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Notas Extraídas de los Libros de las Taxonomías Original y Revisada de Bloom

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Resumen. En una revisión sistemática anterior se realizó un estudio sobre las principales dificultades para el uso de la taxonomía de Bloom en la educación en informática Posteriormente hemos realizado una lectura en profundidad de los libros de las versiones original y revisada de la taxonomía. En este informe, se presenta un conjunto de notas y citas extraídas de los libros. Más allá de las discrepancias encontradas entre las dificultades citadas y los comentarios de los autores de las taxonomías, se hace patente la falta de lectura de las fuentes originales por la inmensa mayoría de los profesores universitarios de informática.

Palabras clave: Taxonomía original de Bloom, taxonomía revisada de Bloom.

1 Introducción

En un trabajo anterior [1] hemos revisado sistemáticamente el uso de la taxonomía de Bloom en la educación en Informática, tanto su formulación original [2] como su versión revisada [3]. Como consecuencia, se documentaron diversas dificultades en su uso por numerosos autores, así como algunas posibles causas conjeturadas por ellos mismos. Es conveniente continuar estudiando el uso de la taxonomía de Bloom desde diversas ópticas.

En este informe presentamos el resultado de revisar los dos libros originales en los que se presentaron las dos versiones de la taxonomía. Recopilamos numerosos comentarios de sus autores que pueden aclarar diversos aspectos del uso de la taxonomía, normalmente presentados como citas literales. Las notas extraídas de la taxonomía original se incluyen en el apartado 2, mientras que las de la taxonomía revisada se presentan en el apartado 3.

2 Notas de la Taxonomía Original

Las citas incluidas de la versión original de la taxonomía no son demasiadas, centrándose en el propósito de la taxonomía y varias cuestiones sobre los procesos cognitivos.

2.1 Qué se Clasifica

Es importante saber que se clasifican los logros esperados de los alumnos. En palabras del libro (pág. 12):

> "Therefore, this taxonomy is designed to be a classification of the student behaviors which represent the intended outcomes of the educational process. It is assumed that essentially the same classes of behavior may be observed in the usual range of subject-matter content, at different levels of education (elementary, high-school, college), and in different schools."
>
> "What we are classifying is the *intended behavior* of students –the ways in which individuals are to act, think, or feel as the result of participating in some unit of instruction."

Obviamente, es probable que algunos alumnos no alcancen dichos objetivos (pág. 12):

> "It is recognized that the *actual behaviors* of students after they have completed the unit of instruction may differ in degree as well as in kind from the *intended behavior* specified in the objectives. That is, the effects of instruction may be such that the students do not learn a given skill to the desired level of perfection; or, for that matter, they may not develop the intended skill to any degree. This is a matter of grading or evaluating the goodness of performance."

2.2 Dificultades de Clasificación

Clasificar ejercicios es una tarea difícil, como reconocen los propios autores (pág. 51):

> "The task of classifying test exercises is somewhat more complicated than that of classifying educational objectives. Before the reader can classify a particular test exercise he must know, or at least make some assumptions about, the learning situations which have preceded the test. He must also actually attempt to solve the test problem and note the mental processes he utilizes. The reader should also take into consideration the possibility that the processes used in selecting the correct answer in a recognition form of question may be somewhat different from those used in considering the incorrect alternatives in the same question."

2.3 Diferencias entre Procesos Cognitivos Relacionados

Veamos algunas matizaciones que hacen los autores para diferenciar categorías:

- *Comprehension, Interpretation* vs. *Analysis* or *Application* or *Evaluation* (pág. 90): "Interpretation as here defined differs from analysis. In the latter the emphasis is on the form, the organization, the effectiveness, and the logic of

the communication. It differs from application is that application is more definitively concerned with the meanings a communication has for other generalizations, situations, and phenomena, or the meanings that generalizations known by the student have for the communication. It differs from evaluation in that evaluation is characterized by the formulating of judgements explicitly based on criteria."

- *Comprehension, Extrapolation* vs. *Application* (pág. 90): "It differs from application, however, in that the thinking is based on what is given rather than on some abstraction brought from the other experiences to the situation, such as a general principle or rule of procedure."

2.4 Usos Conjuntos de Procesos Cognitivos Concretos

En unos pocos pasajes se citan varios procesos cognitivos conjuntos:

> "We would assume that writing as such is primarily a skill in expression, much of which represents the remembering of ideas, the interpretation of given materials, and the translation of ideas into writing." (pág. 163).
>
> "In a work of some complexity it is also necessary that the individual be able to comprehend and analyze the work before evaluating it." (pág. 194).
>
> "It is frequently necessary to break down the problem into a series of rather specific judgements as well as analyses in order to be sure that the entire process of evaluation is a competent one or in order to find the types of errors and difficulties encountered." (págs. 194-195).

3 Notas de la Taxonomía Revisada

Las citas seleccionadas de la taxonomía revisada son numerosas, cubriendo más aspectos que la taxonomía original.

3.1 Objetivos

El libro no contiene una definición única de objetivos, pero podemos tomar esta: "Objetives describe ends –intended results, intended outcomes, intended changes." (pág. 17).

3.2 Terminología

La terminología usada puede inducir a confusión en algunos casos. Los propios autores son conscientes de este riesgo cuando afirman: "A teacher may use the word «explain» when she does not mean «to construct a causal model» (our definition). Rather, she might mean interpret or summarize." (pág. 96).

Otra cuestión terminológica es la estructura gramatical de los objetivos:

> "For objectives that involve *Remember*, *Understand*, and *Apply*, there generally is a direct correspondence between process category and type of knowledge. We do intend, for example, students to recall facts (*remember factual knowledge*), interpret principles (*understand conceptual knowledge*), and execute algorithms (*apply procedural knowledge*).
>
> When *Analyze*, *Evaluate*, and *Create* are involved, however, the correspondence between process category and type of knowledge is less predictable. Consider, for example, *evaluate conceptual knowledge*. We typically do not intend students to learn to *critique* (*Evaluate*) a set of criteria (*Conceptual knowledge*). Rather, we intend them to learn to *critique* **something** based on or in terms of the criteria. (…) Thus, *evaluate conceptual knowledge* becomes in essence *evaluate* [based on] *conceptual knowledge* or *evaluate* [in terms of] *conceptual knowledge*." (pág. 107).
>
> "The point here is simple but important. When objectives involve the three most complex cognitive processes, knowledge provides the basis for the cognitive processes and often multiple types of knowledge is required." (pág. 108).

3.3 Jerarquía de Complejidad de los Procesos Cognitivos

Los autores dejan claro que, aunque la taxonomía original definía una jerarquía acumulativa de la complejidad de los procesos cognitivos, la taxonomía revisada ya no lo hace:

> "An important characteristic of the revised Taxonomy, however, is that in order to conform to the language that teachers use, the six categories are allowed to overlap on a scale of judged complexity. Therefore, the revision places much greater importance on teacher usage than on developing a strict hierarchy." (pág. 267).
>
> "If we were to prevent categories from overlapping, we would have had to place *explaining* in *Apply*, *Analyze*, *Evaluate*, or *Create*. But explaining isn't a kind of applying, or analyzing, evaluating, or creating. It exemplifies a kind of understanding, and so that is where we categorized it, even though it is certainly a more complex process than most simple instances of application." (pág. 267).

3.4 Remember

La taxonomía indica que el nivel de Remember corresponde a aprendizaje memorístico o retención, mientras que los demás niveles corresponden a aprendizaje significativo o transferencia (págs. 64-66). La forma de distinguir Remember del resto de niveles es relativamente sencilla: "Although we will not repeat this point from here on, it applies to each of the process categories and cognitive processes beyond

Remember. **If assessment tasks are to tap higher-order cognitive processes. They must require that students cannot answer them correctly by relying on memory alone.**"

3.5 Objetivos Relacionados con Informática y su Evaluación

Recopilamos los objetivos de informática y su evaluación que la taxonomía revisada de Bloom presenta. Por desgracia, el número de objetivos, actividades o evaluaciones relacionadas con el aprendizaje de la Informática son escasas. Solamente encontramos tres referencias a la Informática (no todas sobre el aprendizaje de la propia informática):

- *Understand* (pág. 70): "Students are said to *Understand* when they are able to construct meaning from instructional messages, (…) however they are presented to students: (…), or on computer monitors. Examples of potential instructional messages include (…) a computer simulation of a trip through an art museum, (…)".
- *Understand, Summarizing* (pág. 73): "In computer science, an objective could be to learn to summarize the purposes of various subroutines in a program. An assessment item presents a program and asks a student to write a sentence describing the subgoal that each section of the program accomplishes within the overall program."
- *Apply, Executing* (pág. 77). Clasifica el acto de ejecutar un algoritmo (aunque no necesariamente en el sentido informático): "*Executing* is more frequently associated with the use of skills and algorithms than with techniques or methods (see our discussion of *Procedural knowledge* on pages 52-53). Skills and algorithms have to qualities that make them particularly amenable to *executing*. First, they consist of a sequence of steps that are generally followed *in a fixed order*. Second, when the steps are performed correctly, the end result is a predetermined answer."
- *Create, Generating* (pág. 87): "In a uses task, a student must list all possible uses of an object, such as «What are the possible uses of the World Wide Web?»"

Dada esta escasez de ejemplos de informática, recogemos objetivos y evaluaciones presentados para materias afines a la informática, normalmente matemáticas y ciencias:

- *Remember, Recognizing* (pág. 69): "In mathematics, an objective could be to recognize the numbers of sides in basic geometric shapes. A corresponding assessment is a multiple-choice test with items such as the following: «How many sides does a pentagon have: (a) four, (b) five, (c) six, (d) seven.»"
- *Remember, Recalling* (pág. 70): "In mathematics, an objective could be to recall the whole-number multiplication facts. A corresponding test item asks students to multiply 7 × 8 (or «7 × 8 = ?»)."
- *Understand, Interpreting* (pág. 71): "In mathematics, a sample objective could be to learn to translate number sentences expressed in words into algebraic

equations expressed in symbols. A corresponding assessment item asks a student to write an equation (using B for the number of boys and G for the number of girls) that corresponds to the statement «There are twice as many boys as girls in this class.»"

- *Understand, Exemplifying* (pág. 72): "In science, a sample objective could be to be able to give examples of several kinds of chemical compounds. A corresponding assessment task asks the student to locate an inorganic compound on a field trip and tell why it is inorganic (e.g., specify the defining features)."
- *Understand, Classifying* (págs. 72-73): "In the natural sciences, an objective could be to learn to categorize the species of various prehistoric animals. An assessment gives the student some pictures of prehistoric animals with instructions to group them with others of the same species. In mathematics, an objective could be to be able to determine the categories to which numbers belong. An assessment task gives an example and asks a student to circle all the numbers in a list from the same category."
- *Understand, Summarizing* (pág. 73): "In computer science, an objective could be to learn to summarize the purposes of various subroutines in a program. An assessment item presents a program and asks a student to write a sentence describing the subgoal that each section of the program accomplishes within the overall program."
- *Understand, Inferring* (pág. 74): "In mathematics, an objective could be to learn to infer the relationship expressed as an equation that represents several observations of values for two variables. An assessment item asks a student to describe the relationship as an equation involving x and y for situations in which if x is 1, then y is 0; if x is 2, then y is 3; and if x is 3, then y is 8."
- *Understand, Comparing* (pág. 75): "In the natural sciences, a sample objective could be to learn to compare an electrical circuit to a more familiar system. In assessment, we ask «How is an electrical circuit like water flowing through a pipe?» (…) In mathematics, a sample objective could be to learn to compare structurally similar word problems. A corresponding assessment question asks a student to tell how a certain mixture problem is like a certain word problem."
- *Understand, Explaining* (pág. 76): "In the natural sciences, an objective could be to explain how basic physics laws work. Corresponding assessments ask students who have studied Ohm's law to explain what happens to the rate of the current when a second battery is added to the circuit, or ask students who have viewed a video on lightning storms to explain how differences in temperature affect the formation of lightning."
- *Apply, Executing* (págs. 77-78): "For example, a sample objective in elementary level mathematics could be for students to learn to divide one whole number by another, both with multiple digits. The instructions to «divide» signify the division algorithm, which is the necessary *Procedural knowledge*. To assess the objective, a student is given a worksheet that has 15 whole-number division exercises (e.g. 874/15) and is asked to find the quotients. In the natural sciences, a sample objective could be to learn to compute the value of variables using scientific formulas. To assess the objective, a student is given the formula Density = Mass/Volume and must

answer the question «What is the density of a material with mass of 18 pounds and a volume of 9 cubic inches?»"

- *Apply, Implementing* (pág. 79): "In mathematics, a sample objective could be to learn to solve a variety of personal finance problems. A corresponding assessment is to present students with a problem in which they must choose the most economical financing package for a new car. (…) Notice that in both assessment tasks, the student must not only apply a procedure (e.g. engage in *implementing*) but also rely on conceptual understanding of the problem, the procedure, or both."
- *Analyze, Differentiating* (pág. 81): "Similarly, in the natural sciences, an objective could be to select the main steps in a written description of how something works. A corresponding assessment item asks a student to read a chapter in a book that describes lighting formation and then to divide the process into major steps (including moist air rising to form a cloud, creation of updrafts and downdrafts inside the cloud, separation of charges within the cloud, movement of the stepped leader downward from cloud to ground, and creation of a return stroke from ground to cloud).

  Finally, in mathematics, an objective could be to distinguish between relevant and irrelevant numbers in a word problem. An assessment item requires a student to circle the relevant numbers and cross out the irrelevant numbers in a word problem."
- *Analyze, Organizing* (pág. 81): "A sample objective in the natural sciences could be to learn to analyze research reports in terms of four sections: hypothesis, method, data, and conclusions. As an assessment, students are asked to produce an outline of a presented research report. In mathematics, a sample objective could be to learn to outline textbooks lessons. A corresponding assessment task asks a student to read a textbook lesson on basic statistics and then generate a matrix that includes each statistic's name, formula, and the conditions under which it is used."
- *Analyze, Attributing* (pág. 82): "In social studies, a simple objective could be to learn to determine the point of view of the author of an essay on a controversial topic in terms of his or her theoretical perspective. A corresponding assessment task asks a student whether a report on Amazon rain forests was written from a pro-environment or pro-business point of view. This objective is also applicable to the natural sciences."
- *Evaluate, Checking* (pág. 83): "A simple objective in the sciences could be to learn to determine whether a scientist's conclusion follows from the observed data. An assessment task asks a student to read a report of a chemistry experiment and determine whether or not the conclusion follows from the results of the experiment."
- *Evaluate, Critiquing* (pág. 84): "In the natural sciences, an objective could be to learn to evaluate the reasonableness of a hypothesis (such as the hypothesis that strawberries are growing to extraordinary size because of the unusual alignment of the stars). Finally, in mathematics, an objective could be to learn to judge which of two alternative methods is a more effective and efficient way of solving given problems (such as judging whether it is better to find all prime

factors or 60 or to produce an algebraic equation to solve the problem «What are the possible ways you could multiply two whole numbers to get 60»)."

- *Create, Generating* (pág. 86): "In the natural sciences, an objective could be to learn to generate hypothesis to explain observed phenomena. A corresponding assessment task asks students to write as many hypothesis as they can to explain strawberries growing to extraordinary size. Again, the teacher could establish clearly defined criteria for judging the quality of the responses and give them to the students. Finally, an objective from the field of mathematics could be to be able to generate alternative methods for achieving a particular result. A corresponding assessment item is: «What alternative methods could you use to find what whole numbers yield 60 when multiplied together?»"
- *Create, Planning* (pág. 87): "In the natural sciences, a sample objective could be to learn to design studies to test various hypotheses. An assessment task asks students to plan a way of determining which of three factors determines the rate of oscillation of a pendulum. In mathematics, an objective could be to be able to lay out the steps needed to solve geometry problems. An assessment tasks asks students to devise a plan for determining the volume of the frustum of a pyramid (a task not previously considered in class). The plan may involve computing the volume of the large pyramid, the computing the volume of the small pyramid, and finally subtracting the smaller volume from the larger."
- *Create, Producing* (pág. 88): "In science, an objective could be to learn to design habitats for certain species and certain purposes. A corresponding assessment task asks students to design the living quarters of a space station."

3.6 Diferencias entre Procesos Cognitivos Relacionados

Cuando los autores de la taxonomía revisada presentan algunas subcategorías, a veces destacan las diferencias entre una nueva subcategoría y otras. A veces se diferencia entre subcategorías del mismo proceso cognitivo:

- *Understand, Exemplifying* vs. *Classifying* (pág. 72).
- *Apply, Executing* vs. *Implementing* (pág. 77).

Sin embargo, las distinciones más clarificadoras se realizan entre subcategorías de procesos cognitivos distintos. Presentamos las comparaciones ordenadas por el la categoría menor (según la numeración del libro):

- *Understand, Interpreting* vs *Analyze, Attributing* (pág. 82): "In contrast to *interpreting*, in which the student seeks to *Understand* the meaning of the presented material, *attributing* involves an extension beyond basic understanding to infer the intention or point of view underlying the presented material. For example, in reading a passage on the battle of Atlanta in the American Civil War, a student needs to determine whether the author takes the perspective of the North or the South."
- *Understand, Inferring* vs. *Analyze, Attributing* (pág. 74): "Finally, *inferring* is different from *attributing* (a cognitive process associated with *Analyze*). As we discuss later in this chapter, *attributing* focuses solely on the pragmatic issue

of determining the author's point of view or intention, whereas *inferring* focuses on the issue of inducing a pattern based on presented information. Another way of differentiating between these two is that *attributing* is broadly applicable to situations in which one must "read between the lines," especially when one is seeking to determine an author's point of view. *Inferring*, on the other hand, occurs in a context that supplies an expectation of what is being inferred."

- *Understand, Comparing* vs. *Analyze, Differentiating* (pág. 80): "*Differentiating* is different from the cognitive processes associated with *Understand* because it involves structural organization and, in particular, determining how the parts fit into the overall structure or whole. More specifically, *differentiating* differs from *comparing* in using the larger context to determine what is relevant or important and what is not. For instance, in *differentiating* apples and oranges in the context of fruit, internal seeds are relevant, but color and shape are irrelevant. In *comparing*, all of these aspects (i.e., seeds, color, and shape) are relevant."
- *Understand* vs. *Create, Generating* (pág. 86): "*Generating* is used in a restricted sense here. *Understand* also requires generative processes, which we have included in *translating*, *exemplifying*, *summarizing*, *inferring*, *classifying*, *comparing*, and *explaining*. However, the goal of *Understand* is most often convergent (that is, to arrive at a single meaning). In contrast, the goal of *generating* within *Create* is divergent (that is, to arrive at various possibilities)."

3.7 Pruebas de Evaluación

La taxonomía revisada de Bloom propone diversas pruebas de evaluación para cada proceso cognitivo (no exhaustivas). Las reflejamos en la Tabla 1.

Tabla 1. Pruebas de evaluación adecuadas para cada proceso cognitivo

Subcategoría	Tipo de tarea
Remember, Recognizing	Verification task Matching task Forced choice task
Remember, Recalling	(Pueden variar según el número y la calidad de la pistas, y en el grado de inclusión en un contexto más significativo)
Understand, Interpreting	Constructed response task Selected response task
Understand, Exemplifying	Constructed response task Selected response task
Understand, Classifying	Constructed response task Selected response task
Understand, Summarizing	Constructed response task Selected response task

	(Puede implicar temas o resúmenes)
Understand, Inferring	Completion tasks Analogy tasks Oddity tasks
Understand, Comparing	Mapping task
Understand, Explaining	Reasoning tasks Trouble-shooting tasks Redesigning tasks Predicting tasks
Apply, Executing	Exercise solving
Apply, Implementing	Problem solving (Puede pedirse que el alumno determine el procedimiento a usar para resolver el problema, que lo resuelva, o ambos)
Analyze, Differentiating	Constructed response task Selected response task
Analyze, Organizing	Constructed response task Selected response task
Analyze, Attributing	Constructed response task Selected response task
Evaluate, Checking	(Sobre operaciones o productos creados por los propios alumnos)
Evaluate, Critiquing	(Sobre productos creados por los propios alumnos o por otros)
Create, Generating	Consequences tasks Uses tasks
Create, Planning	Develop worked-out solutions Describe solution plans Select solution plans
Create, Producing	Design tasks

Incluimos una breve descripción de aquellas tareas que reciben un nombre específico:

- *Verification task*: Pregunta de dos opciones (cierto, falso).
- *Matching task*: Dadas dos listas, el alumno debe relacionar cada elemento de una lista con un elemento de la otra lista.
- *Forced choice task*: Pregunta de múltiples opciones (MCQ).
- *Constructed response task*: Dar la respuesta a una pregunta.
- *Selected response task*: Pregunta de múltiples opciones (MCQ).
- *Completion task*: Dada una serie de elementos, el alumno debe cuál viene a continuación.
- *Analogy task*: Se da una analogía de la forma “A es a B como C es a D”.
- *Oddity task*: Pregunta de múltiples opciones (MCQ). Se dan tres o más elementos y el alumno debe determinar cuál no corresponde.

- *Mapping task*: El alumno debe mostrar cómo corresponde cada parte de un objeto a cada parte de otro.
- *Reasoning tasks*: El alumno debe dar una razón de cierto suceso.
- *Trouble-shooting tasks*: El alumno debe diagnosticar qué pudo fallar en un sistema incorrecto.
- *Redesigning tasks*: El alumno debe cambiar el sistema para que realice cierto objetivo.
- *Predicting tasks*: El alumno debe explicar cómo repercute un cambio en una parte de un sistema en otra parte del sistema.
- *Exercise solving*: Un ejercicio es una tarea para la que el alumno conoce el procedimiento que debe usar para resolverlo, por tanto el alumno está familiarizado con el procedimiento.
- *Problem solving*: Un problema es una tarea para la que el alumno desconoce inicialmente el procedimiento que debe usar para resolverlo, por tanto el alumno debe determinar qué procedimiento usar.
- *Consequences tasks*: El alumno debe dar todas las consecuencias de un suceso.
- *Uses tasks*: El alumno debe dar todos los posibles usos de un objeto.

3.8 El Uso Conjunto de Procesos Cognitivos

La taxonomía revisada explica en numerosos lugares que los procesos cognitivos no aparecen solitarios sino combinadamente.

El frecuente uso conjunto de Remember con otras categorías se reconoce en:

> "*Remembering* knowledge is essential to learning and problem solving as that knowledge is used in more complex tasks. (…) Where teachers concentrate solely on rote learning, teaching and assessing focus solely on remembering elements or fragments of knowledge, often in isolation from their context. When teachers focus on meaningful learning, however, remembering knowledge is integrated within the larger task of constructing new knowledge or solving new problems" (pp. 66, 69)

De forma más clara, se pronuncian en la sección "Descontextualized and Contextualized Cognitive Proceses" (Cap. 5: The Cognitive Process Dimension, pág. 89):

> "Although we have described the cognitive processes individually, they are likely to be used in coordination with one another to facilitate meaningful school learning. Most authentic academic tasks require the coordinated use of several cognitive processes as well as several types of knowledge."

A continuación dan dos ejemplos, resolver un problema matemático de palabras y escribir un ensayo. Veamos lo que comentan del primero:

> "For example, to solve a mathematical word problem, a student may engage in:
> - *interpreting* (to understand each sentence in the problem);

- *recalling* (to retrieve the relevant *Factual knowledge* needed to solve the problem);
- *organizing* (to build a coherent representation of the key information in the problem, that is, *Conceptual knowledge*);
- *planning* (to devise a solution plan);
- *producing* (to carry out the plan, that is, *Procedural knowledge*)."

El libro incluye numerosos ejemplos de tareas que implican varios procesos cognitivos. Un ejemplo representativo se presenta en el Cap. 6 (Using the Taxonomy Table, subsección The Taxonomy Table Revisited, pág. 102). En la sección, se parte de un objetivo de aprendizaje aparentemente sencillo: "Students should be able to learn to use laws of electricity and magnetism (such as Lenz's law and Ohm's law) to solve problems". Tras examinar el verbo ("use") y el nombre ("laws of electricity and magnetism"), concluyen que se trata de *Apply* (*Implementing*) *Conceptual Knowledge* (*Knowledge of Principles and Generalizations*). Sin embargo, su desarrollo como actividades instruccionales y de evaluación adecuadas para implementar leyes científicas exige su descomposición en tres procesos: "(1), determine the type of problem they are confronting, (2) select a law that will likely solve the problem, and (3) use a procedure in which the law is embedded to solve the problem". Su desarrollo lleva a identificar 7 actividades instruccionales.

Ejemplos similares se encuentran en otras partes del libro, sobre todo en las 6 viñetas (caps. 7-13).

En la siguiente subsección se incluyen diversas combinaciones de procesos cognitivos o restricciones mutuas.

3.9 Usos Conjuntos de Procesos Cognitivos Concretos

Cuando los autores de la taxonomía revisada presentan una subcategoría, a veces identifican otras subcategorías con las que suele ir acompañada. En algunos casos, se trata de subcategoría del mismo proceso cognitivo:

- *Analyze, Organizing* + *Differentiating* or *Attributing* (pág. 81).
- *Create, Generating* + *Planning* + *Producing* (págs. 85-86).

En otros casos, sin embargo, pertenecen a procesos cognitivos distintos:

- *Understand, Inferring* + *Apply, Executing* (pág. 74): "The process of *inferring* involves making comparisons among instances within the context of the entire set. For example, to determine what number will come next in the series above, a student must identify the pattern. A related process is using the pattern to create a new instance (e.g., the next number on the series is 34, the sum of 13 and 21). This is an example of *executing*, which is a cognitive process associated with *Apply*. *Inferring* and *executing* are often used together in cognitive tasks."
- **Reasoning by Analogy.** *Understand, Comparing* + *Understand, Inferring* + *Apply, Implementing* (pág. 75): "When used in conjunction with *inferring* (e.g., first abstracting a rule from the more familiar situation) and

implementing (e.g., second applying the rule to the less familiar situation), *comparing* can contribute to reasoning by analogy.

- *Apply, Implementing* + *Understand* + *Create*: "When the task is an unfamiliar problem, however, students must determine what knowledge they will use. If the task appears to call to *Procedural knowledge* and no available procedure fits the problem situation exactly, then modifications in selected *Procedural knowledge* may be necessary. In contrast to *executing*, then, *implementing* requires some degree of understanding of the problem as well as of the solution procedure. In the case of *implementing*, then, to *understand conceptual knowledge* is a prerequisite to being able to *apply procedural knowledge*." (pág. 77). "*Implementing* occurs when a student selects and uses a procedure to perform an unfamiliar task. Because selection is required, students must possess an understanding of the type of problem encountered as well as the range of procedures that are available. Thus, *implementing* is used in conjunction with other cognitive processes, such as *Understand* and *Create*." (pág. 78).
- *Analyze* + *Understand* or *Evaluate* or *Create*: "Although learning to *Analyze* may be viewed as an end in itself, it is probably more defendable educationally to consider analysis as an extension of *Understanding* or as a prelude to *Evaluating* or *Creating*." (pág. 79). "The process categories of *Understand*, *Analyze,* or *Evaluate* are interrelated and often used iteratively in performing cognitive tasks." (pág. 80).
- *Evaluate, Checking* + *Create, Planning* + *Apply, Implementing* (pág. 83): "When combined with *planning* (a cognitive process in the category *Create*), and *implementing* (a cognitive process in the category *Apply*), checking involves determining how well the plan is working."
- *Create* + otras (pág. 85): "A task that requires *Create* is likely to require aspects of each of the earlier cognitive process categories to some extent, but not necessarily in the order in which they are listed in the Taxonomy Table."
- **Critical thinking.** "For example, to think critically about an issue probably involves some *Conceptual knowledge* to *Analyze* the issue. Then, one can *Evaluate* different perspectives in terms of the criteria and, perhaps, *Create* a novel, yet defensible perspective on the issue." (págs. 269-270).

4 Conclusiones

Hemos seleccionado un número de citas de los libros correspondientes a las taxonomías original y revisada de Bloom. Se espera que su lectura permita eliminar algunos malentendidos sobre las mismas.

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