

Bloom's taxonomy – valences and utility in pedagogical practice

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Abstract

In this paper I have made a parallel between the taxonomic levels of Bloom (1) – Socratic questions taxonomy (2) – Wilson's types of questions (3) – applications of Bloom's taxonomy in evaluation items construction (4), taking as an example content the didactic transposition of Bloom's taxonomy. Therefore, we exemplified how we can correlate an objective formulated at a certain taxonomic level with the rest of teaching process –learning– evaluation, so that students to benefit of a cognitive progress. Finally, I could detach some practical recommendations on two dimensions: teachers can create a monitoring system of correspondence between objectives – teaching process – study and what they measure by evaluation probes. Teachers can involve students/pupils in a monitoring process of the study process by creating some study habits in the classroom based on using the superior levels of cognitive taxonomy, applicable later, independent in any individual study.

Keywords: cognitive taxonomic levels, cognitive progress, didactic strategies, evaluation items construction.

1. Introduction

Cognitive objectives taxonomy after Benjamin S. BLOOM (1956) – uses a classifying criteria the complexity of mental operations which involve each category of educative objectives. Taxonomy is a first try to answer the need of precision to express the objectives in the cognitive domain. Also time and educational experience decanted the theory's vulnerability, the authors of

school programs and teachers still are limited to formulations of objectives that determine difficulties in assuring the study evolution of pupils, teaching difficulties, evaluation difficulties. Despite the existent critics, it is obvious that a teacher which has as start point the cognitive taxonomic levels, when he designs a didactic activity he has greater chances to give coherence to this process and to develop the thinking capacities of superior level of his students.

The didactic activity development, according to the steps identified by G. and V. de Landsheere, is a process of anticipating objectives (1), contents (2), resources identification (3), the suitable didactic strategies (4), the evaluation ways and evaluation instruments (5), *in a clear way*.

That is why we will analyze in what way we can correlate an objective developed at a certain taxonomic level with the rest of the teaching process – study – evaluation, so that the students can benefit of a cognitive progress. More exact, we realized a parallel between Bloom's taxonomic levels – Socratic questions taxonomy – Wilson's types of questions – Bloom's taxonomy applications in evaluation items construction, taking as example the didactic transposition of Bloom's taxonomy.

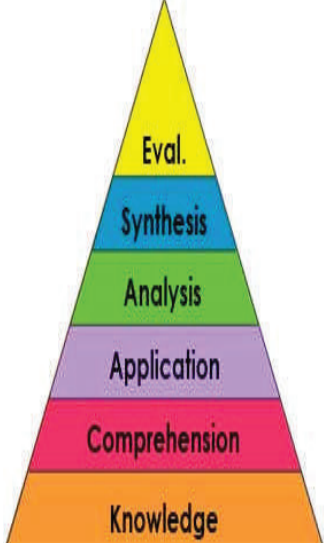
This try is based on the *following arguments*:

In the time when we are involved in the development of a teaching design – study – evaluation, Bloom's taxonomy can be a start point in this design and a check list from which we can assure that we selected the most appropriate types of teaching – study to develop in students the necessary or wanted capacities.

Through the art of thoughtful questioning teachers can extract not only factual information, but aid learners in (Wilson L.O., 1997): connecting concepts, making inferences, increasing awareness, encouraging creative and imaginative thought, aiding critical thinking processes, and generally helping learners explore deeper levels of knowing, thinking, and understanding.

Intending the Taxonomy „as a method of classifying educational objectives, educational experiences, learning processes, and evaluation questions and problems” (Paul R.W., 1985 p. 39), numerous examples of test items (mostly multiple choice) were included. This led to a natural linkage of specific verbs and products with each level of the taxonomy.

The theoretical step is structured in the following 4 aspects, observing the following correspondence:

Bloom's Taxonomy 6 levels	Socratic questions and the correspondence with Bloom's Taxonomy	Types of questions L. O. Wilson (1997)	Application of Bloom's Taxonomy to the design of MCQs
	<p>6. Probe implications and consequences and Questions about the question</p> <p>5. Questioning viewpoints and perspectives</p> <p>4. Probing rationale reasons and evidence</p> <p>3. Probing assumptions</p> <p>2. Conceptual clarification questions.</p> <p>1. _____</p>	<p>6. Evaluative</p> <p>5. Divergent</p> <p>4. Convergent</p> <p>3. Convergent</p> <p>2. Convergent</p> <p>1. Factual</p> <p>Thistypes are in correspondence with Bloom's Taxonomy</p>	<p>Examples of items for each taxonomic level</p>

Socratic questions. The art of asking questions is one of the basic skills of good teaching. Also known as the dialectical approach, this type of questioning can correct misconceptions and lead to reliable knowledge construction. Here are the six types of questions that Socrates asked his pupils:

Conceptual clarification questions – the students are put to explain, detail, argument, think deep, „tell me more”.

Probing assumptions - makes them think about the presuppositions and unquestioned beliefs on which they are founding their argument.

Probing rationale, reasons and evidence - When they give a rationale for their arguments, dig into that reasoning rather than assuming it is a given.

Questioning viewpoints and perspectives. Most arguments are given from a particular position. So attack the position. Show that there are other, equally valid, viewpoints.

Probe implications and consequences. The argument that they give may have logical implications that can be forecast. Do these make sense? Are they desirable?

Questions about the question. And you can also get reflexive about the whole thing turning the question in on itself. Use their attack against themselves. Bounce the ball back into their court, etc.

Why Use Socratic Questioning?

During disciplined, carefully structured questioning, students must slow down and examine their own thinking processes. Thoughtful, disciplined questioning in the classroom can achieve the following teaching and learning goals (Stepien B., 1999):

Model scientific practices of inquiry;

Support active, student-centered learning;

Facilitate inquiry-based learning;

Help students to construct knowledge;

Help students to develop problem-solving skills;

Improve long-term retention;

The teacher creates and sustains an intellectually stimulating classroom environment and acknowledges the value of the student in that environment.

Leslie Owen Wilson (1997) - There are five basic types of questions: Factual; Convergent; Divergent; Evaluative; and Combination:

Factual - Soliciting reasonably simple, straight forward answers based on obvious facts or awareness. These are usually at the lowest level of cognitive or affective processes and answers are frequently either right or wrong.

Convergent - Answers to these types of questions are usually within a very finite range of acceptable accuracy. These may be at several different levels of cognition -- comprehension, application, analysis, or ones where the answerer makes inferences or conjectures based on personal awareness, or on material read, presented or known.

Divergent - These questions allow students to explore different avenues and create many different variations and alternative answers or scenarios. Correctness may be based on logical projections, may be contextual, or arrived at through basic knowledge, conjecture, inference, projection, creation, intuition, or imagination. These types of questions often require students to analyze, synthesize, or evaluate a knowledge base and then project or predict different outcomes.

Evaluative - These types of questions usually require sophisticated levels of cognitive and/or emotional judgment. In attempting to answer evaluative questions, students may be combining multiple logical and/or affective thinking process, or comparative frameworks. Often an answer is analyzed at multiple levels and from different perspectives before the answerer arrives at newly synthesized information or conclusions.

Combinations - These are questions that blend any combination of the above.

2. Some applications of Bloom’s taxonomy to enhance the effectiveness of teaching-learning-evaluation process

In what continues we will show for each taxonomic level, how can be correlated the three aspects mentioned earlier.

2.1. Knowledge. Abilities showed by students: observing and memorizing information, terminology, data, events, places, conventions, main ideas, general elements and abstractions knowledge (laws, principles, theories specific to the domain), knowledge of procedures and methods. Verbs – the student will record, define, tell, describe, identify, differentiate, reproduce, enumerate, show, name, gather, examine, tabulate, quote, when, where, etc.

Table 1. Examples of taxonomic level - knowledge:

Socratic questions - examples	Factual questions - examples	Multiple-choice test - examples
Who, what, when, where, how ...?	Who made a taxonomy of cognitive domain? Which are the 6 taxonomy levels proposed by B.S. Bloom? What are the characteristics of the analyze level? Name three abilities that a student that has reached the analyze level in what concerns the tasks performance is showing	Taxonomy of cognitive objectives after B.S. Bloom contains at the last level: a.) application; b.) evaluation; c.) synthesis.

2.2. Comprehension. „ Translation, extrapolation and interpretation” are “steps” of this taxonomy class. Abilities shown by students: understanding information; understanding the sense; interpreting knowledge in a new context; interpreting facts, comparison, being in opposition; putting things in order, interpret, compare, anticipate, associate, distinguish, estimate, differentiate, talk, extrapolate, transform, analyze, illustrate, redefine, explain, estimate, demonstrate, paraphrase, determine, compare, correlate, argument distinguish, explain, reorganize, etc.

Table 2. Examples of taxonomic level - comprehension:

Socratic questions Conceptual clarification questions	Convergent questions – examples	Multiple -choice test - examples
<i>Why are you saying that? What exactly does this</i>	What tasks can students solve that have reached the	Students demonstrate at the taxonomic level comprehension the following skills:

<p><i>mean?</i> <i>How does this relate to what we have been talking about?</i> <i>What is the nature of...?</i> <i>What do we already know about this?</i> <i>Can you give me an example?</i> <i>Are you saying... or... ?</i> <i>Can you rephrase that, please?</i></p>	<p>analyze level? What is the meaning that a teacher created an operational objective at the cognitive analyze level?</p>	<p>a.) can define a specific principle of a domain; b.) can explain a specific principle of a domain; c.) can catch the relations between the principles of a domain. The teacher proposed to students the following task: „to identify the differences between the taxonomic levels having in front each ones characteristics”. This is a task situated at a taxonomic level: a.) comprehension; b.) analyze; c.) application.</p>
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2.3. Application. Abilities shown by students: using information, methods, concepts, theories in new situations; solve problems using the requested knowledge and abilities, using the correct procedures and methods. Verbs – the student will apply, demonstrate, calculate, conclude, illustrate, solve, examine, modify, associate, change, classify, experiment, discover.

Table 3. Examples of taxonomic level - application:

Socratic questions Probing assumptions	Convergent questions - examples	Multiple-choice test examples
<p><i>What else could we assume?</i> <i>You seem to be assuming ... ?</i> <i>How did you choose those assumptions?</i> <i>Please explain why/how ... ?</i> <i>How can you verify or disprove that assumption?</i> <i>What would happen if ... ?</i> <i>Do you agree or disagree with ... ?</i></p>	<p>How is...an example of...? How is...related to...? Why is...significant? Do you recognize the level that the next operational objective is situated? Create objectives that are situated at taxonomic levels progressively different. Why is the created objective „...” situated at the synthesis taxonomic level? How do we create a task of evaluation to correspond the objective „...” situated at the synthesis level?</p>	<p>Which is the most appropriate question of a teacher that propose to himself to develop the students' thinking at the analyze taxonomic level: a.) What are the characteristics of comprehension level? b.) Give an example of ability that a students that solves tasks at comprehension level shows. c.) Why the comprehension level is inferior to the one called analyze?</p>

2.4. Analyze – involves the elements identification from an integer (“elements analyze”); identifying some logical and causal reports (“relations analyze”); catching the principles that work or is build from a category of products (“principles analyze”). Abilities shown by students: recognizing some known methods, parts organizing catching hidden senses; indentifying component parts, recognizing the argumentation errors, distinguish between facts and inferences, relevant evaluation of data, etc. Verbs – the student will analyze, separate, order, explain, associate, classify, systematize, divide, compare, select, explain.

Table 4. Examples of taxonomic level - analyze:

Socratic questions Probing rationale, reasons and evidence	Convergent questions - examples	Multiple-choice test examples
<p><i>Why is that happening?</i> <i>How do you know this?</i> <i>Show me ... ?</i> <i>Can you give me an example of that?</i> <i>What do you think causes ... ?</i> <i>What is the nature of this?</i> <i>Are these reasons good enough?</i> <i>Would it stand up in court?</i> <i>How might it be refuted?</i> <i>How can I be sure of what you are saying?</i> <i>Why is ... happening?</i> <i>Why? (keep asking it -- you'll never get past a few times)</i> <i>What evidence is there to support what you are saying?</i> <i>On what authority are you basing your argument?</i></p>	<p>How do you know that an operational objective is situated at there comprehension level? Give example of a task by which is evaluated an objective situated at level (X) of comprehension. What determines the selection of a taxonomic level in what concerns the tasks of an evaluation test? Why does often happen that the same verb to be included in different taxonomic categories? How do we know that a certain evaluation task belongs to a certain taxonomic level? Show by example how the same verb can mean different actions situated in different categories. Why is the evaluation level superior to the synthesis level?</p>	<p>At synthesis taxonomic level the students are capable to solve the following task: a.) to solve problems; b.) to create original works; c.) to make predictions.</p>

2.5. Synthesis – involves some ideas restructuration, presenting them in another order, catching new logical correlations, on the basis which are formed personal conclusions, all this leading to elaborating a personal work

(report, composition, essay, technical object, etc). Abilities showed by students: using old ideas to create new ideas; generalization starting from the given data; associating the knowledge came from various domains; conclusion anticipating, etc.

Verbs – the student will associate, integrate, modify, reorganize, replace, plan, create, develop, invent, compose, formulate, prepare, generalize, rephrase, etc.

Table 5. Examples of taxonomic level - synthesis:

Socratic questions Questioning viewpoints and perspectives	Divergent questions - examples	Multiple-choice test examples
<i>Another way of looking at this is ..., does this seem reasonable?</i> <i>What alternative ways of looking at this are there?</i> <i>Why it is ... necessary?</i> <i>Who benefits from this?</i> <i>What is the difference between... and...?</i> <i>Why is it better than ...?</i> <i>What are the strengths and weaknesses of...?</i> <i>How are ... and ... similar?</i> <i>What would ... say about it?</i> <i>What if you compared ... and ... ?</i> <i>How could you look another way at this?</i> <i>What would you predict/infer from...?</i> <i>What ideas can you add to...?</i> <i>How would you create/design a new...?</i>	Mention the aspects under which the Bloom's and Anderson's taxonomy are similar concerning the confusion of phrasing questions at different levels. What solutions do you suggest to eliminate the confusions in items inclusion, to questions at different levels? How could be created a system of monitoring the used levels by a teacher, when he is teaching a discipline? Which are the week and strong points of Bloom's taxonomy? Can we predict a student's performances on the basis of actual situation level in Bloom's taxonomy? What would happen if we did not respect sequential in teaching the taxonomic levels? What solutions do you suggest to pass over the difficulties in the objectives at different taxonomic levels	The reader proposes the next task to the students: to find solutions to eliminate confusions between evaluation taxonomic level (Bloom) and evaluation (Anderson). This is a task situated at the level: a.) synthesis (Bloom); b.) evaluation (Anderson); c.) evaluation (Bloom).

<i>What might happen if you combined...? What solutions would you suggest for...?</i>	development?	
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2.6. Evaluation – requires the students to issue judgments of personal value and argument about a creation making reference to precision, logic, consistence, coherence, rigor (“evaluation by reporting internal criteria”), and also to efficiency, adequacy to the purpose according to a model (“evaluation by reporting at external criteria”). Abilities shown by students: evaluating the importance of theories, presentations; adopting a decision based on reason; checking the facts value; subjectivity recognition, etc. Verbs – the student will evaluate, decide, order, rank, test, measure, recommend, persuade, select, judge, explain, distinguish, argument, conclude, compare, resume, etc.

Table 6. Examples of taxonomic level - evaluation:

Socratic questions Probe implications and consequences	Evaluative questions examples	Multiple-choice test examples
<i>Then what would happen? What are the consequences of that assumption? How could ... be used to ... ? What are the implications of ... ? How does ... affect ... ? How does ... fit with what we learned before? Why is ... important? What is the best ...</i>	How do you believe that The B.S. Bloom’s taxonomy influences the teaching and studying practice? Which are the discriminations between the Bloom’s taxonomy and L. Anderson’s taxonomy? What are the consequences of ignoring the B.S. Bloom’s taxonomy in didactic practice? How could be removed the risk to phrase objectives at inferior level of taxonomy? Why is important that a	Evaluate the answer of a student that is told to argument why the same action verb can be situated at different taxonomic levels. Which of the following answers is pertinent: a.) this situation is not possible because the same verb cannot have different complexity levels; b.) this situation is possible only if the tasks/actions are different as complexity; c.) this situation means an error due to a

<p><i>? Why?</i> Questions about the question <i>What was the point of asking that question?</i> <i>Why do you think I asked this question?</i> <i>What does that mean?</i></p>	<p>teacher to use taxonomy in phrasing operational objectives, questions and verifying tasks? Which are the most important agreement points between the two taxonomies? Do you agree with the reviewed taxonomy version of B.S. Bloom? How do you decide which is the level at which you phrase the operational objectives? How do you select the questions/tasks to evaluate the phrased operational objectives? What criteria do you respect when you evaluate the level at which an operational objective is phrased? Establish the sequences order of pedagogical development in which the Bloom's taxonomy is involved.</p>	<p>misunderstanding of the differences that every taxonomic level involves; Which is the most appropriate method of evaluation to verify an objective situated at evaluation level? a.) multiple choice test; b.) project; c.) portfolio.</p>
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3. Conclusions

Bloom's taxonomy is:

- A reference model in a certain lesson development, of a class, but also in the analytical program development of a taught discipline or an educational program, because in all these cases we start from what we wish to obtain from our students (what will they know, what will they know to do, what will the students know to be) and we finish with their evaluation (how do I know that they have these capacities);

- As initial was wanted, Bloom's taxonomy (including the reviewed one of Lorin W. Anderson), can contribute to academic education formalization and education in general, in the whole world;
- Bloom's taxonomy (including the reviewed one of Lorin W. Anderson), can be constant applied in the development process, but also precise in the teaching – study – evaluation process, so that the students understand the logic of their cognitive progress, and in this way “can be related by the multiple intelligences development, abilities to solve problems, critical and creative thinking and integrating the new technologies” (Noble T., 2004);

A few practical recommendations:

- Teachers can create a monitoring system of correspondence between objectives – the teaching – study process and what they measure by evaluation tests. We cannot formulate objectives at the superior level of taxonomy and evaluate by tasks that are situated at the inferior level of taxonomy by their requesting level. We cannot teach requesting the thinking of the students at inferior levels and to evaluate by tasks situated at superior level. Concerning the evaluation forms, it is recommended a blend of them, because is hard to catch the development rank of superior levels by multiple – choice tests. In case of using multiple – choice tests, it is recommended the item creation that is at superior levels, according to formulated objectives in an appropriate share.
- Teachers can involve students in a monitoring process of the study progress by creating individual study habits. Pupils, students, can be taught to monitor alone the study progress at every class/lesson, starting from the level that presents difficulties, by group or individual exercises. This habit created in the classroom can contribute to the meta-cognition development of the students, so when they will learn a information, they can phrase question by their own at different taxonomic levels, can anticipate the questions and evaluation items, which represents a control over study and evaluation.

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