Use of Taxonomies to Sequence Clinical Objectives
(treatment planning, feeding, developmental delay)

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This paper describes the use of four educational taxonomies in establishing a task grid for guiding and determining sequential learning opportunities and activities for the developmentally delayed child and for treatment planning for team members working with the child. It describes a three-dimensional grid that includes learners, areas of learning, and levels of learning. To clarify the use of this model, the grid has been applied to feeding intervention with the delayed child. Use of the task grid suggests three factors are needed in intervention with the developmentally delayed child: 1. objectives should be stated for all domains of learning since learning occurs concurrently in different areas; 2. activities should be sequenced not only for the child but also for all those directly involved with the child, since all are involved in the learning process; and 3. analytical behavior should be stimulated in the therapist so that theory-based practice can be realized.

Francis Bacon said that "if a man begins with certainties, he will end in doubts, but if he is content to

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begin with doubts, he will end in certainties." (1) The purpose of this paper is to move toward certainties in establishing the progression of treatment by occupational therapists by suggesting use of a taxonomic approach with developmentally delayed children, their families, their teachers, and therapists.

Public Law 94-142 mandates the writing of educational objectives for the developmentally delayed child (2). The therapist must learn to choose the tasks most relevant to the child and develop those tasks sequentially within the confines of the clinic, home, and school. One way to choose or develop them is to base activities on formal classification schemes that provide a hierarchy of sequential objectives as guidelines for learning. This paper describes the early history of such classification schemes, or taxonomies, to delineate their classical characteristics. It applies four educational taxonomies to the establishment of a "task grid" for clinical use, describes the grid as applied to feeding intervention with the developmentally delayed child, and discusses the advantages and disadvantages of the grid. Finally, the need is suggested for a theoretical framework to guide use of the task grid.

This paper does not attempt to show that taxonomies lead to more effective learning, or that learning necessarily occurs because a taxonomy is used. Rather, the paper proposes a taxonomic approach to intervention as a systematic, cooperative, hierarchical, analytical method of planning worthy of further exploration and one surpassing intuitive or monothematic approaches. In the paper the structure and process of planning as exemplified by the taxonomic approach is discussed.

**Taxonomies**

A taxonomy refers to a hierarchical system of classification (3). The word originates from the Greek words *taxis*, meaning arrangement, and *nomos*, meaning law. Thus taxonomy refers to an arrangement of information according to law. A taxonomy is an arrangement in which the parts have a logical structure. It is a classification system, not an inventory or mere listing of information.

**Historical Development.** The earliest attempts to classify information systematically were made by Aristotle in his work as a biologist rather than as a philosopher (4), when he placed Athenian animals in specific genera. He provided for future generations two basic principles of classification. First, a genus has specific characteristics exclusive of other genera. Having a unique set of attributes for each genus defines monothetic classification (5). Second, a classification schema is hierarchical in nature with one stage preliminary to and preparatory for another stage.

Linnaeus, 2,000 years later, built upon Aristotle's principles of classification (6, cited in Dobzhansky TG, 1977) by developing a numerical system and by suggesting use of descriptive ranks of information, such as class, order, genus, species, and variety. However, both Linnaeus and Aristotle erred in maintaining that careful observation reveals the inherent order of nature. It is reported (6) that Lamarck recognized scientific theory rather than skilled observation as the basis of classification. He described the classification of invertebrates according to the theory of evolution and thus established logical theoretical structure as a basic element of classification. This structure makes classifications "constructions of the intellect" (3, p.14), not natural categories to be discovered by observation, as Aristotle suggested.

**Educational Taxonomies.** A theoretical structure differentiates classifications from inventories. According to Travers (3), this structure lacks present day taxonomies for educational objectives. Bloom, on the other hand, states that these taxonomies are consistent with, if not based on, present theories of education (7). By delineating two components of taxonomies as theory and practice, Sokol provides a partial explanation for this discrepancy; according to him, taxonomy refers to both the "theoretical study of classification" and the "arrangement of objects into groups or sets on the basis of their relationships... (whether) observable or inferred." (5, p 1116) While the theoretical bases of occupational therapy (8) and educational taxonomies (9) are being delineated, the instruction of learning behaviors proceeds. Assistance is needed in sequencing these behaviors since learning is developmental in nature. Melton (10) and Duchastel and Merrill (11) suggest collection of empirical data from use of the taxonomies within clearly differentiated settings (e.g., a school for children with developmental delays). Since this coincides with the mandate of PL 94-142, there is good reason to use taxonomies to establish educational objectives, to report on the success of the taxonomies as tools of practice, to establish a theoretical framework for intervention, and to use this framework to guide future intervention.

**The Task Grid**

**Dimensions.** The task grid in Figure 1 is a three-dimensional matrix in which there is breadth, width, and
depth. The breadth of the grid describes the learners, all members of the intervention team. This includes the child, parent, therapist(s), teachers, and school administrator. The term parent refers to whoever is the primary caregiver and therefore may be a foster parent, a natural mother or father, or a grandparent. The therapist designation refers to any therapist, special education teacher, or other disciplinary representative who provides direct intervention with the child or parent. The administrator of the child's school is included to underscore the importance of leadership in providing comprehensive learning opportunities for the developmentally delayed child.

The width includes the three domains of learning: cognitive, affective, and psychomotor. The cognitive area describes intellectual performance and problem solving as organized by the taxonomy of Bloom et al (7). The affective area specifies attitudinal and emotional performance as organized by the taxonomy of Krathwohl et al (12). The psychomotor area describes movement characteristics as organized by Harrow for the child (13) and by Simpson for the older learner (14). Harrow included reflex movement as level one in the taxonomy since it is a prerequisite to all future voluntary movement. For this reason, this taxonomy is applicable to intervention with the child with developmental delays (see Figure 1).

The depth of the grid incorporates the three-to-six levels of objectives enumerated in these taxonomies. All levels have been included since they are hierarchically organized, and mastery of one level is usually preliminary to mastery of the next highest level. Some stages, however, will not be applicable to all learners. Also, these levels are polythetic since they refer to classes of information that "share a large proportion of their properties but do not necessarily agree in any one property." (5, p 1117) Information in these categories may not be explicit but may be more similar than information in other categories. For example, for team members participating in the eating process of the developmentally delayed child, the knowledge level of the cognitive domain is polythetic for it is different but similar for different team members. "Knowledge of specific muscles of mastication" needed by the therapist is different from, but similar to, "knowledge of movement patterns" needed by the participating patient.

Interrelationships. An interrelationship exists between the polythetic levels, among the three different areas of learning and among the learners. For example, the therapist's lack of knowledge and resulting insecurity in oral-motor treatment may be one cause of the parents' defensive attitude toward feeding intervention. On the other hand, the therapist's ability to analyze feeding problems and to intervene effectively may support the parents' interest in feeding intervention (see Figure 1).

Application. The task grid has been applied to feeding intervention with the developmentally delayed child. The term feeding intervention refers to any therapeutic involvement with the child and family directed at correcting or enhancing any aspect of eating. The levels of the grid will be described with examples of objectives for the different team learners. These examples are intended to be illustrative, not exhaustive. They are derived from feeding experiences in a school for children with developmental delays and from recent re-evaluation of four of these children in accordance with the taxonomies.

The Cognitive Domain. Cognitive domain objectives refer to intellectual learning and problem solving. The cognitive levels of learning are knowledge, comprehension, application, analysis, synthesis, and evaluation (7). For the therapist involved with feeding intervention, knowledge may include knowledge of the basic anatomy involved in mastication, of the sequential nature of development, and of theories basic to prehension. It could describe the therapist's understanding of the significance of feeding intervention and the therapist's subsequent ability to convey this significance to the parents.

The third level refers to application. In feeding intervention, the therapist applies the knowledge and comprehension of feeding philosophy and treatment to establish Individualized Educational Programs (IEPs) for each child. In the fourth level, analysis, the therapist analyzes all factors relative to feeding. The therapist relates factors regarding family, child, and environment to obtain a composite view of the feeding situation. In synthesis, the fifth level of the cognitive domain, the therapist coordinates IEP objectives into a framework that guides intervention. At level six evaluation, therapists review their own performance. The resulting requests for either peer review or continuing education opportunities would be actions taken within the organization of the psychomotor domain.

The Affective Domain. The affective area of learning involves the emotions and the value system of a person. The affective levels are learning by receiving, responding, valuing, organizing, and characterizing by a value (12). According to Krathwohl, characterizing by a
value is not the goal of formal intervention in our society (12, p 165) and therefore will not be covered within the task grid. Objectives of lower levels will be used to describe the applicability for a parent of a developmentally delayed child.

At the first level, receiving, the parent attends to the inadequacy of the child’s eating patterns and becomes willing to receive information about feeding intervention. On the second level, responding, the parent acquiesces and meets initial program obligations. It is at this level that program contracting can be introduced. In this situation, both the therapist and parent indicate their responsibilities and designate how they will fulfill them (15).

The third level, valuing, is a description of the worth of feeding intervention for the parent and may be assessed by the consistency of parental use of feeding techniques, the kind of questions asked of the therapist, and the attempt of parents to transfer their knowledge of feeding to others. Coordination of separate values regarding feeding characterizes level four. The intervention plan that incorporates these values is enacted by the psychomotor domain.

**The Psychomotor Domain.** The term psychomotor domain of learning refers to movement characteristics and capabilities. This domain will be illustrated for the child and will be organized according to Harrow’s taxonomy (15), since its first level specifies reflex activity. Here, the child’s primitive reflex patterns and evolving righting and equilibrium reactions should be assessed and objectives established for reflex inhibition and facilitation.

The following four levels involve voluntary activity. The lowest voluntary level, 1, basic fundamental, describes basic patterned move-
Figure 2
Intended Behavior for Therapist: Oral-Motor Intervention According to GNOME chart

<table>
<thead>
<tr>
<th>Domain</th>
<th>Goal</th>
<th>Need</th>
<th>Objectives</th>
<th>Method</th>
<th>Evaluation</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive</td>
<td>To increase knowledge of institutions for residential care</td>
<td>Parental interest in future child placement.</td>
<td>To learn of 5 institutions providing residential care</td>
<td>Contact referring agencies &amp; institutions.</td>
<td>Obtain literature on 5 institutions &amp; share with parents.</td>
<td>One month</td>
</tr>
<tr>
<td>(Bloom, level 1.1)</td>
<td></td>
<td>Rotary chew</td>
<td>To review literature on chewing.</td>
<td>Read 4 articles on chewing techniques</td>
<td>Use at least 1 new technique in Rx.</td>
<td>One week</td>
</tr>
<tr>
<td>Affective</td>
<td>To increase knowledge of rotary chew techniques.</td>
<td>Awareness of family factors influencing development—need for reciprocity in relationship</td>
<td>To attend to parental knowledge discrepancies, and—make opportunities for successful parent/child interaction.</td>
<td>Make time for both parents in training.</td>
<td>Initiate &amp; end Rx with lower-level task for parent/child.</td>
<td>Two weeks</td>
</tr>
<tr>
<td>(Krathwohl, level 1.3)</td>
<td></td>
<td>Comprehend factors of home environment.</td>
<td>To learn of home eating environment.</td>
<td>See how &amp; with whom child eats at home.</td>
<td>Make home visit in evening to include working parent.</td>
<td>Two weeks</td>
</tr>
<tr>
<td>Psycho-motor</td>
<td>To make home visit.</td>
<td>Parental comprehension for compliance.</td>
<td>To teach caregivers 2 methods of intervention.</td>
<td>Demonstrate methods to obtain rotary chew.</td>
<td>Suggest 1 change in home eating environment, e.g., feed away from slamming door.</td>
<td>One week</td>
</tr>
<tr>
<td>(Simpson, level 3.4)</td>
<td></td>
<td>Nutritional dental &amp; developmental.</td>
<td>To feed child to obtain lateral tongue movement.</td>
<td>Position, stimulate tongue with honey stick.</td>
<td>Parents feed child pretzel alternating lateral placement.</td>
<td>Two weeks</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Position, stimulate tongue with honey stick.</td>
<td>Feed child at lunch 1 week adding pretzel, meat stick, cracker.</td>
<td>One week</td>
</tr>
</tbody>
</table>
ments in which a developmentally delayed child might move from head control to segmental rolling to finger feeding. The next category, 2, perceptive ability, defines perception as the integration of sensory stimuli necessary for adaptation. Within the next level, 3, the physical abilities described include endurance, strength, flexibility, and agility. The child might perform breathing exercises regularly to increase vital capacity, decrease residual volume, and improve endurance. The highest level, 4, of skilled movements includes integrated eating in which the child exhibits complex adaptive skills by eating with the family in a restaurant, using utensils, manners and communication skills.

For the adult, the taxonomy of Simpson (14) is used because it is a higher level system that does not include reflex and basic motoric levels. The administrator's psychomotor roles will be used as an example of this taxonomy. On the first level, perception, the administrator recognizes feeding intervention as an integral part of any developmental program. The administrator's set, level two, then facilitates obtaining available information on grants and other support measures to ensure continuing programming in this area. On the next level, guided response, the administrator might share this new information and general oral-motor needs with the advisory board of the school. Subsequently, on level four, mechanism, the administrator might write an application for financial support from public and private sources. To function on level five, complex overt response, the administrator develops skill in speaking before community groups about the feeding needs of the children enrolled in the school. This knowledge is then transferred to other treatment areas in level six, adaptation. Finally, under origination, the administrator coordinates the total intervention efforts of the institution.

**The Clinical Realities.** Performances within the domains may be considered by the intervention team as mandatory, essential, or desirable. The mandatory levels describe performances basic to any intervention and without which initial appropriate intervention will not occur. Essential performances are those critical for all, but of a second order of importance for some team members. Desirable behaviors are those exhibiting the highest level of functioning by any team member.

It is realistic to assume that each learner will be performing at the mandatory level in some areas, but may not be performing at higher levels in another area. For example, in feeding, a parent may need to have cognitive objectives established on level 1.1, knowledge of feeding principles, and have affective objectives at 3.1, valuing the feeding intervention. At the same time, the parents may be working with the therapist on using oral-motor techniques with their child, a psychomotor level 4.1 behavior. The lower levels of performance are mandatory if the parent is to perform later on higher essential levels. For those parents able and interested in pursuing learning beyond this level, desirable levels of performance could be established as long-term objectives.

For the therapist, performance in most areas should be at the highest levels noted within the task grid. Realistically, however, new techniques of intervention will be introduced. In these cases, the therapist's initial performance will be on the lowest level. This fact, visualized by the task grid, can be used to obtain administrative support for continuing education opportunities for the new technique.

For the child, performance will be prioritized. For example, before receiving psychomotor tongue lateralization exercises, a child who is exaggerating a tongue thrust for behavioral reasons will receive intervention from the affective domain. It would be mandatory for the child to have objectives written for the affective level 1.2, receiving, in preparation for the mandatory 1.1 and 1.2 psychomotor levels of performance. However, when the child is playing with peers, he or she may be performing cognitively at level 3.1, an essential level, having already accomplished the mandatory objectives within this domain.

Levels for the administrator may be conceived more loosely but are believed to be necessary for a team working within a preschool setting. Familiarity with the specific contributions of professionals working with these children (cognitive level 1.1) will be mandatory for the administrator responsible for staff recruitment. Concurrent with familiarity will be a comprehension of the kinds of disabilities for which these professionals provide intervention (level 2). Realistically, the administrator must apply this knowledge and comprehension to be effective and, therefore, application becomes essential to the administrator. Ideally, the administrator would visit the lunchroom to observe feeding complexities, although this is unrealistic in some settings.

The purpose of describing the differentiation of behaviors into mandatory, essential, and desirable, is to further clarify the hierarchical nature of all learning, and to note the realistic aspects of intervention.
The therapist is not able to provide oral-motor intervention without preliminary training. The parents cannot value and provide consistent feeding intervention if they do not comprehend the purposes. The child cannot inhibit tongue thrust if his or her position stimulates the same reflex. The administrator will not obtain financial support for intervention if he or she does not understand or value the intervention. However, because of educational and empirical factors, learning capabilities vary among the learners and funding capabilities vary for the administrators. It is the intent of this system to encourage higher levels of performance, not to penalize lower levels of performance.

Evaluation

Advantages. The task grid offers four practical uses in the clinic or preschool setting: 1. It provides a common communication system. 2. It assists in formulating priority goals. 3. It helps coordinate priority goals from different disciplines into a composite program. 4. It assists in evaluation of progress.

To provide a common communication system, the classic organization of learning levels of these taxonomies has been maintained. Recently, numerous matrices have been devised for use in specific learning situations. Greenstein's psychomotor matrix (16), May and Newman's clinical problem-solving matrix (17), and Marion and Angermeyer's collaborator matrix (18) are derived from the taxonomies and applied to specific situations. Bloom himself suggests the value of this. However, if teachers and therapists, parents, and administrators are coming together from different backgrounds, use of one basic system might ease the communication gap. If a goal for the developmentally delayed child is assimilation into the community (19), it is important to employ a coordinating system of intervention that originates in that community and has language common to all members. The strength of a matrix developed by all team members is the likelihood of total support and of a focus for the established goal. Team members unaccustomed to the matrix as a planning structure may need guidance in its use and understanding of its value in establishing program priorities.

Second, the task grid assists in establishing a coordinated, prioritized set of goals. For example, the therapist may determine, correctly, that head control is of primary importance. If the parents do not understand this, then the priority goal changes to improving the knowledge level of the parent.

Third, the task grid enables priority goals to be coordinated. For example, if the parent is interested in the child's achieving self-feeding, and there is no appropriate equipment, the coordinated priority goal for the team will be to obtain equipment and, meanwhile, to train all team members in accomplishing this goal. The administrator may attempt to order equipment, or the therapist may have to design individualized equipment. Meanwhile, the teacher may provide opportunities for cognitive comprehension of self-feeding for the child, and the communication therapist may teach words or signs appropriate to self-feeding.

Fourth, the use of the task grid provides an opportunity for evaluating the child's progress. It also offers a composite view of areas of difficulty and lack of improvement, thereby showing that not all goals will be achieved simultaneously. It therefore indicates on what levels further intervention should occur, in what domains, and by which team members.

Besides these four practical clinical advantages, two more global advantages are proposed. Use of the taxonomic approach in clinical intervention stimulates analytical thinking on the part of the therapist and therefore stimulates development of theory-based practice. When team members adopt an analytical stance, then realistic, comprehensive, and consistent intervention is possible. A taxonomy requires a hierarchical structure for treatment with intervention strategies planned, implemented, and sequenced by all members of the team. For example, if parents have seven children besides their developmentally delayed child, the therapist would not suggest an oral-motor regimen that isolates the child and one parent from the eating experience and environment of the other eight family members. The therapist would assess the total picture and analyze priority goals and effective ways to achieve these goals in the context of other family considerations. This approach, therefore, places more responsibility on the therapist who must be able to analyze the team members' capability of participation and attitude toward participation as well as to analyze his or her own level of development, expertise, and need for assistance.

The taxonomic approach suggests the need for theory-based clinical practice. A theory is a set of principles that "... organize what is known about the subject of the theory." (20, p 19) To use the principles already established in the field of developmental delay and to stimulate research in new areas, theory-based practice is necessary. The taxonomic approach enables...
and even demands that a theoretical frame of reference be established for the team. For example, a general systems approach to intervention with the developmentally delayed child provides such a frame of reference and should be explored.

Disadvantages. Popham (21, cited by Kibler RJ et al., 1970) and Travers (3) opposed the use of taxonomies of educational objectives. Their reasons include: Creativity may be hampered due to the pre-specification of explicit learning; goals are often difficult to evaluate and therefore trivial learner behaviors may receive greater emphasis to ensure treatment progress; the process may emphasize measurable results rather than true competencies; the process is time consuming. This last factor may be the initial negative feature of using the task grid. However, after initial training in using levels of learning objectives, the task grid may be used as a guide in formulating treatment goals for all team members. As a guide, it could decrease the amount of time spent on administrative work and increase the time spent in the clinic.

Application of Task Grid. Figure 2 shows a task grid using the taxonomic approach. The grid, applied to feeding intervention with the developmentally delayed child, enumerates intended learning behaviors for the occupational therapist in the intervention process. The grid uses the GNOME system (22) to conceptualize specific behaviors for all learners. GNOME stands for goals, need, objectives, methods to achieve goals, and evaluation. Formulating objectives in this manner satisfies the mandate of Public Law 94-142 and emphasizes the learning needs and capabilities of all those directly involved with the child. For example, in the psychomotor domain, the therapist makes a home visit, the child improves head control, the administrator visits the luncheon room for observation of feeding, and the parent carries and positions the child without causing the parent back discomfort. Though other behaviors may be learned, it is these enumerated behaviors that will be the measures of success of intervention.

Conclusion

A task grid, based on the educational taxonomies of Bloom, Krathwohl, Harrow, and Simpson, provides an organized method of moving from doubts of treatment intervention and progression to certainties by providing a structured, sequential guide. Certainties provide structure for further learning, for inter- and trans-disciplinary intervention, for clinical investigation, and for theory building. A taxonomic approach is feasible and efficient in planning a systematic intervention program for individuals with developmental delay and for their therapists, parents, and school personnel.

REFERENCES

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