

Multiple Experiences in Multiple Settings = MEMUS a theoretical framework for museum pedagogy

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Introduction

Museums as arenas for learning is a theme which many are preoccupied with. Several have attempted to describe what characterizes museums as places where learning can take place, with contributions from various points of view. George Hein (1998) summarized how museums can live up to the constructivist view on learning. Falk and Dierking (1992, 2000) have presented "The Contextual Model of Learning", which describes the museum visit as interplay between personal, social and physical contexts. Crane et al. (1994) discusses how museums, as informal learning milieus, separate themselves from formal learning milieus, and appeals for collaboration between these. Each of these, with starting points in research done in museums all around the world, have tried to say something about which consequences their finds have for museum pedagogy. They have particularly put their focus on where there is need for more research. In this article, I wish rather to place a focus on the everyday life of the museum pedagogue. This may be seen as a tool for those who would like learning to happen in the museums, a theory for practical action, and which I call MEMUS (Multiple Experiences in Multiple Settings).

The practice which will be recommended through MEMUS has learning as its goal. With learning, I don't mean that type of knowledge which is "remembered", but rather the type of knowledge which is "understood". The goal is not to gain that which Feynman (1985:192) writes about his students: ... *(T)he students had memorized everything, but they didn't know what everything meant....* With the term understanding, I mean the same as Gardner (1999a:119), who writes that ...*an individual understands a term, an ability, a theory, an area of knowledge to the degree that he or she can transfer this in a useful way to a new situation.* This view coincides with what Ausubel et al. (1978) describe as meaningful learning, involving that new information - which may be facts, attitudes and feelings - is linked to existing information in the learners knowledge structure in such a way that the learner is capable of remembering this information after a period of time, and to transfer these ideas to new situations and problems.

A goal like this involves one seeing learning as a process over longer periods of time, which several have pointed out (Crane et al. 1994; Falk and Dierking 2000; Roshelle 1995). One cannot take for granted that an individual museum visit can provide this type of learning, but the visit can be a segment in a process towards understanding in an individual. This means that the museum pedagogue must include what I have called a "multiple setting" perspective in teaching, something I will describe more closely later.

It is also important to believe that learning is an active process which occurs in the individual (Duit and Treagust, 1995). This means that both the learners motivation for learning, and how well prepared the material is to the learner's attitude are important. In the next chapter, we shall look at how motivation influences learning benefits. After that, we shall see how the theory of multiple intelligences can help us to organize for various forms of learning/approaches.

Motivation – an important buzzword for making learning happen

In order for learning to occur, the learner has to want to learn, be motivated to learn (Imsen 1998). Distinctions are often made between inner- and outer-motivation. Imsen (1988:232) define these in the following way:

"When a child is motivated out from inner forces, for example has a need for play and expression, one likes to say that there is an inner motivation as the basis. Natural motivation or case-motivation are similar terms. Activity, learning or the working process is maintained due to interest for the case, the learning materials or the activity in itself... On the other hand, outer motivation means that the activity or learning is maintained because the individual sees the promise of gaining a reward or a goal which actually lies outside of the situation."

When learning occurs with the help of inner motivation, it has been shown to be quite effective (Dewey 1913; Falk and Dierking 1997; Gottfried 1985; McCombs 1991; Schiefele 1991). Many have studied what must be done in order to create a milieu where inner motivation for learning dominates. Some of the conclusions are that; supporting milieus are important (Deci et al. 1981; Deci 1992; McCombs 1991), the activities should be meaningful (Maer 1984; McCombs 1991), it is advantageous that learners are not in bad moods, become irritated, etc. (Baddeley 1994; Diener and Dweck 1980; McCombs 1991), the learners are in control and are given freedom of choice (Pintrich and DeGroot 1990; Covington 1992; Paris and Cross 1983; Paris 1997) and that challenges are adjusted to the learner's abilities (Csikszentmihalyi 1990a, 1990b). Under the right circumstances, both children and adults experience the joy of learning. This joy is demonstrated in various ways in various individuals.

Paris (1997) has focused on the museum as a learning-arena, setting up six components which explain how inner-motivation is dependent on context. He stipulates that the museum program should be such that visitors:

1. Construct Personal Meaning – People are more motivated to learn things which are personally relevant and useful. This is often the reason why visitors come to the museum at all, and are the most prominent memories several years after the visit.
2. Experience freedom of choice – That the visitors themselves can choose what they will learn makes them use more energy in learning. Hands-on and experimental tasks stimulate curiosity and invite participation.
3. Experience challenges – The activities in the exhibitions should neither be too difficult nor too easy. When activities are on the same level as the visitor's skills and abilities, can the visitor have a so-called "flow" experience (Csikszentmihalyi and Hermanson, 1995).
4. Experience that they have control – It has been shown that children who themselves can control or guide their own learning process have greater returns in learning (Ryan and Grolnick 1986).
5. Collaborate on tasks – Social interaction is motivated from several causes. People stimulate each others thoughts, give each other new ideas, motivate to discussion and conversation and encourage each other to work together. People work harder in groups, they have various levels of expertise and seeing what others can do can give confidence; "I can do that, also."
6. Consequences of Learning – Activities which shall be solved together with others influence visitors to focus more on processes than to find out the correct answer. And this process of self-exploration can give confidence and pride in mastery, quite a different learning situation than what many experience in school.

In the following paragraphs, I will discuss these points more closely.

Relevant and interesting theme

Point one took up how important the choice of themes are, that they should be relevant and interesting for visitors. Here, museums have much to gain from the literature within "education", and in our case, particularly "science education". Movements like "Science, Technology and Society" abbreviated as STS (Aikenhead 1994; Solomon and Aikenhead 1994), "Public Understanding of Science and Technology" abbreviated as PUST and "Scientific, Technology Literacy" abbreviated as STL (Coborn 1996; Jenkins 1994; Layton et al. 1993; Shamos 1995) place

their focus on natural science in daily life, and that the information must be tied to the learner's own reality. Information must be chosen with thought for the needs of the public, rather than the structure of the system of knowledge itself. This means, for example, that not all aspects of a scientific discipline can be illuminated each time.

Lately, museum people themselves have placed a question mark on the neutrality of museums, which, in their urge not to offend anyone, refrain (or let us rather say try to refrain) from choosing sides (Norwegian Museum Authority 2000; Journal of Museum Education 1998). Such pedagogical politics have led to the imparted information being focused on facts rather than problems for thought. The themes which museums have chosen have often been cautious, and not particularly socially current, because current problems can be difficult not to address, or because they can act to offend in themselves.

During the museum conference "When traditions get in the way", arranged by the Norwegian Museum Authority, it was proposed that museums should to a greater degree take up difficult themes, be clearer in their choices and attitudes, dare to be controversial rather than conventional, show problems and fine distinctions rather than being objective and impartial (Norwegian Museum Authority 2000). In Sweden, a project called "difficult cases" (Svåra saker) has been started, where the goal is, among other things, to place focus on themes which are difficult, but relevant for the present (Silvén 1998). All of these experiments are done because of a wish that museums shall meet the public on their own terms, and take up questions which they themselves are absorbed with. In this way, museum education is made more relevant and interesting for the public, creating a milieu which stimulates inner motivation.

Freedom of choice and control

As a museum visitor, one is free to choose which exhibitions one will concentrate on and which activities (if the exhibitions are interactive) one will choose. In this way, the visitor experiences a feeling of control over his or her own learning. This is what points 2 and 4 take up, and which actually are two aspects of the same thing, freedom of choice and control. Independent learning is one of the goals which the school system tries to stimulate, and in this context are museums an excellent learning milieu also for schoolchildren.

When learners themselves can choose what they shall learn, they exert themselves more to learn (Paris 1997), they have more stamina, try harder to solve tasks and perform more independently (Covington 1992; Paris and Cross 1983). And when learners have control over the learning situation, they become more active in the search for information and meaning. They make choices and adjust the challenges after their own moods, interests, goals and knowledge (Paris 1997). This is a clear sign that learning occurs through inner motivation.

Challenging

Activities in the exhibitions should be suitably challenging, it says in point 3. Activities that are too simple lead to boredom, and too difficult lead to frustration (Rohrkemper and Corno 1988). The goal should be to give the visitors activities which balance between "not too difficult" and "not too easy", giving visitors what Csikszentmihalyi calls a "flow" experience, where they become totally engrossed in the activity. He calls such experiences "flow", because they are described as a condition where everything happens spontaneously, and almost automatically, similar to a strong stream. A general characteristic of activities which produce "flow" experiences are that they have clear goals and definitive rules (Csikszentmihalyi 1975, 1990b). For example, much like what mountain climbers and chess players can experience.

The challenges can be given through employees asking visitors questions, that the exhibition invites visitors to test themselves against other visitors, or that physical arrangements invite participation.

As mentioned above, it is important that visitors experience that they can accomplish something, that they succeed. Sometimes, however, failure can also be constructive on learning. Clifford (1991) describes "constructive failure" as a possibility to learn the value of stamina, and to find alternative strategies for reaching a goal or a solution. An occasion where one first fails, then finds alternative solutions is called "adaptive learning", meaning that experience can lead to greater understanding (Rohrkemper and Corno 1988).

Cooperation and process learning

The advantages of cooperation and social learning are mentioned in point five, and will be discussed further on in the article. Therefore, I won't go deeper into it here. Point six mentions the advantages of focusing on the process leading to a solution or knowledge, instead of advocating the memorization of factual knowledge, something which is often focused on in school. Earlier, it was explained that we are talking about learning as a process with understanding as its goal, and not memorization.

In order to create a milieu where inner motivation is the driving force, it is important with the choice of academic content, suitably challenging activities, cooperation and focus on the learning process. Freedom of choice and control are already taken for granted in a museum.

MEMUS - Multiple Experiences in Multiple Settings

There will here be unveiled a framework for helping museum pedagogues to create museum experiences which

- have inner motivation as driving force,
- build on an understanding that learning is an active process in the individual, and that each individual has her own approach,
- presupposes that learning occurs over time.

The framework, or MEMUS, focuses on museums offering visitors multiple experiences, including the points made by Paris (1997). Museums should present information in various ways, so that it becomes available for as many as possible. In addition, focus is made on the need for museums to adjust and use the fact that what they offer is just one of several offers from various learning milieus and settings.

Multiple experiences at the museum give individual learning

With learning as the goal of museum pedagogy, museums need to arrange for individual learning, and that different people have different approaches to learning. I believe that Howard Gardner's (1993a, 1999b) theory on multiple intelligences (MI theory) can function as a good framework for this. In the following, I will argue for why I believe this, and will include how I feel that museums can use MI theory. The goal is to prepare for individual learning by giving the public multiple experiences.

Why the theory of multiple intelligences?

Two central directions have dominated learning research. One direction tries to understand what happens in the head of the individual. Jean Piaget (Piaget 1970; Flavell 1963; Gruber and Vonèche 1995; Inhelder and Piaget 1958) has laid an important foundation here, resulting in one being clear that learning is an active process which the individual him/herself controls. The other direction focuses on the social and cultural relationships surrounding the individual while learning occurs. A central figure here has been Lev Vygotsky (Vygotsky 1930, 1933, 1935/1978, 1934/2000; Newman,

Griffith and Cole 1986; Wertsch 1985;). This direction has made us aware that learning occurs in contact with other people, and is influenced by the culture one has grown up in.

These two directions have influenced the view on learning which the natural-scientific educational system operates within today, which is Constructivism. A constructivist view of learning means that individuals construct their own understanding during interaction between their own ideas and input from outside (Duit and Treagust 1995). Many have criticized Constructivism, among others because it says so little about what the surrounding milieu can do to stimulate learning among pupils (Good, Wandersee and St.Julien 1993). I believe that Howard Gardner (1993a, 1999b), with his theory of multiple intelligences brings Constructivism one step further, giving us tools to reflect over and plan our teaching.

Piaget – the individual constructs his own understanding

Jean Piaget describes thinking as an activity built upon cognitive structures which reflect the outside world (Pedagogisk-psykologisk ordbok 1996). He describes maturation and development of "schemata" in the individual (Piaget, 1970), where a "schema" is a cognitive structure which contains the experience and knowledge an individual has. This changes through the individual's interaction with his/her surroundings (Sjøberg, 1998). He describes therefore the intellectual function as a process of adaptation, where the cognitive structures gradually change. This adaptation has two sides:

- Assimilation – new impressions are taken up in existing structures, the new fitting well in with the old
- Accommodation – new impressions don't fit in well with the old, a need arises for changing structures.

The two functions act simultaneously, and must be in balance. Piaget believes that the child's concrete actions are primary for the child's cognitive development, but after the development of language skills, language plays a greater and greater role. For most people, learning is basically a process of assimilation, rather than accommodation. That assimilation is an important aspect of learning has been strengthened after recent discoveries within neuro-science (Calvin 1997; Sylwester 1995).

Piaget describes the development of the child through four stages. Each stage is characterized by a certain type of logic, which is logical on its own premises, but which is qualitatively different from adult logic. Piaget also made visible the relationship or parallel with the development of natural science and the development of children's logical-mathematical thinking. In both cases, it started with simple experiments with objects and the discovery of their patterns of interaction. It is first later in both the development of the child (during the fourth stage, which is called the formal operational stage). He admitted that one could be on the fourth stage of development (the formal operational stage) within one area of expertise, but not necessarily be formally operational within all areas (Frank 1992).

With time, several objections to Piaget's view of cognitive development were given. Tardner (1993b) gives a summary which covers these objections:

- Piaget was convinced that development consisted of a series of qualitative changes of ideas and forms of understanding. This statement can very well be correct with regard to certain areas, such as the child's view of life and death, which change between infancy and teenage years. Still, these qualitative changes don't occur everywhere. Many basic insights, such as that the world consists of bounded objects, is present at birth – or soon after, not going through any long process of development.

- Piaget considered that all milestones were connected with each other, such that all important happenings in different areas take place at about the same time. Today, there is a good foundation for assuming that development in various areas takes place far more independently of each other, in the way that progress in one area often doesn't reflect progress in other area.
- Piaget felt that he studied all cognition and all intelligence, but there are good reasons to believe that his field of view was more limited. The qualifications of natural science stood in the center of Piaget's perspective, and even within the field of natural science much of his awareness was focused on numerical competence. His view of human development was centered around our specie's ability to acquire first class knowledge about numbers.
- Piaget claimed that the older child's more advanced form of understanding exterminated its earlier forms of understanding the world. Such an elimination of earlier ideas can occur in the case of experts, but research on normal pupils shows that earlier understanding can continue to exist side by side with the more advanced (Driver and Easley 1978; Driver et al. 1994; Viennot 1979).

There are still reasons to support Piaget in his belief about development, which begins with an intuitive understanding of numbers and causes and effects, and which can further be followed up to the highest levels of modern logic, mathematics and natural science (Gardner, 1993a). Piaget demonstrates also how well natural-scientific modes of thought fit to the interests and curiosity of the small child. Therefore, we have good reason to begin teaching science as early as possible (Gardner 1993b).

According to Gardner (1993b), the most positive things about Piaget's theories were that he took children seriously, he made important problems visible (especially those tied to the area of natural science), and he provided proof that for each stage and within a wide field of mental operations, the same basic structures may be glimpsed.

Piaget believed that development of the cognitive stages happened independently of social context and subject. With time, grounds were found to doubt that this was the case (Sjøberg 1998). One of the doubters was Vygotsky.

Vygotsky – cultural and social aspects influence individual learning

Lev Semenovitsj Vygotsky (1934/2000) claimed that advanced concepts appear first in a social interaction, and only gradually become available for an individual. According to him, and others, Piaget and other "mind-centered" or "individual-centered" researchers left out at least two decisive factors for cognitive development: contributions from cultural products and inventions on the one side, and contributions from other living people on the other.

Vygotsky developed a theory on the development of specific, human intellectual functions, such as the development of language. He focused on the Zone of Proximal Development (ZPD), which is defined as the difference between what a child can do without help, and what the child can do with help or guidance from others (Newman, Griffith and Cole 1986; Wertsch 1985). In this construction, the child can participate in a cultural practice which lies at a level above his or her abilities. Children who easily pick up abilities and knowledge have a high ZPD.

Experienced grownups can guide learning through "scaffolding", modeling and negotiation, such that the learner is brought into a specialized cultural society. This is something which other researchers have also seen as an important task, where, among others, the institution of

apprenticeship is brought forth as a good example of such interplay (Gardner, 1993b and 1999a). Vygotsky also believed that children cannot know themselves except through knowing others.

Vygotsky was also involved with how one could participate in child development. He felt that at each age level, children have a set of different interests which one should utilize. Just after birth, the children seek emotional contact, they manipulate with objects after the age of two, role-playing and symbolic activities are important between three and seven. After awhile, however, school activities become more important and the choice of vocation dominant.

He separated between "spontaneous" and "scientific" concepts. In this way, he was able to describe the distinctiveness of the school. Spontaneous concepts (such as brother or animal) are acquired in everyday life, while scientific concepts (such as gravity and mammal) are primarily acquired in a school situation. Vygotsky believed that children easier acquire scientific concepts than spontaneous. But later research shows that even though they are acquired easier, they are perhaps weaker, and are more easily remodeled by deeper rooted spontaneous terms (Gardner 1993b).

The renewed attention regarding cultural advances has accentuated in which degree human development is incomplete – perhaps even unintelligible – without taking cultural and social influences and initiatives into account. [...] We end up with the dawning of a theoretical and empirical perspective which is far more complex than what Darwin or Piaget had perhaps wished. If we are lucky, this perspective can perhaps give us a more general view on human development, and guide us in the formation of a more suitable and more effective educational system. (Gardner 1993b:50-51)

Constructivism – a combination of Piaget's and Vygotsky's theories?

After Piaget and Vygotsky, people began to be more preoccupied with subject content, what pupils understood of what was taught, something which gave frightening results. More pupils kept their everyday understanding, even though they were instructed in natural scientific models for understanding (Driver and Easley 1978; Driver et al. 1994; Viennot 1979).

It came to light how strong the child's intuitive understanding of the surrounding world was, and that this was a challenge for teaching. Ausubel (1968) expressed it in this way: "*If I must reduce all educational psychology to only one principle, I would say this: Find out what the learner already knows, and teach him from there on.*" He points out how important it is for the teacher to grasp the prior knowledge of pupils. Age is less important, in other words. It is what you know or don't know which should determine where one starts teaching.

Prior knowledge and the possible everyday ideas school education can create became important starting points within the constructivist view of learning. Interplay became therefore also important, the social context between those who learn and between learners and the teacher. At the same time, Piaget had made it clear that the individual himself constructs his own learning, which the Constructivists also support. One can therefore say that Constructivism has taken elements from Piaget and the "individual-centered", as well as from Vygotsky and the "socio-culturally" centered (Fosnot 1996; Lave and Wegner 1991; Steffe and Gale 1995; Wertsch 1991). But, as previously mentioned, Constructivism is criticized for saying little on how this learning perspective influences practice. Osborne (1998) is one of the critics. He says that the Constructivists confuse learning with "hands on", and that although activities are fine, one should discuss what type of activities promote learning. Osborne and Rice (1998) consider that it is time to look at "minds on", not only "hands on" – more focus should be put on activities which promote reflection and understanding among learners. I feel that Constructivism has much to gain here, from the theory of multiple intelligences (Gardner 1993a and 1999b).

Multiple intelligences – multiple experiences

Howard Gardner has expounded a theory (Multiple Intelligences, MI) that we humans have an inborn bio-psychological potential which consists of several equal intelligences. Up to now, Gardner has identified 8 intelligences. In table 1, an overview is given, with descriptions of each.







ABC	Linguistic intelligence is sensitivity for the sound, structure, meaning and function of words and language
123	Logical-mathematical intelligence is sensitivity for and the ability to separate logical and numerical patterns, as well as the ability to handle long chains of reasoning.
	Spatial intelligence is the ability to perceive the visual, spatial world precisely.
	Musical intelligence is the ability to produce and appreciate rhythm, pitch and resonance.
	Bodily-Kinesthetic intelligence is the ability to control bodily movements and handle objects.
	Naturalist intelligence is the ability to recognize and classify objects, both flora and fauna.
	Interpersonal intelligence is the (social) ability to understand and react adequately to atmosphere, temperament, motivation and the wishes of other people.
	Intrapersonal intelligence is access to ones own feelings and the ability to distinguish between feelings. Knowledge about ones own strengths and weaknesses.

Table 1: The 8 intelligences, as defined by Gardner (1993a, 1999b).

This inborn potential develops in a social and cultural context. He defines intelligence in this way: *A bio-physical potential to treat information which can be activated in a cultural setting to solve problems or develop products which are more valuable for a culture.*

Culture therefore creates both hindrances and possibilities for individual development. Gardner provides several examples of how various cultures "cultivate" different characteristics. For example, Ugandans favor slow, deep engagement in activities, while Mexicans place more emphasis on human compassion, and Chinese value the mastery of large amounts of factual information. The individual isn't born with skills, but develops competence through periods of learning. There are only a few areas where the individual can develop expertise just by reading.

Criteria for the intelligences

In order to come to just these 8 intelligences, Gardner used clearly defined criteria supported by several scientific fields. He says that since neurology shows that the each intelligence has a distinct placement in the brain, biology gives a framework for natural human intelligence, but cultural

relationships will color the way that this potential develops. In table 2, an overview of the criteria is given. In summary, he poses several questions in order to identify an intelligence:

- Are there traces of the intelligence in other species, and earlier societies?
- Is there a set of operations and a symbol system which characterizes the intelligence?
- Are there special persons – geniuses/autistic persons – who especially demonstrate the intelligence?
- Do IQ tests and experimental psychology support that the intelligences are not correlated / interconnected with each other?

FIELD	DESCRIPTION OF THE CRITERIA
Biology	<p>Neurology – is there an independent module in the brain?</p> <ul style="list-style-type: none"> • Can it be localized in specific places in the brain? • Can it be destroyed by brain damage, while others are intact? • Evolution – how can one describe the development of the module, and are there traces of other species and earlier times? • Are there traces of the intelligence among other species (for example: the ability of bees to calculate distance – logical mathematical; and birdsong – musical) • Are there traces from earlier times (for example: language – the oldest written notations are from 30,000 years ago; visual/spatial: cave paintings; logical mathematical: early numbers and calendars)
Logical analysis	<ul style="list-style-type: none"> • Is there a set of operations or core components? (for example: bodily: the ability to control the body's movements and handle objects, or interpersonal: the ability to understand and react in relation to moods, temperament, etc. of other people). • Is there a system of symbols? (for example: logical mathematical: data languages; musical: notation and Morse code; visual/spatial: picture languages (Chinese)).

Development psychology	<p>To be able to describe the development of an intelligence</p> <ul style="list-style-type: none"> • Show a clear path of development which both normal and gifted people go through • Development happens as an end result after top performances, such as people with talent • Can clearly register critical periods in the development, and important phases or clear milestones tied to physical maturation and training (for example: language: rapid growth in infancy, and robust in old age; musicality: the intelligence which develops first, problems in teenage years) • Are there examples of people who are outstanding within the field? • Are there special persons who confirm the intelligence, such as: • Special groups of children and adults, such as geniuses and infant prodigies, • Handicapped and/or autistic persons with special talents. (when a unique ability advances despite great functional difficulties, it is often a sign of an independent module.
Traditional psychology	<p>Is there support from experimental psychology:</p> <ul style="list-style-type: none"> • Do the abilities of persons confirm that there are several intelligences? • Do the reactions of persons to various tasks confirm that there are several intelligences? <p>Is there support from psycho-metric findings (IQ tests)?</p> <ul style="list-style-type: none"> • Is there low correlation between to different types of intelligence?
Anthropology	Are there indications that the intelligence occurs in several cultures?

Table 2: Overview of the criteria Gardner has used to come up with the 8 intelligences (Gardner 1993a).

Use of MI theory

In my opinion, the theory is an excellent framework for thinking and planning multiple experiences within all kinds of learning situations. Gardner considers that education should provide basic understanding for our various worlds – the physical world, biological world, human world, world of human objects and the world of the self. Further, he says that basic skills such as reading, writing and counting should be seen as means, and not goals in themselves.

Schools and other learning milieus have concentrated on the first two intelligences; linguistic and logical-mathematical, while Gardner feels that all intelligences should be equal, and have the same priority.

As small children, we learn intuitively. Therefore it is society's task to arrange that children have access to activities which stimulate all of the intelligences. It is in this age group that development of most of the intelligences occur, and therefore important to give children the possibility to develop and expand their potential. Gardner believes that science centers and children's museums are good examples of such learning milieus for pre-school children.

In the middle-school years, it is important to lead children into our cultural world, and our understanding of the world around us. Here, he suggests apprenticeship as a good method, where the master explains and demonstrates for the apprentice. Experts show how the field can be handled, and guide the child in learning the symbolic language.

In high school age, it is important to focus on young people's abilities and products, stimulate them to independent work, self-reflection and their own work. Young peoples works should stand in the center, they should not copy static pictures, but rather use their creativity to produce something themselves. They should no longer only repeat after the master, but themselves begin to become masters.

Discussion around the theory of multiple intelligences

Criticism has been voiced concerning MI theory. Some people disagree with the use of the term intelligences, while others criticize Gardner for not having any proof for his theory, that it consists of a collection of thoughts (Brook 1994; Roper and Davis 2000). However, this criticism should not hinder museum pedagogues to give the public varied and better adjusted museum options, which pay attention to various approaches, and which don't favor anyone above the other.

The danger, in my mind, is when MI theory is used to place children and adults in pigeonholes – in the same way that IQ tests have been used. Gardner's theory contains only more pigeonholes to choose from – eight of them, to be exact. One can imagine that a child who hears about how well developed his bodily-kinesthetic intelligence is, could be hindered in developing other intelligences. This could be because either he himself creates hindrances, or the surrounding milieu only supports this one intelligence. Such channeling can be destructive for the child, and lead to frightening developments for society.

I believe that this misuses MI theory. Gardner's vision is to find each individual's strong sides, and not label anyone as weak. He feels that we should take our starting point in the strong sides, and use them like bridges to the areas the individual is not particularly strong. In this way, each individual will experience that he/she succeeds in something, and will also be given some challenges. The vision is not to create a society which is out to judge who is smart and who is weak, but a society which gives room for, appreciates and gives equal rights to various abilities.

Thomas Armstrong (1998), a colleague of Gardner, has set up the following 4 points which are important to remember in relation to MI theory:

1. All humans possess all eight intelligences. MI theory is not a 'type theory' for categorizing by intelligences. It is a theory of cognitive functionality. It is stipulated that all humans have abilities within all eight intelligences, and that they work together in a way which is unique for each individual human.
2. Most humans can develop each intelligence to a fully competent level. Gardner feels that just about everyone has the capacity to develop all intelligences to a fairly high level of functionality if one receives appropriate encouragement, conditions and instruction.
3. The intelligences normally function together in a complex way. Gardner points out that each of the intelligences which he describes are actually fictitious. That means that none of the intelligences occur individually (except in very seldom cases, such as among people with brain damage, etc.).
4. There are many ways to be intelligent within each intelligence category. There is no standard set of basic characteristics which one needs to have in order to be considered intelligent within a special area. This means that a person who has problems with reading can easily be linguistically gifted, because he is a fantastic story teller, or has a large vocabulary. MI theory points out the rich diversity of ways people show their talents within intelligences, as well as between them.

The theory of multiple intelligences describes each individual with 8 types of intelligences - or 8 different ways of collecting information – which work together in a way which is unique for every single individual. One practical consequence of the theory for museums is to give the public multiple experiences, something which I shall discuss later.

MI theory and parallels with Constructivism, Piaget and Vygotsky.

Piaget focuses on what happens inside the head, how the individual assimilates information, and adjusts or doesn't adjust it to what already is there. He holds that the child goes through a development from assimilating practical and concrete experience, to more abstract thinking. It is this development which determines what the child acquires from the surrounding world.

For Vygotsky, culture and humans were the most important factors for the child's development and learning. The child would not go far without interplay with the surrounding society.

Gardner agrees with Piaget concerning our being born with a potential and a special drive to learn. But he also focuses strongly on the influence of culture, and the drive of this development. It therefore appears as if Gardner's view on learning has parallels with both Piaget, Vygotsky and the Constructivist view on learning: We are provided with a potentiality, some inner possibilities, which are developed in social and cultural interplay.

In his theory of stages, Piaget felt that he presented a theory for the development of intelligence. Howard Gardner believes that Piaget describes the development of only one of several intelligences; logical-mathematical.

Vygotsky considered that all higher mental functions have social origins, and first exist between individuals (on an interpersonal level) before they become internalized in the individual (on an intrapsychic level) (Vygotsky 1978; Wertsch 1986). Language binds the interpersonal and intrapsychic levels together, and has two functions: it is used to observe social interaction between individuals, and cognitive activity in the individual (Vygotsky 1978; Berk 1986; Wertsch 1985). Here, he touches several of Gardner's intelligences, such as intra- and interpersonal intelligences, and linguistic intelligence. Vygotsky appears to place the linguistic above the other two, because he feels that this is what binds them together, while Gardner equates them.

Further, Vygotsky believed that children cannot know themselves without knowing others, while Piaget was of the opinion that the child must first become known to himself in an egocentric phase, before understanding others. Gardner (1993b) feels that both of these are onto something important. They only describe different sides of the development of the child's personal intelligences, the intra- and interpersonal intelligence.

The interplay between expert and pupil which Vygotsky expounds is important, and is in line with Gardner's view on apprenticeship (Gardner 1993b).

In other words, Gardner's MI theory contains pieces from Piaget, Vygotsky and Constructivism. In addition, MI theory contains several perspectives which the other theories don't have, and which I experience as very constructive when they become transformed into practice. The theory gives no answers, but rather functions as a framework for the various aspects of learning, providing an extremely good foundation for thinking and educational planning. In short, it may help museum pedagogues to give the public 'multiple experiences', including social interaction, physical and mental experience with objects, and the discovery of the uncountable aspects of objects; their stories, use, aesthetics, sounds, etc. Let us look a little closer on the application of Gardner's theory in museums.

Application of MI theory in museums, with support from results in museum studies: What does this mean for museums in practice?

Gardner (1999a) is not alone in suggesting that museums should give the public varied experiences. Hedge (1995) stipulates the importance of exhibitions not being too similar and foreseeable – people then lose interest. He feels that museum staff must make sure that visitors get varied experiences over time. He compares going to museums with shopping in a shopping center. In both places, one receives the stimulation of several senses, which is experienced as satisfying and entertaining. Museums can be seen as shopping centers, where an entire center gives a greater experience than an individual store. The same pertains to entire museums, in comparison with an individual exhibition. This is also parallel to what Worts (1995, 1999:129) says: "*For me, museums in the future years will include a new form of partnership with the public – where the many ways of meaning-making are encouraged, supported and respected*". Others, such as Falk and Dierking (2000), encourage museums to vary what they offer. Miles and Tout (1994) say that this is important for hindering museum tiredness. Perry (1994) concludes that exhibitions should raise curiosity, give visitors self-confidence, challenge them, let visitors experience that they are in control and invite them to play and communicate. In other words, give a varied offering, which also Paris (1997) encourages.

Below, discuss a few activities and teaching methods which museum pedagogues can use in order to give the public multiple experiences. The activities and methods are sorted by which intelligences I believe they stimulate, and their qualities are evaluated with support from results collected through several museum studies.

Linguistic approach

"Visitors don't read museum texts" has been accepted on faith by museum staff. Some go so far as to refrain from using texts in exhibitions at all. We will see here that this isn't so simple. In fact, there are some who read texts, even some who read them very much. If the texts are read or not depends on many things: the form and content of the texts, who the visitor is, how they assimilate information and who they come together with.

Museum texts, lectures, audio recordings and dialogs or conversations are the means museums have to stimulate linguistic intelligence. Dialog and conversation will be discussed in the sub-chapter "social or interpersonal", while we go through museum texts here. Let's take a closer look at who reads or doesn't read museum texts, and why.

The aim of the text

The aim of the text is important. Screven (1995) has listed 5 points for which functions museum texts have:

1. They give information on what the visitors see: Name, dates, why the object is included in the exhibition, what it is used for.
2. They give instructions to the visitor on what they shall do, notice or look for.
3. They make the themes personal, and draw lines from the new and unknown, to known experiences.
4. They interpret the content of the exhibition – sensory experiences, the meaning, causes and effects.
5. They orient the visitors about what they can expect from the exhibition, how it is organized and how they can relate to the content of the exhibition.

Visitors feel the need to stay oriented, and like to know what they are going to. Good orientations about the content of the exhibition, how much time it takes to see the exhibitions, etc., please

visitors and increase their knowledge (Bitgood and Benefield 1989; Griggs 1983; Screven 1986; Shettel-Neeube and O'Reilly 1981).

Who the visitor comes together with

Who the visitor comes together with is consequential for whether they read texts. In groups where there are children, family groups, for example, texts are seldom read (McManus 1991, 1999). Not even instructions for activities are read. Generally, it is only when family members aren't able to do an activity they in the end read the instructions (Diamond 1986). Couples or individual visitors read quite a lot of text, but don't discuss them much (McManus 1991, 1999).

Does the text invite reading?

The text must be inviting in order to be read. For example, it is possible to start projects in order to get more people to read texts. The use of questions has been shown to function both as inspiration and in raising curiosity. In a test, Hirschi and Screven (1988, 1999) formulated questions, the answers of which could be found by visitors in the other texts. This helped. More began to read the texts after this. Open questions lead the visitor to use the exhibitions more creatively (Eratuuli and Sneider 1990). It has also been shown that the use of PCs in exhibitions stimulate visitors to read museum texts (Hilke, Hennings, Springule 1988; Klevans 1990). The form of the text is another device. Blais (1995) and McLean (1993) give much good advice about what is the optimal length of an exhibition text, what kind of words and formulations one should avoid, which fonts and sizes are effective and what one should remember in the placement of text posters (such as reading height and lighting).

Choice of text content

The content of the text is also important for whether people read it, and what they get out of it. Texts can engage, inspire and provoke – depending on which content one wishes to present. Museums have long been concerned that information should be neutral, as mentioned earlier. Coxall (1991, 1999) shows how texts are not neutral, but always a result of attitudes and choice of content, and that this is important for museum staff to be aware of. According to Kentley and Negus (1989, 1999), texts should be clear, concise, relevant, consistent, and enthusiastic. They encourage also to be direct in texts, tell visitors what they should look for instead of only informing them what they can see. They also have a few additional suggestions on how information should be structured.

If the texts contain difficult scientific ideas and principles, shorter texts may be detrimental for understanding (Davidson 1984). These would need longer sentences (Shuy and Larkin 1978).

Using stories can also give benefits. Cognitive studies show that people can mentally organize information effectively if it is presented for them through the help of stories (Mandler et al. 1980; Mandler and Goodman 1982; Schauble, Leinhardt and Martin 1998). It has also been found that people make stories for themselves about their own experiences, and that these stories help them to make sense of their experiences (Bruner 1996; Cortazzi 1993; Feldman et al. 1995; Roberts 1997).

Some good techniques

- Tell the many stories of the object
- Give good orientations about the content of the museum, both written and oral (using guides)
- Use questions
- Invite discussion
- Use sound equipment where the content is presented on cassette
- Use stories, anecdotes, poems, etc.
- Use PCs, multimedia
- Offer lectures
- Introduce memory games

Logical-mathematical approach

Museums can stimulate the logical and mathematical approach through experiments or interactive exhibitions. Such experiments invite visitors to foresee, or reason out, a hypothesis about what would happen if they do a specific action, and give the visitor the possibility to test out the hypothesis. Exhibitions which use information with numbers as figures, percentages etc., or which are presented through graphs, tables or diagrams are also prepared for a Logical-mathematical approach.

It has been shown that interactive exhibitions keep hold of children and young people longer than static and more traditional exhibitions (Bailey, Kelly and Hein 1996; Brooks and Vernon 1956; Melton 1936; White and Barry 1984). Not all interactive exhibitions function well. It is important that activities invite engagement, that visitors spend some time with the activity and that they need to think about what is happening and why (Duckworth et al. 1990; Sauber 1994). In addition to "hands on", one has included "minds on" as an important aspect in the development of activities (Osborne 1998).

In order to hold on to the public and get them to do activities, it has been shown in some tests that the correct use of text can increase the amount of experimenting (Borun and Miller 1980; Davidson, Heald and Hein 1991; Bitgood et al. 1987). In "bodily and kinesthetic" below, interactive exhibitions will be discussed closer.

Some good techniques

- Present the numbers of the object (as size, weight, quantity), and tie them to hypotheses
- Illustrate information through statistics, numbers, graphs and tables
- Stimulate towards problem-solving
- Utilize practical experiments
- Invite toward hypothesis-testing, analysis and interpretation of data
- Use mathematics problems and mathematical games

Spatial/visual approach

The visual is important for learning among all of us, but appeals especially to those who easily pick up information visually. An exhibition and an exhibition room are very visual. Therefore one can say that museums, with their exhibitions, really contribute to giving visitors visual experiences. But not all exhibitions are equally successful. We shall here consider how the museum should help visitors to orient themselves physically in the museum and in the individual exhibitions, how the physical context, design and structure of the exhibition are important for learning benefits among visitors.

Spatial orientation

Hiemstra (1993) discerns between field-dependent and field-independent museum visitors. The field independent don't need help in order to understand an exhibition. They build up their own structure and catch the thoughts of the exhibitor. Others, however, are more field-dependent, needing clearly defined structure and help in order to learn that which is presented.

Visitors are more satisfied when they get to know where the various facilities and exhibitions are found (Bitgood and Benefield 1989; Screven 1986; Shettel-Neeube and O'Reilly 1981), and according to Levine (1982) a strategically-placed overview map is very important for visitors. This map should contain, according to Levine, among other things, a 'you are here' mark and 'landmarks' - meaning exhibitions or parts of exhibitions which are visible from where you stand and read. The

public prefers to receive maps which they can carry around with them in the exhibitions (Bitgood and Richardson 1987), and these should be as simple as possible, with some easily recognized landmarks marked off.

Adults and children orient themselves in different ways. If children are in a bounded room which hinders them from seeing the rest of the exhibition or museum, they concentrate better on the exhibition they are in. For adults, lack of overview can be detrimental for the museum experience (Frank 1992).

First-time visitors act differently than frequent visitors (Falk and Dierking 1992). First-time visitors spend more time in orienting themselves and finding their way, while those more used to the museum know the rules for how one is to behave in the museum, and can therefore concentrate on the exhibitions. This pertains to adults, as much as for children. If one has a school group visiting, the children should be given time to acclimatize, meaning that they should become known with the physical space of the museum before the teaching program starts. Otherwise, the children have problems in concentrating (Balling and Falk 1980).

A number of studies have been made on how people move around in exhibitions. Here is a list of points:

- People go from landmark to landmark (Bitgood 1992, 1999). A landmark can be sound, moveable objects and large objects.
- When they come into an exhibition room, they start with the closest exhibition (Bitgood 1992, 1999).
- Exhibitions which are placed in the middle of the room can often become 'pockets' which no-one visits (Bitgood et al. 1991; Miles et al. 1982; Shettel 1976).
- Visitors more often choose exhibitions where there are other visitors present, as long as they aren't too many or lines (Bitgood 1992, 1999).
- People often choose the shortest way through the exhibition to the exit (Melton 1935).
- Exhibitions out in the periphery are seldom seen (Bitgood and Richardson 1987).
- People have a tendency to walk straight ahead, if possible (Bitgood 1992, 1999), and turn to the right (Melton 1935) as long as nothing else draws them in other directions.

Content in relevant context

It has been shown that the ability to transform experiences to reasonable and meaningful knowledge for the individual – actually, the ability to learn – is strongly dependent on the individual's ability to place earlier experiences inside of the context the experiences belong (Abrams and Falk 1995, 1996; Bielick and Karns 1998; Falk and Holland 1994; Falk, Luke and Abrams 1996; Holland and Falk 1994; Luke et al. 1998; Luke et al. 1999; McKelvey et al. 1999; McManus 1993; Medved 1998; Stanton 1994; Stevenson 1992).

If children and adults have been presented with a concept in a decontextualized physical milieu, they can have problems in learning the material to begin with, and not least have difficulties in transmitting the information to a new situation (Falk and Dierking 2000). It is only possible to generalize learning to new situations when the individual recognizes elements in the unknown learning context from a context when earlier learning occurred (Perkins and Salomon 1989). More and more psychologists have found examples of individuals who complete tests poorly in the laboratory, but who do very well when the same tests are completed in a meaningful physical setting or context (Ceci and Roazzi 1994; Cole 1975; DeLoache and Brown 1979; Frank 1992; Gelman 1978; Gleason 1973; Labov 1970; Scribner 1976; Shat and Gelman 1977; Wellman and Somerville 1980).

Design and structure

Physical space is determinant for how objects, ideas and visitors meet and are transformed (McLean 1993). The use of color can influence peoples feelings (Belcher 1991). Texture and patterns can also develop feelings. Very large or small objects can act to allure the public. Good design can create a framework which encourages the visitor to study an object and read the text (Falk and Dierking 2000).

It isn't always the extremely structured exhibitions which reach the highest success. A professionally-seen unstructured exhibition, which gives visitors the possibility to choose for themselves which elements they want to spent time on, gains as high learning results as the exhibition where the scientific content follows a structured series where the public has to follow the designer's setup (Falk 1993, 1999).

To place an object in an exhibition where it really doesn't belong can raise awareness among adults, while children don't even notice it (Frank 1992). The use of video can also increase the visitor's knowledge enrichment (Herman 1986; Hilke et al. 1988; Klevans 1990; Menninger 1991).

Some good techniques

- Accentuate the objects aesthetics – or lack of aesthetics – its form and color
- Use pictures, symbols, diagrams
- Make orientation in the room simple, through maps etc.
- Think through the use of design, light and color
- Use activities (including PC programs), such as puzzles, orientation in the room, tied to architecture
- Use cartoons or symbols instead of texts
- Use film and video

Bodily-kinesthetic approach

Many learn through using their hands and body. It is through the use of our senses and body that we humans collect our first experiential foundation, which much of our further knowledge builds on. Some of us develop this further, and become very capable with our hands and body. Exhibitions with activities and objects which visitors can touch and use for something ('hands on' activities) are therefore important for these visitors. We call such exhibitions interactive exhibitions, and it has been shown that these can be effective for teaching (Borun et al. 1983; Friedman, Eason and Sneider 1979).

Interactive exhibitions attract more visitors than static exhibitions, and hold on to them longer. This can therefore contribute to better learning results (Borun 1977; Brooks and Vernon 1956; Eason and Linn 1976; Koran, Koran and Longino 1986). The long-term learning effect from interactive exhibitions has been documented (Stevenson 1992). In order for interactive exhibitions to be experienced as fun and as providing learning, instructions are important. And if the instructions are going to be read, they should be clear, simple and visible (Eratuuli and Sneider 1990).

Not everyone is as active in using interactive exhibitions. Children use 'hands on' more often than adults (Diamond 1986; Koran and Koran 1984; Koran et al. 1986, Koran et al. 1988). But there are exceptions here. For example, groups of elderly play enthusiastically with interactive exhibitions, even without children (Donawa 1993, 1999), and women who visit museums alone play more often with interactive exhibitions than men who visit museums alone (McManus 1991, 1999).

Experiencing objects influences attitudes (Hedge 1995). An experiment done by Fazio, Zanna and Cooper (1978) distinguished between direct and indirect experiences. Direct experiences can be to play with a doll, while indirect can be that a child is told about a doll of another child. CD-ROM, video, books etc. provide indirect experiences, while museums can give direct experiences through

'hands on' activities. Fazio et al. (1978) found that direct experiences give affective results, influencing the conduct of visitors to a greater degree, compared with indirect experiences. The cognitive result – of remembering information – was therefore independent of whether the experiences were indirect or direct.

The use of theater (Hughes 1993) and drama (Hayes and Schindler 1994) is another way to use the body, and can make the contents more accessible for visitors. The use of instructions, such as 'Imagine that you are a geologist', which can be given to visitors before they visit an exhibition have been shown to provide a positive effect on learning (Ellis 1993; Koran and Koran 1996). The same thing applies to 'pretend that' games, which promote both cognitive and social development (Rubin 1980; Saltz and Saltz 1986).

The use of PCs and computer programs also invite the public to be active. Serrell and Raphling (1992, 1999) have discussed what the designers of a computer program should pay attention to, if they wish that the program should be utilized and reach visitors in the exhibition. Several studies (Herman 1986; Hilke et al. 1988; Klevans 1990; Menninger 1991) show that presentations through PCs increase the learning benefit among visitors.

Some good techniques

- Let the public touch, make or use the object
- Use dance, role playing, drama theater
- Involve visitors in dance, role playing and drama
- Use practical experiments with crafts, models and real objects
- Recommend or arranged excursions or tours which are relevant
- Use PCs and computer programs

Musical approaches

Sound and music is something that has, after awhile, been taken into use in exhibition. There is little information about how this affects the public, but there are a few studies. Peart (1984) showed that sound attracts an audience's attention. Ogden, Lindburg and Maple (1993) showed, in an experiment with and without sound in an exhibition, that the use of sound can give both cognitive and affective benefits. It seems that museums have not experimented much with the use of music and sound, so there is a development potential here.

Some good techniques

- Let the public experience the object's sound or resonance
- Use soundscapes (bird song, Gregorian song, sound of a machine which is running)
- Invite visitors to make sounds with musical instruments, singing and various objects
- Use relevant music
- Use musicals, optionally inviting the public to participate

Naturalistic approach

Museum collections are a result of several persons abilities to collect and sort living and non-living materials by similarity and dissimilarity, seeing the interrelationships between them. This is also something museums should encourage visitors to do, to a greater degree. Exactly with museum collections as the starting point, museums have excellent possibilities for stimulating the naturalistic intelligence.

Traditional exhibitions show lots of objects, and are really a picture of what the museum collections represent. But, as we have seen above, traditional exhibitions don't have much appeal with the public. Museums must therefore test out new ways of stimulating the naturalistic approach.

Some museums have begun to open their depots for the public. Others have developed a system where visitors can use the exhibitions and employees in order to identify objects they themselves have bought, received or found. This is a beginning, but museums still have a great potential for development here.

Some good techniques

- Let the public become known with the systemization of the object
- Invite visitors into the museum collections
- Invite the public to have their objects identified
- Offer activities around systemization, for example, courses in the registration of collections
- Offer activities around taxidermy, for example, courses in the preparation of animals
- Offer activities about the sorting of objects, identifying similarity and difference etc.

Interpersonal (= social understanding) approach

Several (see, among others, Falk and Dierking 1995; Hein 1998) have illustrated the wonderful possibility which museums have to stimulate social learning, because visitors often come together in social groups, and because there one often finds several people together in an exhibition at the same time. It isn't only for practical reasons that one encourages museums to stimulate social interplay, but also because it has been shown that social interaction allows visitors to go further than their own individual experience, developing their knowledge and their way to learn (Brown and Ferrara 1985; Matusov and Rogoff 1995). Most studies investigating social interaction have looked at family groups, but several of these finds have transfer-value to other groups.

According to Bandura and Walters (1963), most of what we learn, we have learnt non-verbally throughout childhood from parents, close relatives and friends. Because of this, they say that 'model-learning', social learning and observational learning are very important. Museums can arrange for such learning through several schemes. Through museum texts, museum staff can ask questions which get visitors to discuss among themselves. Through the use of guides and guards, the museum staff themselves can make contact with the visitors and create dialog between staff and visitors.

A few museum studies have been done on how the interaction between children and adults functions, influencing the benefit for both parts. Eratuuli and Sneider (1990) showed through their studies that if children and adults do something together, their happiness about the learning situation and their understanding of the academic content increases. Crowley and Callanan (1988) found that the most potent 'hands on' exhibitions were those that invited children and parents to cooperate. Dierking and Falk (1994) have made a summary of some of the discoveries from studies on family learning:

- Mothers are those who most seldom choose which exhibition the family should stop at. When mothers are alone together with the child, they are more active together with the son than with the daughter.
- Families go through museums in a foreseeable way, meaning that one finds a general museum conduct for families.
- The discussion and conduct of family members in front of exhibitions is a sign that they have learned something. They often tie information in the exhibitions to previous knowledge.
- Family learning is dependent on several variables, such as: previous knowledge, the type of exhibitions, sex and age, the parent- child relationship and what time during the visit the family reaches an exhibition.

- Family learning is both knowledge- and experience-dominated, where social aspects are determinant.
- There is little evidence to prove that advance instruction helps for learning among children in a family setting.

Borun et al. (1998) has identified 7 characteristic traits of family-friendly exhibitions; 1. They should be multi-faceted, so that family members can stand around at the same time. 2. They should be multi-usage, so that several can use them at the same time. 3. They should be available in a way that both children and adults can easily use them. 4. They should give multi-results, meaning that the results vary, and are complex enough to create a discussion. 5. They should be multi-modal, so that they appeal to various forms of learning and levels of knowledge. 6. They should be readable, in that the text is divided into understandable segments. 7. They should be relevant, in a way that the material creates links to visitors prior knowledge and experience.

Some good techniques

- Use the object as a starting point for a dialog or a social activity
- Use activities and tasks which must be solved together with others
- Use texts and other materials with stimulate dialog
- Use questions which visitors can ask each other

Intrapersonal (= self-understanding) approach

Not all visitors learn best through social interaction. Some prefer studying on their own, and museums can join in on giving also these visitors a relevant and ordered offering. Relevant activities can be to take up themes with appeal to independent thinking, to ask the public to figure out what they believe about something, or to present questions which don't have an answer, but which invite towards combining knowledge and attitudes before one arrives at one's own conclusion.

We have also seen through studies within natural science education, that the learning benefit is dependent on what the individual knows from before, and which interests the individual has. This is also confirmed through studies done in museums (Crane et al. 1994). Bower (1981) has also found that various exhibitions bring out different moods among individual visitors, and that this has an influence on what the visitor remembers from the museums experience. Serrell and Raphlin (1992, 1999) point out that personal engagement increases when visitors can see the consequences of their choices and actions, something which computer programs and the use of PCs in exhibitions can contribute with.

Some good techniques

- Use the object and show what connections it has to the individual visitor
- Use questions which provoke, engage and invite towards inner reflection and self-understanding
- Use activities which can be solved by oneself
- PCs and computer programs which can be used on their own

Summary

A summary is presented here of how museum pedagogues can take seriously that we human beings are different, and foster individual learning. But this summary doesn't mean that every exhibition and every educational program should contain all 8 elements which are summarized here. Each exhibition or program must be evaluated individually. Tests and checks should be made on which approaches are natural in relation to the theme, and which would reach the public. Sometimes only two might function, other times, it might be appropriate to include all eight approaches.

The most important is that the museum pedagogue imagines multiple experiences, and tries to present the theme in as many ways as possible. To imagine multiple experiences inspires creativity, one sees the theme or the subject from angles which one hadn't thought of earlier. It also invites cooperation with other professionals who are different from oneself, in order to receive help in developing activities that fit approaches different from those one self has done.

In an educational program we called Geomusa (geology in the museum), we gave the participants (who were schoolchildren) multiple experiences through activities within all eight approaches (Frøyland, 1997, 1998; Frøyland and Jorde 2001 submitted). Geomusa is a module within what we call the "Extended Classroom Model" (ECM). The ideas behind this model is that museums, in collaboration with schools, shall give pupils multiple experiences in multiple settings. We found that Geomusa gave pupils both cognitive and affective benefits. It was particularly the concepts, which were demonstrated through several activities and put into various contexts which really became understood by the pupils. When we asked the pupils about what they liked best, we received various answers. Together, pupils mentioned activities within all of the approaches we had chosen to use in Geomusa. This only confirms that pupils are different, and that our teaching should have regard for this.

In summary, there are several advantages with including multiple experiences in museum education:

- The teaching is adjusted to as many individuals as possible, and their approaches.
- The subject or theme is presented from various angles, and therefore reaches the interests of more visitors, which is Paris's (1997) first point for creating a learning milieu with inner motivation in focus.
- The teaching becomes varied, and not foreseeable. This means that visitors continually discover new things, which is also an important element for inner-motivation, according to Csikszentmihalyi and Hermansen (1995).
- Because the pedagogy varies, most will experience that they easily master some activities, while others are perhaps more challenging. In this way, one hopefully balances between not too easy and not too difficult tasks, as described under point 3 in Paris (1997).

'Multiple settings' pay attention to time and context

Learning occurs over time

Several have pointed out that learning often occurs over time (Crane et al. 1994; Falk and Dierking 2000; Roshelle 1995). Learning can be a lengthy process, which museum pedagogues, for example, must take into consideration. This means that when museum educators plan their teaching, it is important to understand that what the museum offers is just a small piece of a much larger context. Falk and Dierking (2000) point out the same thing, saying that it is important that museum staff plan their educational program, exhibitions and web pages as parts of a larger learning arena for visitors, and not as if the museum offering was in a vacuum, independent of the surrounding world.

In practice, this can mean that museum pedagogues must try to follow up on the themes which are taken up in other milieus or settings, such as libraries, archives, books, magazines, TV programs, radio programs, PC programs, internet or newspapers. In this way, the public is presented with knowledge over time, and the museum pedagogue has taken into account that learning occurs over time.

Knowledge placed in context

When knowledge is presented through various media or settings, it will also simultaneously be placed into various contexts, presented from various angles, and therefore give the public a more subtle picture of the knowledge.

'Multiple settings' contains two dimensions of learning

Learning as process and knowledge in context lies in what I have chosen to call 'multiple settings' – perspective on education.

Why is 'multiple settings' important?

The generally educated population

In order for a democratic society to function economically, administer resources responsibly and have a population which is able to live the good life, the population needs to have general education. This means that the population should have a certain level of knowledge within several subjects, be able to reflect on this knowledge and use it in their daily life – they have to have learnt and understood the knowledge.

Schooling can't handle this alone

The school plays an extremely important role in this context. It contributes to giving pupils an important foundation. Through 10 years (or more) of education, the perspective of time is also included in pupil's learning, but several studies show that the school doesn't always succeed. Many who leave school, missing basic knowledge within, for example, the natural sciences (Driver et al. 1994). The reasons can be that pupils don't receive instruction which gives multiple experiences (Gardner 1993b), and that the knowledge is often disconnected from relevant context (Aikenhead 1994; Jenkins 1994; Layton et al. 1993). The school needs to prepare its teaching through, among other things, cooperation with other learning arenas.

Besides, there are none, or few, who go to school for their entire lives. What about all of the newly acquired knowledge which is produced after one finishes school? How do we make sure that those who are finished with school can continually receive updates?

There are many milieus which can play an important role, as mentioned earlier; books, magazines, TV programs, internet and, not least, museums. We are speaking here of several learning milieus or multiple settings, which have the common goal of educating a population. In order to reach this goal, one is dependent on the population understanding and really learning what is taught.

What consequence does 'multiple settings' have on museum education?

Learning takes time

It is obvious that an individual museum visit gives visitors a limited learning benefit, even if the museum utilizes multiple experiences, unless the museum has exhibitions or similar offerings which take up themes the visitor has heard of before, so that the museum's message can be tied to something which is already known. The visitor can have read or heard about the same theme in other museums or other settings (TV, internet, newspapers etc.), and therefore have something to build the information from the museum on, and the chance that they learn increases.

This means that museum pedagogues must be oriented about what happens in society, which themes are discussed in other contexts, and try to follow up on themes which are natural for their museum to follow up on. First then is there hope that visitors learn something and the museum gives its contribution to create a society with a generally educated population.

Contemporary social themes in the museums – something new?

What is today's status in Norwegian museums, regarding the discussion of contemporary social themes? Does the public experience museums as sources of information which contribute to general education? In one study (Henriksen and Frøyland 2000), we found that none of those we interviewed considered museums as sources of information. Their associations to museums were "old fashioned, static, history etc.". It was especially this about museums being somewhat drawn back in relation to time and the surrounding society which those interviewed associated with museums. The public didn't see museums as relevant in relation to their daily lives.

Museum staff have obviously not been good enough to place museum programs into a connection with the society they belong to. Therefore, Norwegian authorities are requesting greater engagement in contemporary themes in Norwegian museums, such as ecology and multiculturalism (Kulturdepartementet 1996).

Museums in other countries have come further in this field, and have much to teach Norwegian museums. Examples are science centers, which discuss themes such as gene manipulation, AIDS, anorexia, overweight, energy conservation, just to name a few.

Knowledge placed in context

The object is the most important content of the museum. The public can here not only read about it, or look at two dimensional pictures of it, but really experience the object in three dimensions – and in the best case touch it and feel it. The museum places the object in various contexts, depending on what kind of museum it is. It can be a historical context, it can be a relevant context the object occurs in, or an experiment where the public can use the object.

Collaboration with other settings

Museum pedagogues can also enter into active collaboration with other settings, in order to present the same themes.

Collaboration between schools and museums is perhaps the best example. Finds show that the museum's educational program can make the school's education both easier and better (Allard, Boucher and Forest 1994; Anderson 1999; Gardner 1993b; Sheppard 1993). With this as a foundation, we developed the extended classroom model (ECM), as mentioned earlier (Frøyland 1997, 1998; Frøyland and Jorde 2001 submitted). Pupils received teaching in three settings; the classroom, in the museum and out in nature. We spent time in teaching, and placed the scientific content in various contexts. In addition to the cognitive benefits, we were able to see how it was to use various settings, change milieu, and keep pupil motivation up during the entire educational program.

Chen et al. (1998) did a similar experiment where school, museum and pupil's homes were used. Their idea was also to repeat the knowledge in various settings and various contexts. They call this type of learning resonance learning. Again, the results showed that this gave dividends, both cognitive and affective levels.

Regarding the benefit of collaboration between other types of learning arenas, much research remains. It is a contemporary trend for the authorities to encourage several of the informal learning arenas - such as libraries, archives and museums – to collaborate. In the UK, the consolidation of these institutions is underway, and a report to the Norwegian parliament has been written, where this aspect has been discussed (Kulturdepartementet 1999-2000). The parliamentary report focuses mainly on the simplifying of some practical work if these institutions are consolidated. The most interesting in our case is that the three milieus will be seen as one, and that the authorities are saying something about what they would like to do with these in relation to a social need. It will be

interesting to follow along in the future, in order to see what effects this can have on both peoples understanding of these milieus, and if collaboration gives the public a benefit in learning.

The large museums can give more than what they typically present

In museums which are large enough, museum pedagogues can plan museum education as something more than exhibitions, where books, videos, games etc. are offered to the public which may be taken home. They can arrange tours out in local milieus related to the exhibitions, or relevant courses for the public. In this way, the museum alone uses multiple settings in their teaching, and gives the public programs they must acquire over time, placed in various contexts.

But this is something only larger museums have the possibility to do. Museums which can't expand their programs to such a degree can concentrate themselves on what no other settings than museums can offer, and do a good job at that.

Unique sides of museums as learning arenas

Many have tried to say something about what is unique about museums as learning arenas (Crane et al 1994; Falk, Dierking and Holland 1995; Ramey-Gassert et al. 1994). Here, I wish to cite Sweeney and Lynds (2001, p. 125): *"They (informal learning environments like museums) provide the members of a community with various ways to learn about the science. Through collections, exhibitions, unique environments, and staff expertise, these institutions create powerful firsthand learning experiences that honour multiple learning styles and background.*

Opportunities for general public to learn science by inquiry are rare. Passive learning opportunities are readily available. Science-related documentaries are common on cable television, computer-based science materials are widespread on the Internet, and scientific computer packages are becoming more popular. Even when this information is of high quality, it often does not have the impact and multidimensionality of tangible objects, multisensory experiences, and reality-based learning situations offered in a museum, science centre, or other ISLCs (informal science learning centres).

To think that the museum is one of several learning arenas gives museum pedagogues the possibility to concentrate on the uniqueness of museums as learning arenas. Museum pedagogues can concentrate their contributions around what Sweeney and Lynds (2001) mention as the unique about museums, and what no other setting has. No one can do everything, and such a limitation can be of help when one needs to prioritize. In this way, the various settings can also develop themselves and specialize in different things, and we as the public or as visitors experience that we receive various programs.

An imagined example – MEMUS in practice

A family of four, consisting of Mother, Father, 12 year old Mari and 10 year old Stein are on their way to the museum of natural history. It is Sunday morning, and the parking lot shows that many have already come to the museum, but there is still plenty of space to park the car.

On the way to the museum, they have discussed the new series which started on television Saturday evening, called 'Our changing planet'. This is an American series, and the first program discussed that the earth's crust consists of several plates which move in relation to each other. Mari has noticed that on the borders between these plates, there were lots of earthquakes and volcano eruptions, and wonders if we in Norway should be worried. Neither Father nor Mother have the answer, because the program had focused on places in America, and which consequences plate movement has for America. Mother says that she will see if they can find a book in the library tomorrow which can answer Mari's question.

The family arrives at the big museum at 11:00, and the first thing that they meet is a big map, which shows them all of the sections and exhibitions which are found in the museum, and a pocket with maps they can take with them. Beside the map, there is a board with many different pockets, and in each pocket there is a bundle of paper. The sheets of paper represent suggestions for different tours visitors can take through the museum. Some tours are for first-time visitors, others for those who have been to the museum many times. Some suggestions are for those who only have a half hour of spare time, others for those who will be there for a whole day. Some are theme tours, while others are treasure hunts. While they stand and discuss what they should do, Mari cries out "Look at that tour, there!". She points to one of the suggestion sheets, which has the title "Did you see 'Our changing planet' on Saturday?". "We can take that one". Everyone agrees that this was a good suggestion. They take one of the sheets, and find the department which is recommended for visiting.

The first thing they discover, are several large puzzle pieces, picturing a map of the world. Mari and Stein run across and start putting the pieces together. Mother takes out the sheet of paper they have taken with them, and finds the puzzle recommended there. On the paper, there is also a list of questions the adults can ask the children while they put together the puzzle:

- *Put together everything: what is the picture?*
- *What do you think the puzzle is supposed to be?*
- *Where is Norway?*

Mother doesn't get any further before Mari discovers that Norway lies right in the middle of a piece of the puzzle. She continues, and finishes the puzzle called "the world today". They have understood for quite a while that the pieces should symbolize the plates which the earth's crust is built up of. Deeply relieved, Mari understands that the danger for earthquakes and volcanic eruptions is quite small in Norway. But then Father discovers that on the puzzle called "the world 300 million years ago", the border goes along the entire Norwegian coast, and inside of Oslo fjord. "What can this mean?", asks Father. "Maybe there were lots of earthquakes and volcanoes in Norway a long time ago?", answers Stein. "Does this mean that there can be earthquakes and volcanoes in Norway, after all?", asks Mari.

They begin to study all of the puzzles, and find that the plate borders have varied, and that Norway has sometimes been in the middle of a plate, and other times all the way on the edge of a plate border. "Do the plates move so fast?", asks Mother. "Maybe our maps won't be right in a few years?". They look at the paper they have taken with them, and there it is actually suggested to visit an exhibition which discusses the speed of the plates. The exhibition shows a contemporary map of the world, with plate borders drawn in and arrows which mark how fast the plates move towards each other or away from each other all around the world. It shows that these are different. Stein thinks it was especially strange that Iceland actually is growing in width 2.5 cm every year. Mother takes another look at the paper, and finds suggestions for a mathematics problem: If Norway and Greenland are moving 2.5 cm per year, how far away from each other have they moved since you were born and up until today?. They agree that it luckily moves very slowly, and Mother finds out that we don't need to worry about the maps for a long time, yet.

Stein discovers an entrance to a dark room, and Father reads the title over the door: "Will you feel how it feels to stand on the plate border while the plates move?". Father and Stein go into the dark room. It is completely dark in there, and Stein takes Father's hand. Suddenly, the floor starts to move, it is difficult to stand up straight and they hold on to each other. In the background, they hear something that rumbles and crackles, first very low, but after awhile, the sounds become louder. Stein can't stand anymore, and runs out, Father coming behind. Outside, they see Mother and Mari studying the fossils that Wegner used as proof for his theory of plate movement. Stein recognizes them again from yesterday's TV program.

Father feels that it is time for a cup of coffee, and checks the map to see where the cafe is. After the cafe visit, all four of them a tour inside of the museum store, where Mother finds the book "Norway is created", and Mari and Stein get mini-versions of the puzzles they put together in the exhibition. They go home, and agree that they would go there one more time. "Then, I'll take one of the treasure hunt tours", says Stein.

The story shows how a natural history museum can include multiple settings in their pedagogy. The museum follows up a TV program, and gives visitors experiences and knowledge which they can tie together with what they have seen in the program. In addition, visitors can buy objects and books related to the exhibition in the museum store, which they can study further when they come home. The museum staff give visitors multiple experiences through activities, such as the puzzle, questions on the suggestion sheet, the mathematics problem, the illustration of the world map, real fossils and the earthquake room with sound and movement. We have an inkling that they have used even more techniques in the various types of tours which visitors can take through the museum. The story isn't true, but meant as a simple example of how a museum can practice multiple experience in multiple settings, MEMUS.

Conclusion

The theme here has been museums as learning arenas, where learning is understood as an individual process occurring through time. I have presented a framework or a theory for museum pedagogical practice which I have called MEMUS (multiple experience in multiple settings).

I have argues for that through the use of MEMUS, museums can

- create learning milieus, where inner motivation for learning is the driving force.
- give the public, with various types of intelligence and approaches, something which fits for them, where Gardner's multiple intelligence theory is used as a foundation.
- give the public information which is relevant and interesting for them, and place information in a relevant context.
- together with other learning milieus or settings, take up the same themes. In this way, the public is presented with information from various angles and through several settings, not only during a short museum visit. Therefor, regard is taken for learning occurring over time.

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