

Various Factors Related to the Selection of Media for Instruction

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1. Introduction

Researches on instructional methods and learners' factors are more frequently conducted than those on the differences caused by media. Under these circumstances, a new model for the selecting media for instruction was proposed (Reiser & Gagne, 1983), based on R.M. Gagne's theory of instruction (Gagne, 1985)¹⁾. This model is an integration of the research findings that the Educational Technology Center of Florida State University conducted over several years. The purposes of this article are: (1) to introduce the new model by Reiser and Gagne, which has been developed in order to select instructional events by using media, not to select media themselves; (2) to discuss how various factors related to the selection of media for instruction are explained.

2. Trends in research on media for instruction

As various media for instruction are available today, it is very difficult and complicated to select appropriate media for instruction. Although researches on media for instruction have a long tradition, an extremely limited number of practical research findings are available for teachers in the selection of media for their instruction. According to Schramm, for example, out of some 1,000 research studies comparing media that he looked at, more than half could not find a significant difference between any combinations of media comparison, or could not reject their null hypothesis (Schramm, 1977).

Statistically significant differences have recently been often reported in researches on comparisons of instruction using computers against traditional instruction (For example, Kulik and other's meta analysis²⁾: Kulik et. al., 1983). It is pointed out, however, that many such differences are thought to be the results of errors in experimental control due to the novelty of instruction using computers, or actually trivial differences even if there are statistically significant differences (Clark, 1983). What has been obtained from media research over the past 50 years is the suggestion that there may be a few learning effects gained by the use of special media (Clark, 1983; p.450). There are also some cautions stating that research on media comparisons should be limited to focusing only on cost, efficiency, fairness, and delivery (Petkovich & Tenneyson, 1984; p.240).

If no differences are found in media effectiveness as Clark insists, factors to consider in the selection of media should be extremely practical. Such factors would include which media is easy to use, or which media incurs less costs for preparing materials. Other factors may be considerations required for implementation of instruction depending on classroom conditions, including which media can more flexibly respond to curriculum change. Needless to say, these practical factors are important considerations in the selection of media. Furthermore, unrealistic discussion on the selection of media is meaningless. However, there are some

problems with the selection of media that depend solely on practical factors. First, as conditions are different in different places, various factors vary in the implementation of instruction. Accordingly, it is not convenient to propose a certain media selection model or procedure. If certain media is selected based on such practical factors, efficient instruction may be designed. However, it does not always mean the media are able to make the instruction more effective. As long as the central interest concerning the selection of media for instruction is what kind of media should be used in order to make instruction more effective, the solution may not be found by considering practical factors. This is why it is important to connect theories and models of instructional design for more effective instruction to the selection of media.

3. Media to generate instructional events

Various series of steps to make instruction more effective have been studied and proposed as systematic theories and models of instructional design and development³⁾. These research studies pursued how and what instructional events should be prepared in order to make learners with certain characteristics achieve specific learning objectives effectively. In those studies, media for instruction is defined as those generating instructional events. Media for instruction are regarded as those that help shape materials designed for effective instruction and provide them to learners.

Accordingly, in steps of systematic instructional design and development, the selection of media for instruction should never come first. It should be just before the development of the materials, and after design for instruction has been completed. Until the order of how and what are indicated to learners is decided, or so called instructional events is designed, it is impossible to select media for instruction. After deciding on the contents, media are to be selected as a means to actualize the contents. After effective instructional events are decided, whether those desirable instructional events can be generated by using specific media is carefully considered, and the media are adopted accordingly. For example, when a certain instruction with the theme of “power and acceleration” is designed and presenting the movements of a physical body is thought to be very effective, media (e.g., TV, or actual objects) that are able to show movements should be selected. Rather than selecting media themselves, selecting media focusing on attributes of the media is important. This is why many models for the selecting media for instruction ask questions before selecting media. Among such questions are: “Is sound required?,” “Is movement required?,” “Is interaction with learners required?”⁴⁾

As a premise for the consideration that media should be selected in order to make instruction effective, there is a premise that effects differ depending on the media: media A is more suitable to a specific instructional event than media B. According to Reiser and Gagne, as each type of media has different functions which generate different instructional events, selection of media tends to give substantive affects to instruction’s effect (Reiser & Gagne, 1983; pp.5-6). On the other hand, selection criteria adopted in the models indicating general steps for selecting media for instruction rarely function well. If the selection criteria functioned well, the selection of media should often be apparently appropriate. For example, in many cases of tasks and instructional events, the question “Is color required?” and “Are sounds required?” are answered with “Either will do.” Cases in which any media are apparently required often include a case where coloring is effective when the goal of a learning task is discriminating colors and a case where using sound factors is effective in leaning music appreciation and how to read a poem aloud, etc. (Reiser & Gagne, 1982).

Schuramm, who conducted media research, describes his knowledge in simple terms: “simple media and active students (Schuramm, 1977; p.42).” It means that simple media with minimal media attributes required by the learning task should be selected rather than selecting media only because they are complicated, high-class, and flamboyant. If there is little difference in effectiveness among media, simpler media will function well enough, except for cases in which certain media attributes are definitely required. The issue here is, what are the cases in which some media attributes are definitely required? Are those only the apparent cases as shown in the above?

It is prospected from a theoretical perspective that conditions of learners and characteristics of learning tasks affect media selection. This connects tasks/learners’ conditions to more effective instructional events. In that sense, the logical conclusion mostly depends on the theory of instruction which is also applied to the theory and model of systematic design and development of instruction⁵⁾. Many of models for selecting media for instruction in the past have developed as part of the steps in systematic design of instruction. Accordingly, basic knowledge on instructional design was necessary in order to use those models independently. In other words, those models for selecting media cannot be used unless what constitutes more effective instructional events is understood. The models only for selection of media do not define what kind of instructional events are more effective for given tasks/learners’ conditions.

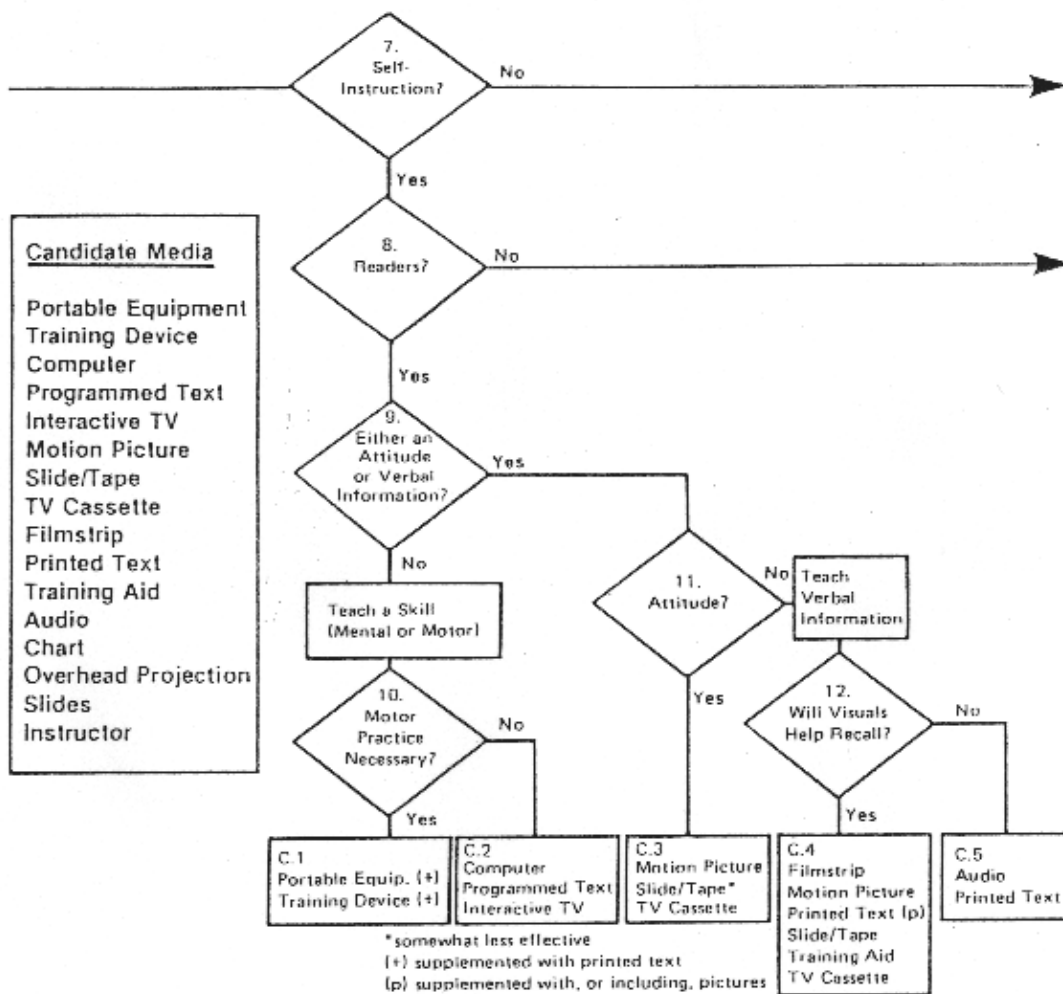
4. Media Selection Model by Reiser and Gagne

A model for selecting media by Reiser and Gagne was developed based on past media researches and the current state of theories and models of systematic design of instruction in order to build a model that can be easily applied to the purpose of improving learning outcomes. This model is based on Gagne’s theory of instruction (Kaneko et al., trans.; 1982). It proposes that factors of instructional design should be considered first in order to select media. The model focuses on the principle of learning that affect selection of media in order to explore the conditions for desirable media that enable instructional events to promote learning.

The following four points should be confirmed as the requirements when using this model. The first is what the learning objectives are. The second is which category of learning outcomes those objectives belong to. The third is what the instructional setting is. The last is whether learners have the ability to read. Needless to say, setting learning objectives is the most important step in the systematic design of instruction. The learning objectives are categorized into five learning outcomes in order to prepare external conditions of instruction for learning. This categorization is the core of Gagne’s theory from the standpoint of instruction because it is the foundations common in many learning cases, and learning in different categories requires different desirable conditions⁶⁾. The instructional setting is grouped into three: (1) instruction by remote broadcasting, (2) instruction by individual learning, and (3) instruction led by a teacher. Those are dealt with as implementation issues of instruction. As a factor of learners in relation to the selection of media, only whether learners have enough reading ability is dealt with in the model. This is reflecting the current state of research on Aptitude Treatment Interaction (ATI).

The core of Reiser and Gagne’s model consists of six panels of flowcharts. The chart first distinguishes between the instructional setting and the learner’s ability to read and then gives directions to one of the panels. Figure 1 shows a panel for self-instruction of learners with high reading ability. At the beginning of the flowchart, four media out of 20 media for

Self-Instruction with Readers



Explanation of Questions - Chart C

7. Self-Instruction? Are students expected to learn by self-instruction, without an instructor?
8. Readers? Can the students, with reasonable efficiency, gain information from printed text?
9. Either an Attitude or Verbal Information? Is the aim either to influence the student's values (attitudes) or to have the student learn to 'state' (rather than 'do') something?
10. Motor Practice Necessary? Does the skill to be learned require smooth timing of muscular movements (a "motor skill")?
11. Attitude? Does instruction aim to influence the student's values or opinions?
12. Will Visuals Help Recall? Is it likely that the use of visuals will help the student establish images that will aid recall of verbal information?

Figure 1 Panel for Self-Instruction of Learners with Reading Ability

instruction included in this model have already been removed. It is indicated that 16 candidate media are left. As learning tasks are further grouped, fewer candidate media are left at the end of the flowchart. The final candidate media remaining in the next step are those generating instructional events effective to the given task/learner conditions.

In the final step, practical factors are considered. From among the final candidate media list, candidates are screened by a process of elimination, in considering practical factors including a time limit for material production, the cost of maintenance and operation, or harmony with the existing implementation methods. Finally, media to be used are decided after discussing the costs and if the use of more than two media should be required for achieving learning objectives.

According to the model proposed by Reiser and Gagne, factors related to the selection of media for instruction can be grouped into two. The first group consists of factors that define learning outcomes. As the factor categorized to this group, characteristics of learners and learning tasks are taken from the perspective of the systematic design of instruction. This is based on Gagne's theory of instruction. Reiser and Gagne's model places importance on those factors that define learning outcomes. They propose that media to be used should be screened according to these factors.

The second group consists of practical factors such as costs. When the candidate media have been selected based on the factors that define learning outcomes, any factor will theoretically generate the same effects under the given conditions of tasks/learners. The next step is to decide which media should be used according to the second group factor. These two factor groups and the process of media selection are shown in Figure 2.

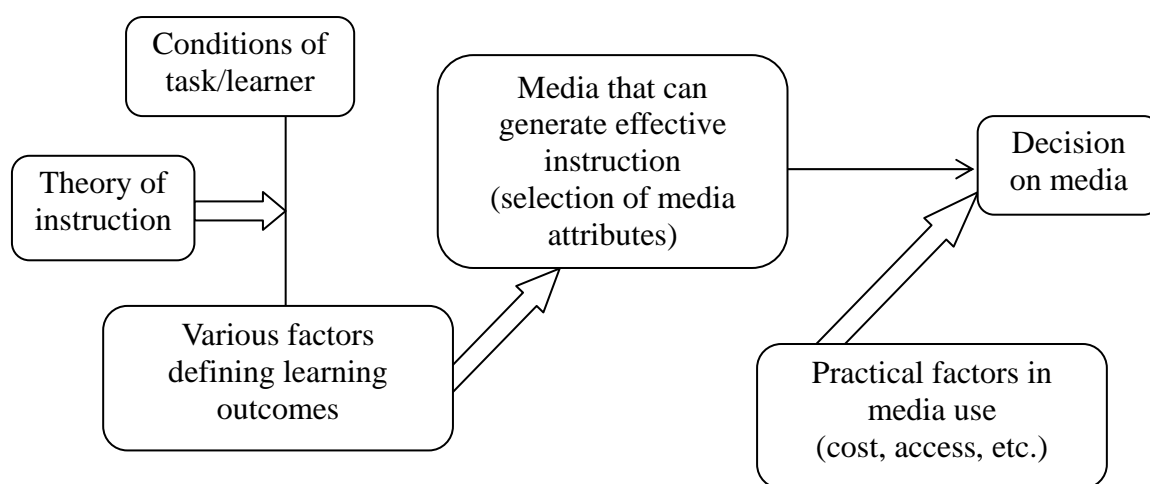


Figure 2 Media Selection and Various Factors

The model for the selection of media by Reiser and Gagne received formative evaluation several times in the process of its development. It is reported that the model has been improved based on these formative evaluations (Reiser & Gagne, 1983; pp.107-109). Research on the effectiveness of the use of the model in practical selection of media continues (Higgins & Reiser; in press). To conclude, it can be said that the model is practical and that the effectiveness of media selection by practical use of the model is verified.

5. Issues concerning how to use the selected media

While Reiser and Gagne discussed the issue of media selection in the discussion of the instructional design process, they directly connect conditions of tasks/learners to media. It is regarded that those who use the model can select media that will generate the instructional events that promote the learning only by understanding the conditions of the tasks/learners and media. However, the issue of how to use the selected media still remains. In order to solve this issue, we have to know the reason why the conditions of tasks/learners and final candidate media are connected.

As described above, Gagne's categorization of learning outcomes is based on differences in external and internal conditions for promoting learning. Accordingly, theoretical background used for the model for the selecting media is nothing other than that difference. What kind of utilization of the final candidate media is, then, expected as a premise in order to achieve each learning outcome more effectively? For learning intellectual skills, media that are able to give detailed corrective feedback (e.g., teachers and computers) responding to the responses of learners are selected. This is based on Gagne's theory of hierarchy among mutual intellectual skills. It is designed so that the intellectual skill learning is promoted by reviewing the subordinate objectives that caused an error. Verbal information does not have such a hierarchical structure, and detailed feedback is not necessary. However, it is desirable to select media that are able to present the information in a larger context, or those that are able to indicate organizational structure of information in a diagram. Learning of the cognitive strategies is dealt with in the same way as that of the intellectual skills in that it requires acquisition of intellectual skills. This illustrates the limitations of past research on the cognitive strategies in instruction. For learning about attitudes, observing human models is thought to be the most effective. Accordingly, media that are able to describe movements of human models are selected. This is because the desirable behaviors are indirectly reinforced through observing that such behaviors generate good results. For learning motor skills, feedback gained through muscles is inevitable. Accordingly, more practical media is selected for motor skills.

Media selected according to the model of Reiser and Gagne are able to bring effective instructional events in given conditions of tasks/learners. Nevertheless, the model does not guarantee that instruction using the media is always effective. It goes without saying that whether instruction is successful or not depends on how the media will be used. It is necessary to see media and the systematic design of instruction in the larger context.

6. Conclusion

This article discussed various factors related to selecting media for instruction through the Reiser and Gagne media selection model. It is clear that the results of both the theory of systematic design and the one of instruction are very important for instruction in the classroom, just as practical factors, such as cost or media characteristics, are important when considering the effectiveness of instruction.

Among many research activities on educational technology, few research results are practical and useful for teachers or those who are developing curricula. The new model by Reiser & Gagne has an important meaning in the sense that it has reformed Gagne's previous theory into one which can be realized.

Notes:

- [1] *The Conditions of Learning* by Gagne published in 1985 was revised into *The Conditions of Learning and Theory of Instruction* (4th Ed.). The new chapter of media selection added in the 4th edition introduces Reiser and Gagne's model dealt with here (pp.282-301).
- [2] Meta analysis is referred to as a comprehensive method of analyzing results of the past empirical research studies on a specific topic, proposed by Glass (1976). Meta analysis works out the tendency of the effective size of specific variables, such as CAI in secondary education, and its practical significance is questioned. Many meta analyses were conducted by Kulik and others. To date, more than 100 researches have been presented.
- [3] Detailed introduction is found in, for example, Nakano (1982), etc.
- [4] For example, Smeltzer (1984) etc. computerized the model proposed by Anderson (1983).
- [5] Leading example is Gagne & Briggs (1979).
- [6] The relationship between Gagne's theory's another pillar, nine events of instruction and characteristics of media is introduced by Azuma et al. (1979; p.214) and Ouchi (1983; p.48)

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The Educational Technology Center of Florida State University developed a new model for the Selection of Media for Instruction, based on the R. M. Gagne's Theory of Instruction (Reiser & Gagne, 1983). This model is an integration of the research findings that the Center conducted for several years. The purposes of this article are:

(1) to introduce the new model by Reiser & Gagne, which has been developed in order to select instructional events that can be occurred only by using media;

(2) to discuss how various factors related to the selection of media for instruction are explained;

(3) to clarify that the results of both the theory of development of systematic design and the one of instruction are very important for instruction in classes, as well as practical factors, such as cost or media characteristics.

Among many research activities on educational technology, few research results are practical and are useful for teachers or those who have developed instructional curricula.

The new model by Reiser & Gagne has an important meaning in the sense that it reformed the Gagne's preceding theory into the one which can be realised.
