# DEVELOPING MATERIALS FOR EDUCATIONAL TECHNOLOGY BASED ON MULTIPLE INTELLIGENCE THEORY

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## INTRODUCTION

Educational technology is regarded as an important element of a learning process. The purpose of the learning process is, generally, related with a formation of a learning climate and environment. However, to what extent is technology alone helpful for individual's learning? Technology, which is not compatible with the knowledge of individual's learning style, will not be profitable at all. The only possible way to provide datum on how effective the materials are for instructional technology is to determine how an individual learns and how and what kind of systems a person's brain works with (**Veenema & Gardner 1996; Rhodes, 1994; Callister & Dunne, 1992**).

In order to improve technological materials, the main question of "how an individual learns?" should be answered. It is noticed that many theories have been formed in order to answer this question. Behaviourist and cognitive approaches, which were formed to answer this question, depends on the fact that each individual has a unique intelligence structure. However, in recent years, the determination of single intelligence has been demolished by the Multiple Intelligence Theory and has been replaced by the understanding based on the capacity of multiple intelligences (**Gardner, 1983**). What theory aims is to put seven intelligences into action and creating learning situations that are suitable for students (**Armstrong, 1994; Campbell, 1996; Demirel, 2000**). The most essential problem, which should be solved to reach that target, is to create proper atmosphere and to provide supportive materials that can help the theory to come into being in real life. In this study, the differences between conventional learning theories and multiple intelligence theories in terms of what they contribute to the formation of learning situations have been discussed, the principles which will enable to design educational-technological materials that can help to put MIT into usage have been given and new suggestions and models have been put forward for the material improvement.

### Behaviourist Approach and Educational Technology

This approach accepts learning as a connection process between stimulator and behaviour by reinforcing the connection, as a behavioural change. In the behaviourist approach, it is observed that Pavlov and Guthrie's mentality supports the idea of rejecting all mental elements and accepts learning as a reaction to external stimulus, moreover, there are views like those of Thorndike that regard learning as a problem-solving process (**Fledman, 1996; Westen, 1996; Özden, 1999**). Although there are different approaches, the behaviourist psychologists' explanation on learning is based on the connection between stimulation and reaction. The approach that takes teaching as a mechanical process and provide four principles as below:

1. Learning by doing is essential. Learning takes place by being affected from stimulant and responding in appropriate ways.

2. Reinforcement is one of the important factors of learning
3. Repetition is crucial for permanence.
4. Motivation is vital for learning (**Westen, 1996**).

Practical activities and materials in these four principles should design a teaching atmosphere that is formed for behaviourist approach. Programmed teaching model is seen as the one on which behaviourist approach is applied. It is stated that a model, which is prepared to put it into use for programmed learning model, should have the characteristics below:

1. The knowledge is separated into small steps to comprehend. Material's content is organised according to these steps.
2. Participation of a student is provided through effective materials and materials. It is thought that with questions and exercises this might take place.
3. The material should include the right rein forcers for the right behaviour to appear.
4. The material should be designed in order to correct mistakes instantly and to cause students to get the right behaviour.
5. The material should be regulated according to individual speed (**Pocztar, 1977; Demirel, 2000; Usun, 2000**).

The materials, which are improved by these principles, provide benefits, but on the other hand include a mechanical process; however, they have no chance for replying a student's learning needs. As an alternative to behaviorist approach which overlook mental processes and sees learning as a mechanical process, the cognitive approach regards learning is a non-observed mental process.

## Cognitive Approach and Educational Technology

Even though it is accepted that behaviourist movement defines "learning" only partly, it is also a common idea that learning includes a more complicated process, more than its connection with stimulant-response (**Cullingford, 1990; Brooks & Brooks, 1993; Özden, 1999**). It is mentioned that learning comes true by individual's self-filtering the knowledge rather than just receiving it, thus trying to attach different meaning. In this progress, it is also claimed that an individual's mental schemes play a big part. (**Piaget, 1952; Ellis & Hunt, 1993; Wood, 1988**).

According to cognitive theories, learning is an individual's meaning giving to what is happening in individual's environment. The progress is defined as perceiving stimulus, comparing it with previous knowledge, gaining new ideas and remembering the knowledge that is stored before (**Wood, 1988; Kazancı, 1989; Erden ve Akman, 1995; Fledman, 1996; Senemoglu, 1995**). Cognitive theory that puts emphasis on mental processes in learning has these principles below:

1. Learning starts with attention process. An individual has no possibility to learn if the stimulus is not recognisable in a mental way (**Gagne, 1970; Wood, 1988**).

2. Perceiving enables the process, which starts with attention to continue. The unidentified attention stimulus loses its meaning in time; therefore, the positive atmosphere should be provided in order for the stimulus to be received. Perception of the object and the situation depends on the individual's previous learning and experience of the individual (**Ausbel, 1968; Shuell, 1986**).

3. Meaningless repetitions have an unimportant part for the comprehension ability

of the knowledge in mental structure. Instead, the individual should put an effort to comprehend the essence of the subject (**Brooks & Brooks, 1993**).

4. In the mental structuring process, operating on knowledge is crucial. Old and new information should be combined during the learning process. It is claimed that by using this process, the knowledge would be meaningful (**Ausbel, 1968; Ellis & Hunt, 1993; Westen, 1996**).

In the light of the principles stated above, the characteristics that a teaching atmosphere and materials should have in order to activate cognitive theory are given below:

1. There are countless stimuli in teaching atmosphere. The instructor needs a much more dominant stimulus among others. There is a need for having materials, which would take an individual's attention and make him/her to focus on a subject mentally. The stimulus that is used at the beginning of a teaching process should keep individual's attention on any subject. If the stimulus is not related with the subject then it may be useless (**Sönmez, 1994**).

2. The materials should be supportive for the perception of new knowledge. In other words, the material should remind the previous information with examples.

3. Unless used, knowledge has no value. Reaching and using the information is as important and difficult as the educational progress in individual's mentality. Therefore it is necessary that the educational materials should be restructured to enable student to retrieve what they have already learnt, to restructure their mental existence by using them (**Wood, 1988; Erden & Akman, 1995; Senemoglu, 1995**).

According to cognitive theory these three types of materials for the teaching atmosphere should be used: (1) Materials providing attention, (2) Materials supporting perception, (3) Materials helping students to use information.

## Multiple Intelligence Theory and Educational Technology

While cognitive approach explains learning via mental processes, it also accepts the existence of some other types of mental schemes (**Veenema & Gardner, 1996**). By using mental schemes, the individual perceives his/her environment and creates new schemes (**Piaget, 1952**). Although the advocates of the cognitive approach believe that each individual has a different memorial structure. They also accept the notion of memorial capacity that can be measured with different tests. This view shows that individual has single intelligence, which is revealed, to a large extent, with the mathematical and linguistic talent.

The idea caused schools to, specifically, focus on mathematical and linguistic skills and ignore individuals' potential talent. While perceiving the situations in life, the individual uses a kind of a combination of the whole memorial structure. As the school focuses on only two fields, the individual is not able to be successful enough in life with the previous doctrines that are given in school (**Gardner, 1983; Armstrong, 1994; Campbell & others, 1996**).

According to Gardner, the ones who have education traditionally designed mentality behave in the same way as others who have no education, because the school has no effect on basic memorial schemes and only masked them with a thin dust layer. In real occasions, this layer goes off and the individual's previous memorial schemes come out; thus, the education does not help the person to cope up with the problem he/she faces. He/she reflects similar behaviours to the ones performed by those who have no education at all (**Veenema & Gardner, 1996**).

The solution for the problem is to have an education, which would activate all the memorial schemes. Gardner (1983) accepts each field, which is taken as a talent, as memorial types of individual. It is stated that there are seven fundamental domains in the theory of Multiple Intelligence (**Campbell, 1989; Campbell, 1990; Armstrong, 1994; Campbell and others, 1996; Gardner, 1998; Demirel, 2000; Mills, 2001**).

MIT is based on individual's intelligence potentials. It benefits from the findings of cognitive approach and the findings of neurology, and claims that autonomous forces form each individual's intelligence capacity and talents and these involve the power of intelligence (**Armstrong, 1994**). Gardner (1983) puts the seven memorial powers in the order as it is given below:

1. Linguistic Intelligence
2. Interpersonal Intelligence
3. Logical-Mathematical Intelligence
4. Bodily-kinaesthetic Intelligence
5. Visual-Spatial Intelligence
6. Musical Intelligence
7. Intrapersonal Intelligence

Except genius and mentally retarded individuals, these fields are in interaction with each other all the time. For example, a football player uses his Bodily-kinaesthetic Intelligence while running and hitting, Visual-Spatial Intelligence while recognising the football field, Linguistic and Interpersonal Intelligence while learning the rules of the game and sharing them with his team-mates, Interpersonal Intelligence while evaluating himself/herself. It is claimed that all individuals in the normal limits have these abilities and depending on the proportion of their usage in life, they may get blunt and sharpened. The hypothesis on which MIT depends can be listed as below:

1. Every individual has all the seven intelligence fields.
2. Many of them can improve the intelligence at the specific level.
3. Intelligence fields often work in a complex way together.
4. There are various definers to determine individuals' intelligence in a certain field.

The one who is believed that he is talented in a certain field may show lacking in the same field but in another talent. For example, a footballer may not be a good actor. That is, there are no definite criteria for the ability in intelligence fields (**Armstrong, 1994; Campbell & others, 1996**). When the literature concerning MIT is examined, three basic points should be elaborated in class practices:

1. All intelligences have the same importance and teachers should value each equally. It is because MIT aims to improve students' usage on talent rather than conventional education that only gives importance to logic-mathematics and linguistic intelligence.

2. Instead of focusing on specific intelligence for certain fields, teachers should use their materials or activities on teaching a subject for all intelligence fields.

3. All individuals are born with seven intelligences; however, they come to class as the ones who are improved intellectually in a different way. This constitutes the base of various learning styles. A teacher who carries out his/her study according to the fields reaches students, but fails to provide support the ones who are perfect in certain fields of intelligence (**Gardner, 1983; Campbell, 1989; Campbell, 1990; Armstrong, 1994; Campbell & others, 1996; Gardner, 1998; Demirel, 2000**).

As Gardner formed the theory, he emphasised that if related activities are not to be designed for students' mental fields, this would lead traditional progress, especially with the fields of math-logic and language and only the ones who have interest on these fields will get benefit. Yet, the aim of the school is to reach many students, so there is a need to know students' learning styles. In technological use, the MIT's fundamental aim is to use materials for students to prove themselves. Technology should encourage the deep understanding levels within and among disciplines. In addition, education process should enable teachers to reach more students. This is crucial for the students who cannot profit from conventional teaching. If technological materials are formed with proper characteristics and activities that are suitable for each intelligence field, then everyone would be able to get each detail in which s/he is perfect about, which is what is suitable for the intelligence field. (**Veenema &,Gardner, 1996; Campbell & others, 1996; Armstrong, 1996; Hoerr, 2001**).

Reaching the majority of the students depends on making the necessary regulations, taking individual diversity between students into consideration. According to Gardner, these individual differences are related with seven intelligence schemes. This contains the taking, using and reflecting knowledge. In this case, we should recognise the variety of intelligences in an educational setting. In choosing material for education, this point should be taken into consideration. In improvement and selection of technological materials, there is a need for determination of goals. If the goals are not clear enough, or in other words, if how and where the material is used is uncertain, this situation may cause confusion rather than an advantage (**Veenema & Gardner, 1996**).

Schools should no more be a non-functional establishments, which only transfers the knowledge and makes students to memorise some of it. In this sense, students should be able to get a chance to comment and explain the information that is given to them in this new form. The materials which would be improved in the guidance of basis has three stages:

1. Using materials that would cause what has been presented to recognise with attention by stimulating intelligence fields.

2. Using materials, which would provide support for learning and recognising by stimulating and easing the using intelligence fields.

3. Using materials, which may help students to create products in relation to the subject.

In the light of these explanations, the principles given below should be used in process of developing and choosing teaching materials:

1. The student's benefits that are aimed should be determined about lessons.

2. The indirect and direct relations of these benefits with intelligence fields should be determined.

3. The details which will activate intelligence-fields active should be demonstrated.

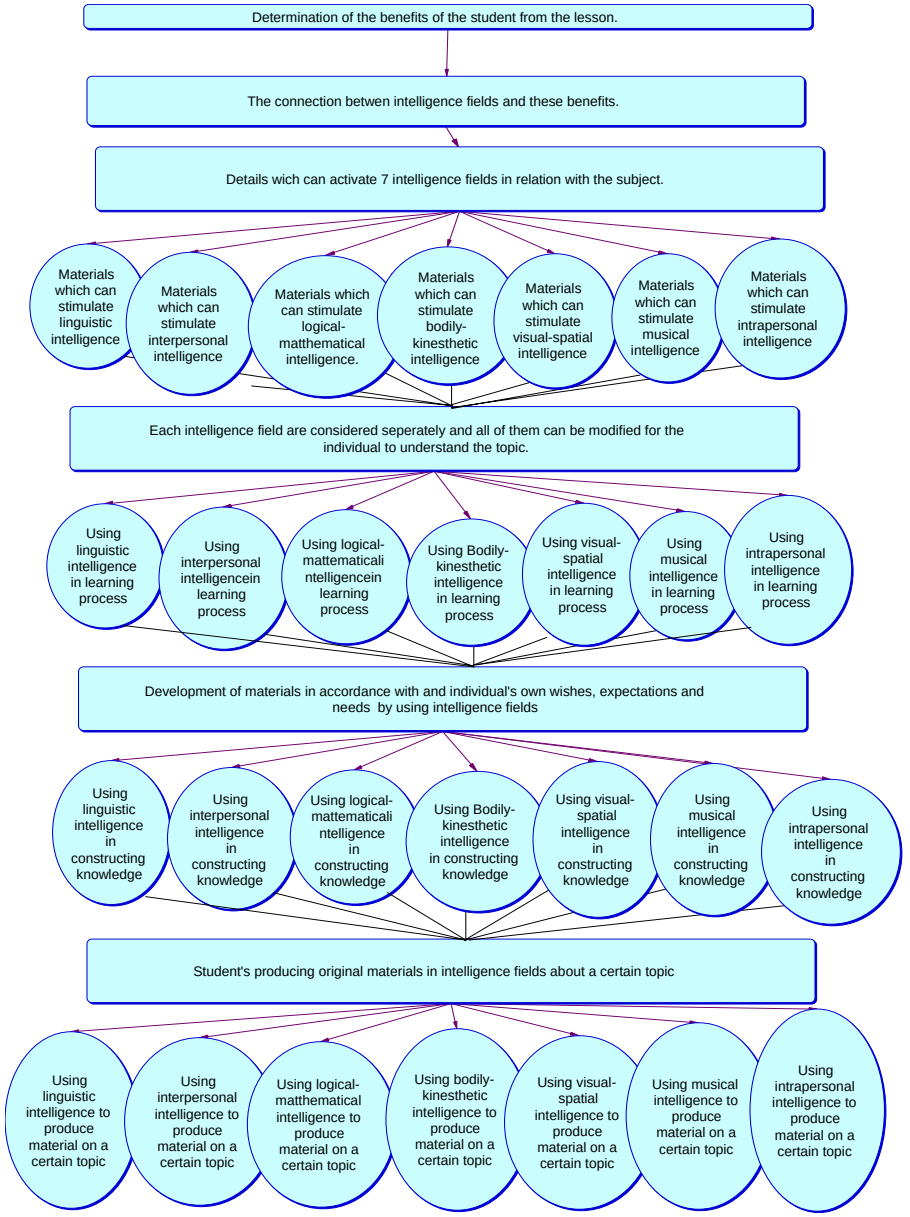
4. Each intelligence area should be taken into consideration separately or together and materials should be prepared for the individual to take in the knowledge by using all of them.

5. Instead of what we want to teach, materials which would help them to learn should be prepared in favour of the student's own wishes, expectations and needs.

6. The materials should be prepared for the students in which students produce new works.

According to MIT on learning and the rules educational-technological principles that are given above can be improved with this model.

## MODEL RECOMMENDATION ON THE BASIS OF MULTİPLE INTELLIGENCE THEORY TO DEVELOP MATERIALS FOR EDUCATIONAL TECHNOLOGY



As is seen, six steps form the model. In these steps, the activities given below should be followed:

*1st Step*: The determination of the students' benefits about a unit: In this step, Bloom's taxonomic classification can be used for the determination of students' interest during learning (**Armstrong, 1994**). However, it shouldn't be forgotten that behaviour and goal should reach application levels and further, because the main goal in multiple intelligence theory is student's producing his/her own works.

*2nd Step*: The determination of direct and indirect relations between intelligence fields and the goals that are aimed in a unit: The connections between the benefits and seven intelligence fields should be put forth. It is necessary to determine the connection between seven intelligence fields and all topics in every field. The activities to be carried out in the future will be based on these relations. Hence, there should be teamwork, using a brainstorm technique to find the originality.

*3rd Step*: Details should be determined that would activate intelligence fields in accordance with their connections to the related subjects. How each intelligence field related to corresponding subjects will be activated should be determined at this point.

*4th Step:* Materials should be prepared that will activate intelligence fields, either considering them separately or all of them together, thus starting the process where an individual will learn new subjects that are presented. Here new knowledge is recognised and materials that will help it be accepted by memory should be prepared. As the number of intelligences increases, the process of recognising knowledge and taking it in accelerates.

*5th Step*: Materials should be prepared for processing and structuring knowledge by using intelligence fields. It must be an obligation at this point for an individual to use all the intelligence fields. The more connections are built with mental structures in the process of structuring knowledge, the more stable and easier-to-reach the new structure becomes. Therefore, materials where an individual will use all intelligence fields should be prepared.

*6th Step:* The ultimate aim of multiple intelligence theory is for an individual to create products. The fact that these products, which will be a basis for evaluation, turn out in accordance with subject-intelligence field would be a result of correct application of multiple intelligence theory. Materials that would encourage an individual to create subject-centred products related to intelligence fields should be prepared. Materials that would encourage creating products for each intelligence field not only would reinforce the subject-intelligence relationship but would also contribute to enhance the capacity of intelligence fields.

## Possible Problems While Developing Materials for Multiple Intelligence Theory and Precautions to Be Taken

1. Students should have the necessary information about the process of the method and its importance. What is more essential is for intelligence to get importance rather than subject and students' indifference to the subject should be avoided. The main aim here is not to carry out musical learning, social activities etc. but to use these for the learning of the subject.

2. One-way perspective should be stopped because when intelligence fields are used separately multidimensional perspectives can't be achieved. Multiple dimensions cannot be functional when different intelligences work for the case.

3. Students' focus on the material rather than the content should be prevented.

4. The information should not be relative, so new materials for this aim have to be prepared.

5. The material's aim for usage should be determined; otherwise, this may cause confusion (**Veenema & Gardner 1996**).

## Conclusion and Recommendations

It is well known that without taking care of an individual's learning style, technological materials have no significant contribution in education. Therefore, findings that are related with the learning style of the individual play an important role in learning.

From the perspective of learning theories, it is observed that behaviourist approach regards learning as a connection-building process between stimulator and response, which mechanical in nature and this mechanical view is reflected in the technological materials, which are improved in accordance with the teaching principles. Cognitive theory, which try to explain learning by taking mental processes as a base (1) don't comprise all the students, (2) can't provide a suggestion to get rid of individual differences, (3) in not helpful enough to provide suggestions about how the mental structures which are said to exist would be included in learning process

MIT has a design in which individual diversity is reflected as a new subject. The studies show that in the groups that Multiple Intelligence theory had been used, the students had a colourful learning process and participation was high in the groups. Also the students were pleased to be in the environment. MIT has brought forth some principles, which would colour the learning process, with a design that would encompass a larger part of the students by using individual differences. While conventional learning theory focuses specifically on individual's single intelligence, Multiple Intelligence theory aims at an individual to put seven intelligences into motion. As is indicated in the literature the materials that would be improved via Multiple Intelligence theory will provide more students to join. Besides, it will help students to recognize their hidden talent as well (**Campbell; 1989; Campbell, 1990; Demirel & others, 1989; Mills, 2001**).

Individuals are not passive receivers of the knowledge. This is what the materials aim. Therefore, this let students to produce good works and comment on a subject instead of memorizing it. One of the basic problems of learning process is how an individual take in the knowledge in his memory and how he should be supported in this respect. MIT solves these problems with providing a connection between intelligences. Developing technology affection in class training is seen as a fundamental problem. MIT provides good solutions, which would help teacher to use developing technology more effectively in class practice (**Hoerr, 2001**). How the developing technology can be used more effectively in class is a problem awaiting to be solved in educational systems. With the principles and findings of MIT, CD-Room designs and their integration to educational processes would be much easier.

Using technology in learning process, the explanations about individual's style of learning should be taken into consideration in using technology for the educational process. Materials should be prepared in a helpful manner to make students use all their potential talents. By using computer technology, educational materials should be devised to activate all the intelligence fields of an individual. In addition, materials can

change monotonous and mechanical learning processes as well as create a new learning atmosphere for various intelligences. How the theory may be functional in material improvement and be effective in learning cycle should be searched. Material development Model that is proposed above in accordance with the principles of MIT can be used to develop materials for different lessons and their effects on learning processes should be examined.

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