity to verify the schema against the newly acquired information.

Science education takes up natural phenomena as topics and, on the other hand, students spontaneously acquire knowledge and concepts about nature through interaction in daily life. The knowledge acquired through experience sometimes conflicts with the theory which appears in the textbook. Thus, the topics in science education has the potentiality to surface and focus on imminent conflicts between school knowledge and everyday knowledge, or schema. The following two examples are taken from one author's experience as a secondary science teacher in Zambia.

(Case 2.1) Air, a mixture of gases  
Subject: Environmental Science  
Topic: Characteristics of air (in gases)  
Target: Grade 9 (the final year in two-year junior secondary education)

In order to show that air is a mixture of gases, mainly nitrogen and oxygen, the following experiment was set.

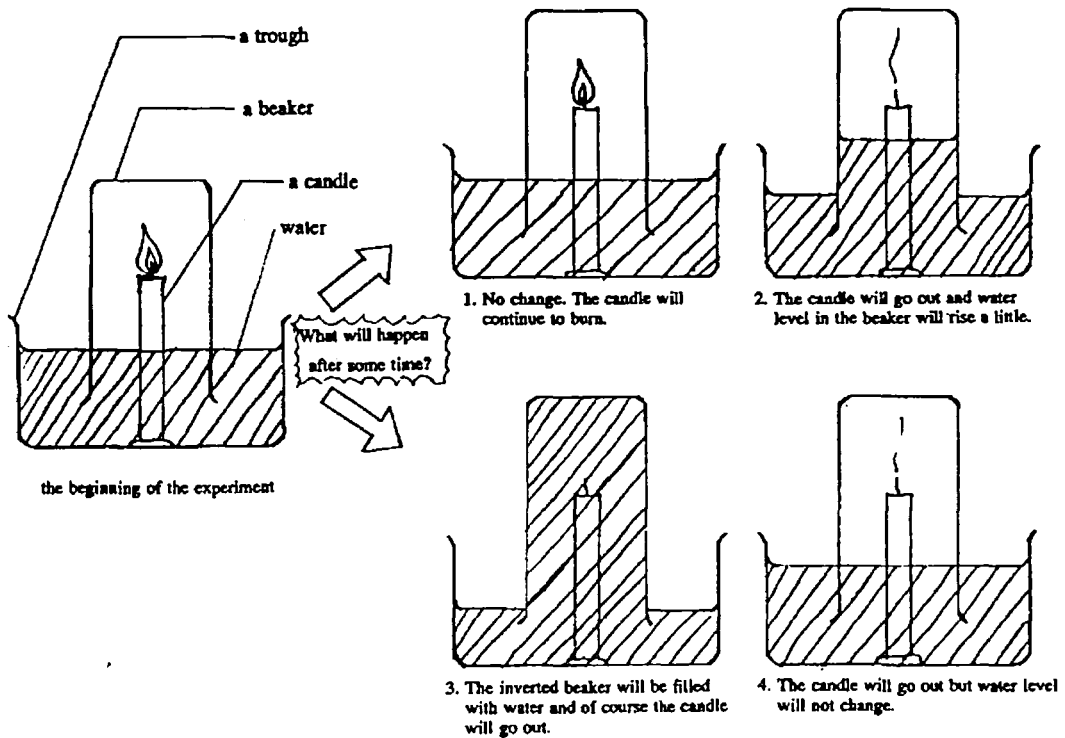


Fig. 2.2 Setting and Experiment and Possible Results

Before the experiment, the students were presented with the four possible results in the above diagram and required to give the most likely result as an answer and a reason for it as well. Then the debate starts regarding their answers and reasons.

One student didn't agree with any of the presented four results and contested that water in the trough would bubble because oxygen dissolved in water would come out to supplement the consumed oxygen.

(Case 2.2) Quills of porcupine  
 Subject: Environmental Science  
 Topic: Diversity of mammal's physical features (in Mammals)  
 Target: Grade 9

In a class, the function of porcupine's quills was discussed as an example of various physical features of mammals. Then the argument broke out between students and the author against his explanation that porcupine's quills come off easily and stuck in predator's face so that it could run away while the predators were busy with taking off the quills. Most of students opposed to the explanation and retorted that porcupines shoot their quills to the predators for protection. The author tried to refute their opinion logically but they held on the pretext of their relative's observation or saying. We were never on the same wavelength until the end of the class. These are not special cases of the particular class but the similar response is often experienced in other classes or grades.

Both cases exemplify how students form

their concepts and these concepts can conflict with other concepts. In the former case, the student might have studied some characteristics of oxygen, such as its solubility in water and support of combustion. He probably formed the above opinion catalyzed by such knowledge and also the image of a carbonated drink's being opened. On the other hand, in the latter case, their concepts were highly influenced by their tradition.

So far we have pointed out that science education brings about conflicts which will lead to verification of schema. The next issue is how to transform schema. Though it is not an easy task to transform schema by external effort as mentioned in the above cases, how can science education contribute to this autonomous transformation of schema? One of the objectives of science education is to promote scientific attitude based on scientific process. The scientific process consists of mainly four steps, that is, 1) understanding a problem, 2) setting up a hypothesis, 3) conducting experiments and 4) verifying hypothesis by the results of the experiment. The positivistic attitude to verify the hypothesis with experiment in the steps 3) and 4) bears a strikingly resemblance to the one of schema verification in the above. Thus, promotion of scientific attitude may give a clue to acquisition of the way of autonomous transformation. Especially, if the discussion is organized in class; pupils can practice the process more effectively as they can relativise their opinions (or schemata) through the interaction with other stu-

dents.

From the above discussion it may be concluded that science education is one of the suitable ways to promote an active attitude to verify schema with relation to received information.

### (2-3) An example of class activity

Taking account of the above discussion, the authors would like to present an example of class activity using the (case 2.2). The main aim of this activity is to develop a balanced perception and judgement of information through class discussion on their results by comparison.

#### (Class activity)

This class activity is meant for Grade 9 students who have just finished a study on animals in Environmental Science. As a part of the summary, students are requested to do some field research; the research results and their opinions are reported in the form of the following list. Their results are arranged in one big sheet for the discussion.

#### Procedure:

Ask your family or your neighbors about proverbs, tradition, experiences or observations, concerning features and behavior of animals. Write the details of your interviews and mention the sources of information (either their observation or tradition, and so forth) in the following table. Compare these or your experiences with your knowledge learnt in class. Write down your opinion in the table.

Table 2.1 Features and Behavior of Animals

Name of animal	Features and behavior	Details of interview	Source of the information	Your experiences and observations	Knowledge from school	Your comment or opinion
Porcupine	Quills	They shoot their quills to their predators when they are in danger.	Heard from my grandfather as a tradition. My uncle said he also observed it in the bush before.		Their quills are required by transformation of their body hair.	I believe porcupines can shoot their quills because my uncle observed it.

Through this activity, students are expected to judge and process their schemata logically and relatively with comparison to other information. However, it must be re-emphasized that the objective of this activity is not necessarily to make students scrap their own cultural codes and preconceptions, but to make them examine these ideas and then recognize their applicable limits. As a result, the recognition acquired through these activities nurture among students a balanced attitude in information processing.

#### (2-4) Science education for information receivers and transmitters

In the discussion so far, we have mainly focused on the situation in developing countries. But how about the situation in developed countries? Now let us direct our attention towards the developed countries before concluding this chapter.

We observed earlier that the objectivity and diversity of people's schemata are secured due to the superfluous amount of information in developed countries. This can be assured with the provision that the quality of information is sustained up to a permissible standard. On the contrary, with the rapid increase in the quantity of information, the security of its quality is getting in the face of difficulty. In fact, we often come across a large quantity of information that is just released without taking account of the expected information receivers on the other side. Such a thoughtless transmission is merely a discharge of noise, and thus, it is likely to deteriorate the quality of information. As a result, people are now facing the danger of forming misconceptions by selecting low-quality information rather than by their cultural code. In order to surmount such a situation, it is necessary to be able to evaluate received information rationally. Therefore, the development of criticalness in literacy is also necessary in

developed countries.

As has been discussed in the section (2-2), science education can play a vital role to develop the criticalness in literacy. This idea is based on the concept that science education can provide a number of opportunities to nurture the attitude towards verification and autonomous transformation, by arousing confrontation between school knowledge and students' schemata. To this extent, science education is applicable to both developed and developing countries, but the discussion so far also implies that the criticalness directs its intention at two targets. For the sake of convenience, let us define it as inward and outward criticalness according to its intention. Inward criticalness targets at people's schema and outward criticalness at school knowledge, or in a broader sense, a body of knowledge behind external information.

In the extreme informational circumstances, the intention may be inclined heavily towards one target. But in a practical manner, we normally need to adjust our emphasis on these targets according to informational circumstances. Then, how can we manage to harmonize these two intentions of the criticalness? We may say that comparative verification between schemata and a body of external knowledge will play a key role to resolve this issue.

In spite of the different progress in each country, the rapid popularization of information technology is undoubtedly taking place all over the world. And this tendency will consequently bring about the drastic change as a by-product in the relationship between information transmitter and receiver. The word "interchangeability" depicts clearly this future relationship where people will interchange their position from information receiver to transmitter and vice versa according to circumstances. Under these circumstances, it is important to have an ability not only to evaluate the received information but also to evaluate ourselves as an



information transmitter because we will need to bear responsibility for its quality. Since an expansion of the evaluative skills requires the sense of inward and outward criticalness, science education again holds the key to educate students as an information transmitter and receiver.

### 3. Conclusion

The aim of this paper is to redefine the meaning of literacy of today. The literacy may be interpreted simply as three R's but the concept of literacy in this paper has been discussed in much wider context. That means it forms a fundamental ability to handle the information effectively and survive in this information-oriented society. The idea of literacy of course originated from three R's but it has been transformed according to the societal needs.

Information must have existed since the very beginning of mankind and it had been taken for granted for a long period. Much later times during war time the information was given a special meaning to overcome the opponent. However, it was not seriously discussed as an object of research until the computer has increased tremendously the amount of information beyond the capacity of human being and has changed its status similar to the one of material. The drastic change in quantity as well as quality of information has brought about the information-oriented society where communication technology and computer play major role. As being discussed in chapter 1, the quantitative change leads the qualitative change of information in this society.

There is another aspect of information. Information, material and energy are three major components which support modern science and technology. Only information seems not to have a limitation to its resource while the other two has been already showing some sym-

ptom of diminishment. Thus it can be multiplied without much worry of exhaustion. However this uncontrollable increment of information becomes hazardous to us. And any information seems destined to be overwritten at the next moment. In other words, too much information is similar to no information. What to be sought is the higher level of information (or meta-information) to control this ironical affluence of information.

In many developing countries instability of information can be observed due to the scarcity. In this situation it is not easy to countercheck the information with another information of the same kind, though the situation doesn't always remain the same but fast changing. What complicates more the situation is that these countries suffers from uneven influx of information, and here the critical judgement of information is crucial.

And in the developed countries on the other hand, the information has stability. The more the information, the more often it can be checked by and against another information. So the critical judgment is necessary not for the scarcity but this time for the incalculable amount of information which has been created somewhere and disposed elsewhere every day. That means it is important to pick up a useful bit from the ocean of information and reconstruct one's own meaning out of it.

There are many dissimilarities between these two societies, the developed and developing countries, but they share two important properties, that is, networking and individualization. And the simultaneous progress of these is a phenomenon to connect individuals in various aspects of life according to their interests and it sometimes goes beyond the national borderline. And each individual is to find something worthwhile for oneself there. The characteristics of the whole system is dynamic and multi-strata. Each individual belongs to

many networks such as family, company, circles, neighbor, etc. and sometimes change their affiliation to another network while the networks tend to be formed and dissolved depending on the necessity. In this dynamic system, it is not just enough to wait for something favorable to happen but it is necessary to create own networks and thus information in between various information. In other words, the positive and critical attitude towards information is essential.

The positiveness of attitude means to take an action towards information and make a decision depending upon the feedback. Here, the highly sophisticated knowledge or technique is not necessarily required but rather it is important to go back to the basics in process of acquisition of knowledge. This positiveness bears some fruits by being methodologically conscious about the transformation process of pre-knowledge to knowledge.

On the other hand, the criticalness of attitude is the concept which supports the autonomy in the process of information and has a function to facilitate transformation of schema. This can be classified into two types of criticalness, namely the one towards schema and the one towards the scientific knowledge.

These two properties in attitude synchronize with the basic idea of the viability.

“No matter how the society changes, what is demanded of each child from now on then is the ability to find out his/her problem, to learn and think by himself/herself, to make decisions and takes actions subjectively, and to solve problem better. And it is thought to

be a rich humanity to control oneself, cooperate and sympathize with others, and have a sensitivity.”(the Central Council of Education, 1996)

While both the new view on learning ability and the viability show the seriousness of the problems which our society faces and have a symbolic power to focus in our efforts at their solution. Rather, the focus of this paper is on how to realize these ideals into practice and construct the meaning of learning within every day life.

We believe that the lesson which promotes the transformation of schema in chapter 2 can grow these two attitude. In other words, they follow the definition and ideal of the new literacy which is defined in this paper and materialize it into the classroom lesson.

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## 情報活用能力の今日的意義とその育成

—理科の教材開発にむけて—

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近代社会はある意味で大量の「モノ」の生産・流通・消費に向けて発展してきたといえる。そうした社会を維持するために、「読み・書き・算盤」がミニマム-エッセンシャルズとして機能してきたことは言をまたない。この伝でいけば、現代社会は大量の情報という「コト」の生産・流通・消費に向けて発展しているともいえる。その意味で上記の3R'sは情報処理機器上の「入力・出力・処理」と読み替えていいのかもしれないが、そこに新たな視点と意義を求めなければ、今日の社会の変化に主体的に対応することなど、とうてい望めないであろう。

例えば大量消費と生産に支えられた社会構造を変更しなければ、宇宙船「地球号」の進路を誤ることは明白であろう。この問題の解決に必要なシステムが高度情報化社会であり、それを支える能力こそ、批判的な視座を有する情報の「入力・出力・処理」能力つまり情報活用能力であると考えている。いうまでもなくこの宇宙船には先進国も途上国も乗船しており、いずれの場合も情報活用能力の育成は今日の教育課題に他ならない。

本稿では途上国における理科の教育実践を紹介し、それが情報活用能力の育成に果たす役割を批判的識字の視点から検討した。具体的には学校知と日常知の葛藤を梃子に、情報の収集と選択という側面から考察し、情報活用能力の育成が世界観の変更に果たす役割を明確にした。