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Taxonomy of Educational Objectives for Value and Skill Education in Product Design Program

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Abstract: Bloom's taxonomy provides a useful set of guidelines for defining educational objectives in a curriculum centred around outcome based education paradigm. Curriculum designers make use of a hierarchy of educational objectives from simple(remembering) to Complex(creating) as defined in Bloom's Taxonomy. Accreditation authorities like NAAC in India, recognise universities that align their curriculum around Bloom's taxonomy. In a standard curriculum design process of an educational institute, the educational objectives of any course (or subject) are broadly categorised into Knowledge, Values and Skill. Bloom and his colleagues (David R. Krathwohl, 1965), in their original publication provided taxonomy for knowledge through cognitive domain, taxonomy for values through affective domain and taxonomy for skills through psychomotor domain (not written by bloom). However, it is widely observed that curriculum designers only make use of Bloom's taxonomy of cognitive domain only. Even for educational objectives dealing with values and skill, only keywords defined in Bloom's cognitive domain are used. This is especially problematic for programs in design discipline like Product design and visual communication. In India, new Design institutes, opening under NAAC accredited universities have to rely upon Bloom's taxonomy of cognitive domain for creating a standardised curriculum. Remedy for the problem proposed is to use separate taxonomy for affective domain and taxonomy for psychomotor domain, along with taxonomy of cognitive domain for defining objectives in design discipline like product design and visual communication. The research concludes by suggesting that such an approach for using taxonomy of affective and psychomotor domain may be useful in defining educational objectives for other similar programs whose program outcomes require inclusion of values and skills along with knowledge.

Keywords: Taxonomy of Educational Objectives, Bloom's taxonomy, Affective

1. Introduction

In the current higher education scenario, educational institutes not only focus on imparting knowledge pertaining to subject matter, but also develop certain attributes and qualities in students such as critical thinking and teamwork that go beyond acquiring content knowledge (Moalosi R., 2017). Graduate attributes further help in giving direction to learning objectives and outcomes of each individual course within a program of study. Both graduate attributes and course objectives are categorised under three broad objectives of Knowledge, Values and Skill (Evers, 2007). This helps in identifying the outcomes of an educational program. The advantage of Bloom's taxonomy is that it helps in selecting action verbs that define an outcome at a specific level or hierarchy of complexity. This is the reason Bloom's taxonomy has achieved such a universal degree of acceptance in not just India but university systems across the globe. Figure 1 shows how keywords relating to a particular level of knowledge acquisition change as we go above the hierarchy of educational outcomes.

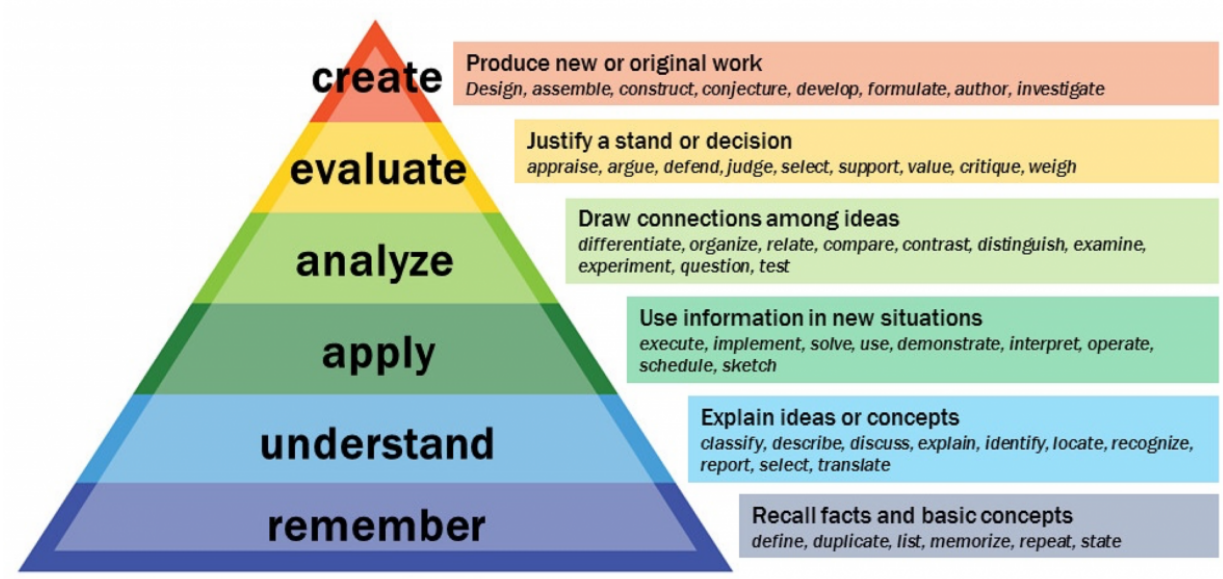

Figure 1: Bloom's taxonomy with key action verbs. CNM (2023): Bloom's Taxonomy revised. Retrieved May 2023.

As a course of study progresses through various semesters, the educational objectives gain complexity and bloom's taxonomy keywords help a curriculum designer to select the right keywords that describe a learning outcome relative to a particular level of complexity in a particular semester.

However as accreditation agencies maintain that curriculum objectives have to include Values and skill in learning outcomes rather than knowledge alone, there is a want of keywords in Bloom's taxonomy, as it only describes objectives for knowledge and not for values and skill. But

curriculum designers instead of challenging this limitation of bloom's taxonomy use the taxonomy for knowledge to describe learning objectives in **Value** and **skill** which is a problem as the taxonomy is not originally designed to cover values and skill. This is a situation of a "crisis" in the field of education in terms of how Thomas Kuhn described "crisis" in a field of science when certain pressing questions have no answers or are answered through compromised logic.

2. The ignored Taxonomy of Affective and Psychomotor domains

The taxonomy of educational objectives was first described by Bloom et al in 1956. The authors had clearly mentioned that it consists of 3 parts. The second part which was primarily authored not by Bloom but by Krahthwal described the taxonomy of educational objectives related to the affective domain which mainly covered **value based objectives** in contrast to **knowledge**. The third part, which was supposed to be about educational objectives related to psychomotor domain (skill) was never completed, but the vision for such a book was described in volume 1. That project was later completed by Elizabeth Jane Simpson in 1966 (Simpson, 1966).

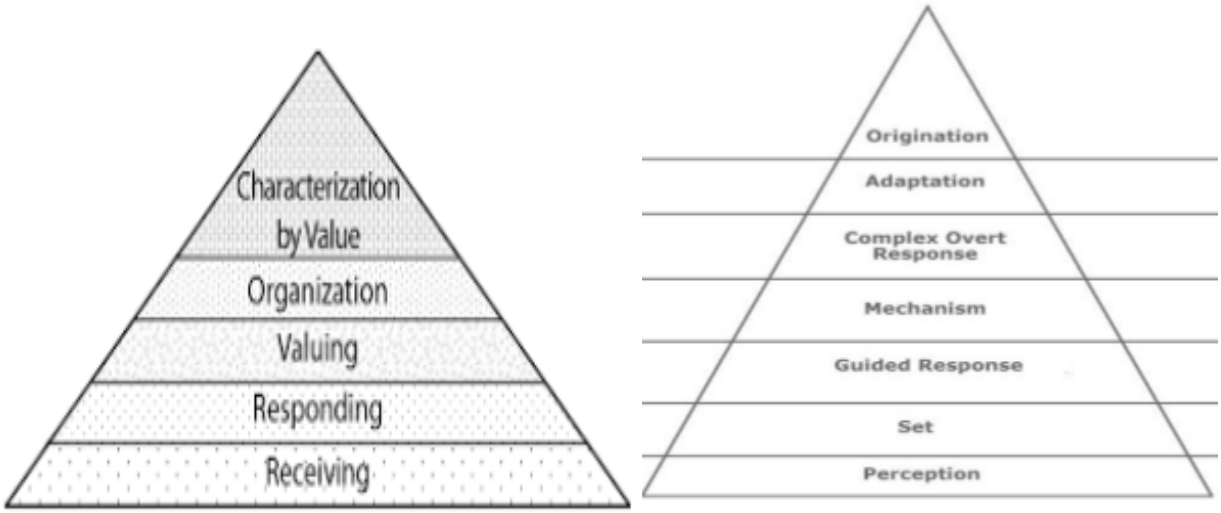

Figure 2 (a). Hierarchy of educational objective categories in affective domain are receiving, responding, valuing, organisation and characterisation by value. (b) Hierarchy of educational objective categories in the psychomotor domain are perception, set, guided response, mechanism, complex overt response, adaptation and organisation.

There could be several reasons why curriculum designers have ignored the existence of relevant but limited literature present in defining the taxonomy of objectives in the affective and psychomotor domain.

One of the reason's being the belief that values are seen as forced from above, by institutions with an agenda and hence there is a resistance from teachers to pursue it (Connolly & Penn-Edwards, 2005). The other reason could be the subjective nature of learning objectives in

the taxonomy of affective domain. Even though the taxonomy of affective domain provides action verbs to describe educational outcomes, still it is not clear what are the observable indicators of those action verbs. For example, one of the action verbs in the “affective” domain is “listens”. What are the visible indicators that measure the presence of “listening” ability is not clear. But this is not sufficient reason to completely ignore the presence of the “affective” domain. On the contrary, more research is required in defining the measurable indicators of action verbs in the affective and psychomotor domain.

Maybe some educational institutes are using taxonomy of affective and psychomotor domain, I don’t know, but at least accreditation agencies like NAAC, only check alignment of curriculum with the cognitive domain, even though it advocates presence of values and skill related subjects in the curriculum.

Alternatively, value education becomes a separate subject in which generic human values are discussed rather than values in relation to a particular subject matter.

The author has designed curriculum for graduate programs and attended several training workshops on bloom’s taxonomy and curriculum design and arrived at this observation that only taxonomy of cognitive domain is employed to write learning outcomes for not just knowledge, but also for course content related to values and skills.

Although there is very little evidence of Bloom's taxonomy used for describing educational objectives in *design* disciplines, Qamar, Ramanathan and Rawahi (2016) have described a framework for using Bloom’s taxonomy for outlining educational objectives for Product design programs. The problem I have described above is clearly visible in the framework (Sayyad Zahid Qamar, 2016). The program outcomes described by ABET accreditation agency are categorised into Knowledge, Behaviour and skill. The accreditation agency in India, NAAC divides educational objectives into Knowledge, values(behaviours) and skill. A statement like “Identify, formulate, solve engineering problems” is an educational objective under the “knowledge” category. However, a statement like “professional and ethical responsibility” does not come under knowledge domain, it is situated under affective domain judged by Values and behaviours. However, in the Qamar et al framework, these kind of objectives are also addressed through Bloom's taxonomy of cognitive domain only (table 1); which should have ideally been dealt with through Taxonomy of Affective domain as described in figure 2.

Table 1 Distribution of educational objective in Product design program according to Taxonomy of cognitive domain
Another educational objective "proficiency in techniques, skills and modern engineering tools" is also not an educational objective under cognitive domain, it falls under the psychomotor domain, but again, the current curriculum planner describes it through taxonomy of cognitive domain rather than psychomotor domain.

ABET student outcome	Bloom's taxonomy level/category					
	Remembering/ Knowledge	Understanding/ Comprehension	Application	Analysis	Evaluation	Creation/ Synthesis
(a) Apply math, science, engineering	X	X	X			
(b) Design/conduct experiment, and analyze/interpret data		X	X	X		
(c) Design system, component, process	X		X	X	X	X
(d) Team work	X	X	X			
(e) Identify, formulate, solve engineering problems		X	X		X	
(f) Professional and ethical responsibility		X			X	
(g) Communicate effectively (verbal, written)		X	X	X	X	X

2.1 Distributing learning outcomes across cognitive, affective and psychomotor domain

In this section, I demonstrate how learning objectives need to be distributed across the three major taxonomies of knowledge, values and skill. Here I take out some of the learning outcomes from Qamar et al framework and put them in the taxonomy of affective and psychomotor domain.

Table 2: Learning outcome of values according to taxonomy of affective domain.

affective learning outcome	**Receiving**	**Responding**	**Valuing**	**Organisation**	**Characterisation**
Teamwork	Listen to others, Remember names of newly introduced people		Demonstrates belief in democratic process. Is sensitive towards individual and cultural differences		
Professional and ethical responsibility				Recognizes the need for balance between freedom and responsible behaviour. Accepts responsibility for one's behaviour.	
Global Environmental and social impact					Has a value system that controls their behaviour. Revises judgement and changes behaviour in light of new evidence.

Table 3: Learning outcome of skill according to taxonomy of psychomotor domain.

psychomotor learning outcome	**Perception**	**set**	**Guided response**	**Mechanism**	**Complex overt response**	**adaptation**	**organisation**
Techniques, skill and modern engineering tools		Shows desire to learn new process	Follows instructions to build a model		Operates a computer quickly and accurately		
Design system/ process						Responds effectively to unexpected experiences.	Creating new patterns to fit a particular situation. Construct a new theory, training program

Similarly, certain learning outcome can be described in a better way through taxonomy of psychomotor domain as compared to taxonomy of cognitive domain:

Observe the learning outcomes on the left most column and how the visible indicator increases in complexity as we move from left(lowermost) to right(higher) level of complexity of affective and psychomotor domains. The detailed list of observable behaviour and action verbs under affective and psychomotor domains can be found in volume 2 and 3 of Taxonomy of educational objectives envisioned by Bloom and his colleagues. The keywords and phrases in the Affective and Psychomotor domain are more appropriate than the action verb phrases described in the famous bloom's cognitive domain.

3. Conclusion

The objective of this paper was to point to an error in the curriculum design process of outcome based learning. The error, simply described, is this; that Taxonomy of educational objectives as outlined by Bloom et al originally comprised THREE major components namely Taxonomy of Cognitive, Affective and Psychomotor domains. However Curriculum designers use only the taxonomy of cognitive domain to judge educational outcome in affective and psychomotor domain as well. This paper briefly demonstrates how educational outcomes need to be judged according to action verbs and phrases described in Taxonomy of psychomotor and affective domains published by Bloom and his successors. Accreditation agencies need to modify their criteria of judging validity of a curriculum alignment with not just Taxonomy of Cognitive domain (the popular bloom's taxonomy) but also with Taxonomy of Affective and psychomotor domains. There is a greater need for research in finding innovative ways of discovering measurable indicators of action verbs in affective and psychomotor domains so it becomes more conducive(and user friendly, in design terminology) to be used by teachers in their professional practice.

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