Montessori observed that children form abstract concepts by repeatedly manipulating concrete materials. Young children are able to perform operations using concrete materials that they cannot perform until older without the aid of the materials. Montessori believed that children were led easily into abstractions through the structured use of materials. Thus, some apparatus is introduced to the pre-school child and is worked with on the sensorial level; his actual experiences with the material continue through the primary grades; he discards the materials when he no longer needs them. More complex and abstract uses of the material are presented to the child as he moves along in school; the child discovers many of the concepts in the materials without the teacher's having brought them to his attention (Rothman, 1973, p.23).[1]

Besides environmental elements having some degree of concreteness, they also have, or lack, some degree of clarity. Clarity is created by contrast, focus, order, subtlety, consistency, and immediacy of information.

Contrast is the degree to which an element stands out and is different from other elements. Teachers need to consider contrast in arranging the environment in order to facilitate differentiation.

In arranging environments placement of equipment and display of materials requires proper contrast for drawing attention.

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[1] See also--Piaget, Jean, The Construction of Reality in the Child New York: Ballantine Books, 1954, p.2.

In addition to these aspects of structure, the teacher must also consider two basic characteristics of elements which make up structure: 1) concreteness and 2) clarity which involves contrast, focus, and order which involves consistency, subtlety, immediacy, and sequence.

Elements

Instructional units can be concrete or representational. In other words, an element may be real (like a dish) or representational (like a picture of a dish). As mentioned in the review of the literature, Twelker claims that elements can be either concrete, iconic, analogical, or symbolic. Blocks would be concrete, paintings iconic, models analogical, and writing and speech symbolic. Actually, elements can be judged on a continuum from concrete to representational. Therefore, it is possible to have concrete symbolism and abstract symbolism.

As far as determining which kind of stimuli is most perferable, Montessori and Piaget recommend that children move most naturally in a sequence from concrete to abstract.

Young children won't be able to select out individual objects from a jumble of objects if they are all placed together. For example, a one and a half year old boy was playing ball with his father. The ball rolled into a pile of toys and the child couldn't find it. He stood looking right at the ball in the pile of toys while asking where the ball was.

Contrast is also important for aiding differentiation. Instead of giving a child one color to paint with a teacher should give the child at least two colors. In teaching a child a concept like "dog" a teacher can improve understanding by contrasting the features of a dog against the features of other animals like cats, cows, etc. In this way, contrast aids in clarity of definition. It helps focus attention.

Focus is the degree to which a stimulus has distinct, precise definition. Clarity of outline and careful attention to specifics help focus. For example, writing can be made more distinct and clear by outlining a general framework and then defining it with specifics.

Obviously, in outlining a general framework for a speech or a piece of writing, the outline clarifies order. Order is how the different parts, elements, or sections fit together. It's only through order that we can better understand and deal effectively with the world. Montessori pointed out how important order was for children' learning and growth.

The term "order" as used by Montessori means the order of life, the relationship of things, places, and times-- not just keeping things in their proper places. A small child must construct an ordered picture out of chaos; he has to make thousands of classifications and connections. One of the main purposes of the Montessori apparatus is to help the child to classify and to discover relationships. At home, the parents can try to give him a routine he can depend on (though naturally one can't keep a schedule 100 percent of the time). His room and toys should be arranged in a consistent fashion. Parents should tell him where they are taking him and why, instead of dragging him around without any explanations. He should be disciplined and reacted to in a consistent, dependable way. This helps him to feel secure, to organize himself, understand the world, and "construct" his personality.(Orem, 1971. p.33).

About order, Paula Lillard adds, "Only in such an environment can the child categorize his perceptions, and thus form an inner conceptual framework with which to understand and deal with his world (Lillard, 1972, p. 33)."

Order exists naturally in the universe, but sometimes it is too subtle or too complex for a child to explore without some assistance. Both the Montessori and Anisa teachers help the child considerably by carefully arranging the environment. The environment is arranged so that order is highlighted. Order that is self apparent in materials enables the child to learn about his errors through the materials;

...he is not dependent on the teacher for correction or rewards. A Montessori teacher is not to interfere with a child who makes a mistake with the materials; when the child uses and reuses the material, he will come to understand it fully and will see his own error. The didactic materials are carefully sequenced so that the child can proceed from one step to another, from the simple to the complex, from the concrete to the abstract with only a minimum of teacher intervention (Rothman, 1973,p. 11 taken from Montessori, 1965, p.44).

11. The materials are able to be used over and over again. The child gains new insights into the material as he continues to use it. Most materials are designed to be used in a variety of ways, each of which brings out a particular attribute of the material.

12. Each material has been developed to be used with children of different ages, different interests, and different ability levels. The child brings his own level of understanding to the material; the child gains from the material learnings that correspond to his developmental level (Ibid. p. 22, 23, 24).

Arranging concrete environmental stimuli in an orderly fashion becomes an effective and powerful way of structuring the environment for facilitation of learning. Consistency, subtlety, immediacy, and sequence are necessary for establishing such order.

Order is maintained through the provision of consistency. Consistency is agreement, and logical connection between things, acts, statements, decisions. If there is inconsistency the search for order must continue. Inconsistency means that predictions can't be made. Inconsistency requires a person to find some rule or principle which will at least improve predictability.

Usually, the problem of consistency presents itself in two types of situations. In one kind of situation, inconsistency is perceived because of inadequate interpretation of complex phenomena. In such cases, children may find it too difficult to discover the consistency by themselves. The teacher's task is to arrange the environment so that the number of variables are reduced, thereby making it easier for the children

Predictability is a central concept throughout all of Montessori's philosophy. The child who enters a Montessori classroom always knows where the materials are kept. He knows how to care for himself, for the materials, and for the environment: he has been taught a sequence of steps which will lead him to success every time. He knows how to use the materials in the room properly. Since materials are always returned to their proper place, the child knows where to find what he needs. Ground rules and standards for order remain constant, because the teacher, also, is consistent in her classroom tone, the child knows there will be a calm atmosphere in which he can work. The materials may change from day to day, but the general approach, the ways in which the child goes about his work remain constant (Ibid. p.17 and 18)

Guidelines for creating pedagogical materials are:

1. Any material which is in the room is there for a specific purpose.

2. The equipment is easy for the child to handle and manipulate.

3. The apparatus for a given exercise is kept together so that the child can proceed in his work in an orderly fashion...

4. The purpose of the material is readily grasped by the child.

5. Materials are constructed which isolate the difficulty or the new concept which the child is to learn. Only one new concept is presented at a time.

6. The materials are self-correcting either by the child's own sensory perceptions of the material or by the child's use of an answer key or master chart.

7. The materials are able to be used by the child after a concise, simple introduction by the teacher.

8. The materials are carefully sequenced to build upon former learnings and to lay the foundation for new knowledge. It is because the teacher is fully aware of the sequence and the breadth of parallel exercises available at every level that she is able to bring into the environment what the child needs at any specific time and is able to keep track of the child's work.

9. The materials proceed from the concrete to the abstract.

10. The materials are interdependent. Learning from one material is reinforced and expanded by using companion materials.

to find the consistency. In the second kind of situation, in-consistency is perceived because a social phenomenon truly is inconsistent. In such cases, the teacher needs to be care-ful to help social behavior become more consistent (especially the teacher's own behavior).

So, in the first kind of situation, natural phenomena may appear inconsistent because of great complexity. Even simple unknowns may appear inconsistent until the various factors are explored and understood. For example, a child may at first think two bar magnets react in an inconsistent way because they sometimes repel and sometimes attract. However, because the variables are fairly simple, the child soon learns that certain ends consistently attract and certain ends consist-ently repel. In more complex phenomena, however, a child may not be able to discover the consistency because there are too may variables. In such cases, the teacher can simplify the problem by reducing the number of variables that the child has to explore at any one time in order to find consist-ency.

Inconsistency also appears in the human environment as well as in the physical. In the human environment teachers are inconsistent in action by varying 1) rules and their application, 2) amount of attention they are willing to give, 3) punishments, 4) reactions to questions, and 5) expectations. In addition, teachers are often not aware how the consist-ency of their actions are inconsistent with their intentions.

Often they say one thing and do another, threaten but never carry out the threats, say assignments are important but never correct them, say they want students to be self govern-ing and then dictate, tell students how important creativity and freedom are and then react negatively to styles of dress, say that students should be enthusiastic about learning and then give them drill, etc.

Sometimes, teachers appear inconsistent to their students because they don't clarify the reasons and intentions underly-ing their behavior. For example, a teacher who claims that he has no favorite students may appear inconsistent to students because he always seems to select certain students for the important jobs. For instance, if the class produces the school newspaper, the teacher may have Jane type the final stencils because she is the only person who has had typing and types well. Many members of the class probably like to type and would like the job. Therefore, they may think that Jane is one of the teacher's favorite students. As far as the teacher is concerned he is picking Jane because she can do the best job. He would be willing to let anyone else do the typing if she could type fairly rapidly without too many mistakes. The teacher believes he is not showing favoritism. However, the teacher's reasons are not clear to the students and they do not feel that there is any way that they could

get a chance to type. They see it as favoritism. The teacher is causing an unnecessary problem by not discussing the typing job with the class. The class is learning only the teacher has favorites and is learning nothing about job requirements, efficiency, division of labor, by the teacher making the decisions himself. Student participation in decision making would soon clear up what appears to them to be an inconsistency. As inconsistencies disappear, learning takes place.

Teachers need to be careful to make sure that apparent inconsistencies are explored, and that actions are consistent and they are also consistent with intentions.

Sometimes individual elements, or patterns of elements are too subtle to be easily differentiated out by a child. In such cases the child may need help in focusing and contrasting the elements in order to differentiate them.

Subtlety, of course, may occur in the human, physical, and self environments. In the human environment, for example, a teacher may consistently give one child certain privileged responsibilities because the child has proven himself capable, responsible, and dependable. Meanwhile, another child who is not yet responsible and dependable because he hasn't learned (differentiated and integrated) the elements of dependability and responsibility probably will not recognize that the first child was chosen for the job because of his dependability and responsibility. He will probably think the first child was chosen because of favoritism. So, the teacher

must help the second child learn dependability and responsibility by clarifying their elements. These elements can be defined by bringing them into focus. The teacher can draw attention to them, point them out, and illustrate them. Then, he can contrast them with irresponsibility. In this way, through attention and specific difinition, a teacher can help subtle elements become more obvious.

Psychological and emotional elements from the self environment can also be extremely subtle. Students need to learn to differentiate out the subtleties so their underlying aims can be identified and directed. For example, a student may be trapped in a low expectancy cycle where he begins to feel there is no way to be successful. On the surface, he can't point to any concrete cause for depression, falling self esteem, and his declining confidence. Low expectancy on the part of others is too subtle as is his own sense of self esteem and confidence. The student may turn to escape (like drugs) without even realizing what is happening.

The physical environment can also present very subtle stimuli. For example, the problem of infection from bacteria due to unsanitary conditions is to complex a notion for children to discover by themselves. Therefore, natural order in the environment is not enough to promote learning by itself. The teacher must arrange phenomenon so elements become more obvious. For instance, in the case of bacteria, just by introducing microscopes, a teacher has improved the chances for children to discover the world of micro-organisms.

Another element that effects clarity, through its influence on subtlety, consistency, and therefore, order, is immediacy. Immediacy means a direct relationship is apparent. For example, the relationship between unsanitary conditions, bacteria, and disease may not be readily apparent to students because of the passage of time between unsanitary contact and effect of disease. In such cases, the teacher needs to clarify the link or arrange the elements so that information is more immediately available.

Immediacy of feedback becomes particularly important. This is why self correcting materials are so effective. Whenever a student must depend upon the teacher to correct responses, there is a time delay. If a student has to wait a long time before receiving information about the correctness of his response he may lose the connection between his response and the feedback and forget the nature of the original response. In addition, his learning is greatly slowed because exploration variation is brought to a stand still while unproductive time passes waiting for information.

Sequence refers to an orderly change in the environment. A teacher can help students discover the order present in the change by making the sequence become more apparent to children. The sequence can help define the change. Timing can be used effectively pacing the steps in a sequence in order to aid differentiation.

Sequence refers to an orderly change in the environment. A teacher can help students discover the order present in the change by making the sequence become more apparent to the children. The sequence can help define the change. Sequence needs to be emphasized. Timing can be used effectively in pacing the steps in a sequence in order to aid differentiation.

To summarize this last section on structure, it can be said that a teacher in arranging environments, chooses the level of complexity and the degree of variation, concreteness and clarity which is appropriate for a child's developmental level. Clarity is influenced by contrast, focus, and order. Order is an important aspect of structure by itself. The clarity of order is influenced by consistency, subtlety, immediacy and sequence.

Choice among these variables is made by considering certain basic criteria.

Criteria for Evaluating Environments

In this chapter many different elements have been listed that teachers need to consider in arranging environments. All the elements are judged against three basic criteria: 1)feasibility, 2) desirability, and 3) functionality.

Feasibility

In considering feasibility a teacher must ask if an arrangement under consideration is possible, if it is economical, if it is the most efficient use of resources, and if there is time to arrange it.

instructional objects, audio-visual aids, field trips, simulation games, reading matter, bulletin boards, and physical demonstrations. These are arrangements of supplies, materials, and equipment.

The human environment consists of humans and their patterns of interaction. The human environment can be analyzed in terms of its general climate and patterns of activity which form human instructional units. The human environment has the following static attributes: number of people, size, age, age ratio, and sex. It also consists of the following dynamic attributes: consistency, reinforcement, freedom from threat, tension, and fatigue, degree of member contribution, structure, sensitivity, objectivity, and obedience. These influence the elements of trust, security, empathy, standards, supportiveness acceptance, respect, openness, responsibility, and self discipline. These elements go into establishing a climate which will consist of some degree of solidarity, loyalty, morale, satisfaction, and atmosphere.

Instructional units involving the human environment are: lecture, discussion, modeling, demonstration, role playing, group games, brainstorming, synectics, and problem-solving sessions. These require arranging group size, goals (agendas), procedures, communication networks, feedback systems, inter-action patterns, and the managing of interpersonal skills-- both task and socio-emotional.

Both the physical and human environments need to be analyzed in terms of content, structure, and criteria for evaluation. Content requires consideration of potential

Desirability

Next, a teacher needs to consider how valuable the proposed environmental stimulus will be. Will it be suitable (match developmental level and interest)? How healthy will it be (will it promote development)? Is it politically astute (will some parents object)? Is it aesthetic? Is it moral? Is it ethical (does it conform to ground rules, school rules, professional code and judgement, and state laws)?

Functionality

Lastly, and certainly important, is the environmental stimulus useful? What is the degree to which it meets purposes. What are the deficiencies in the proposed arrangement? Does it satisfy needs in terms of content, process, necessary attributes (size appropriate for students, etc.) and structure? Can it serve several purposes? How much flexibility does it allow? Will it serve several developmental levels?

Summary

There are many things to consider in arranging environments. First of all, the two basic environments that the teacher arranges are the physical and human environments. In the physical environment the teacher arranges context and instructional units. The general attributes of both are: shape, size, weight, color, texture, and substance. Context consists of the following elements: space, surface, lighting, ventilation, accoustics, temperature, and various types of furniture. In arranging these the teacher needs to consider setting, display, storage, time, and healthiness. Physical instructional units are

purposes, consequences, and information. Structure requires
arrangement of patterns and their complexity, variation, con-
creteness, and clarity. The basic criteria for evaluation
are 1) feasibility, 2) desirability, and 3) functionality.