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Bloom's Taxonomy, Backward Design, and Vygotsky's Zone of Proximal Development in Crafting Learning Outcomes

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Abstract

This article aims to present some fresh insights into one of the milestones in the field of education. For sixty years, Bloom's taxonomy has been one of the most significant tools used in course design as it provides a rigorous framework for crafting learning outcomes and designing both assessment tasks and instructional activities aligned with these learning outcomes. Though not a panacea for all problems of course design and educational assessment, when meticulously understood and wisely used in a student-centered environment which integrates the taxonomy with other useful approaches and tools such as backward design and Vygotsky's zone of proximal development (ZPD), Bloom's taxonomy could provide an invaluable and indispensable roadmap for crafting effective learning outcomes that drive the whole process of course design.

Keywords: Bloom's taxonomy, Learning outcomes, Cognitive domain, Backward design, Zone of proximal development

1. Introduction

1.1 Background

On Bloom's taxonomy's sixtieth birthday, Bennett (2012) sketches a terrible picture made of very vivid medical metaphors to sound the death knell for one of the milestones throughout the long and rich timeline of the educational theory:

> Bloom's Taxonomy at 60 is showing severe if not critical signs of aging. The taxonomy is almost taxiderm. Greying of the eyebrows, plus almost total loss of scalp hair; cracking skin amid huge fat deposits; high-blood pressure and hardening of the arteries; and finally an unnamed auto-immune disorder threatening major-organ failure: All spell disaster. Determining the exact pathology of these myriad problems plus deriving a course of cure is a complex task at best and may be utterly daunting to the even the most sober and judicious of minds (p. 110)

Yet, Bennett (2012) admits that there is nothing so universal in today's educational settings as Bloom's taxonomy of learning objectives. As a tool for significant and profound learning, the taxonomy is "considered indispensable in ensuring quality education by countless school systems" (p. 109). A quick search of the World Wide Web "yields clear evidence" that the taxonomy has always been applied to a "variety of situations… [and] results include a broad spectrum of applications represented by articles and websites describing everything from corrosion training to medical preparation" (Forehand, 2012, p. 44). Just google the phrase 'Bloom's Taxonomy' and you will come across a wealth of terms and phrases that celebrate the vitality and vigor of the taxonomy, and the fact that it still thrives well in a world of conflicting paradigms and uncertainties. On just typing the phrase, you may see, for instance, the following:

> Bloom's taxonomy and critical thinking
> Bloom's taxonomy and learning outcomes
> Bloom's taxonomy learning domains
> Bloom's taxonomy learning style
> Bloom's taxonomy in assessment
> Bloom's taxonomy for the digital age
> Bloom's taxonomy assessment tasks
> Bloom's taxonomy and technology
> Bloom's taxonomy revised
> Bloom's taxonomy in lesson planning
> Bloom's taxonomy in math
> Bloom's taxonomy in the classroom
> Bloom's taxonomy in the 21st century
> Bloom's taxonomy assessment tool
> Bloom's taxonomy and formative assessment

A taxonomy is an orderly structure which accurately classifies things according to some natural relationships within a specific field. Bloom's taxonomy of educational objectives is "a framework for classifying statements of what we expect or intend students to learn as a result of instruction" (Krathwohl, 2002, p. 213). Though named after Benjamin Bloom (1913-1999), the taxonomy is a series of publications by Bloom and a handful of other researchers and educationalists. The publication of the first volume of the taxonomy followed several conferences from 1949 to 1953 chaired by Bloom who intended to facilitate exchanging educational tests and create item banks to measure the same educational objectives at different universities. For this purpose, Bloom enlisted a group of curriculum and measurement experts from across the USA. The rationale for developing the taxonomy was to help "curriculum builders" "plan learning experiences and prepare evaluation devices", analyze the intended "educational outcomes", and have a frame of reference for "viewing the educational process and analyzing its working" (Bloom and Krathwohl,1956, pp. 2-3). The first volume of the taxonomy, *Handbook I: Cognitive Domain* by Bloom, Engelhart, Furst, Hill, and Krathwohl, was published in 1956 (Krathwohl, 2002, p. 212). Later, *"Handbook II: Affective Domain"* by Krathwohl, Bloom and Masia was published in1965, and different versions of the psychomotor domain were developed by Simpson (1966), Harrow (1972) and Dave (1975). Recently, the various components of the taxonomy have undergone a series of revisions and modifications by a plethora of researchers (*some of them are Bloom's colleagues and students who collaborated in writing the original taxonomy*). The most significant revision throughout the timeline of this classic work is a version of the cognitive domain edited in 2000/2001 by Anderson, Krathwohl, Airasian, Cruikshank, Mayer, Pintrich, Raths, and Wittrock.

Since its emergence, Bloom's taxonomy has been instrumental in shifting instruction from teaching and assessing incoherent facts to teaching and assessing students in systematic and predictable ways, a significant shift that has remarkably revolutionized education. It is really hard to appreciate, in the context of contemporary curriculum design theories, the huge impact and magnitude which Bloom's taxonomy has effected on education for the past sixty years. The framework has continued to inspire curriculum and course designers worldwide due to its intrinsic characteristics and merits as the taxonomy is particularly:

1) **Simple/Useful:** It is underpinned by a few and very simple principles. This enables the taxonomy to address practical issues which are at the core of any educational experience. Though 'severe' criticisms have been put forward regarding the psychological realities that underpin the trilogy of domains and the hierarchical structures of the levels in each of these domains, the taxonomy as a whole is extremely useful if wisely used. Bloom's taxonomy is "gradually being supplemented—and may perhaps even supplanted one day—by new insights into the workings of human thought and learning made possible by advances in brain imaging and cognitive science." Yet, "given its logical simplicity and utility, Bloom's taxonomy will continue to be widely used by educators" (Bloom's Taxonomy, 2014).
2) **Inclusive/Universal:** It could be incorporated into almost all disciplines and it "has been used by educators in virtually every subject area at virtually every grade level" (Marzano and Kendall, 2007, p. 1). Fourteen years ago, Krathwohl (2002) testifies that the taxonomy was translated into twenty-two languages (p. 213). Some of the taxonomies developed

later are relatively specialized and they rarely tackle the epistemological and educational questions addressed in Bloom's taxonomy. Plus, Bloom, as Krathwol states, "saw the original taxonomy as more than a measurement tool". He assumed that it could serve as a "common language about learning goals to facilitate communication across educational settings to "determine the correspondence of educational objectives, activities, and assessments in a unit, course, or curriculum" (Krathwohl, 2002, p. 212). Thus, while other educational taxonomies have been developed, it is Bloom's taxonomy which remains, even after half a century of the publication of the first handbook of the cognitive domain, the "de facto standard" (Forehand, 2012, p. 41).

3) **Flexible/Dynamic:** The taxonomy has stood the test of time as it has allowed some drastic modifications and changes to integrate new insights and approaches without losing its essential core.

1.2 Thesis of the Article

In their revision of Bloom's taxonomy, Krathwohl, Airasian, Cruikshank, Mayer, Pintrich, Raths, and Wittrock (2001) define the four key questions crucial to any learning experience:

1) The learning question (*the question of the learning outcomes*)
2) The instruction question (*how instruction is delivered to maximize learning*)
3) The assessment question (*valid and accurate assessment of learning*)
4) The alignment questions (*harmony between learning outcomes, assessment, and instruction*) (p. 6).

This article focuses on the first question of crafting learning outcomes in terms of Bloom's taxonomy of educational objectives, McTighe and Wiggins' backward design, and Vygotsky's ZPD. The goal is to show that Bloom's taxonomy of learning is still a valid tool in designing learning outcomes that drive the whole process of course design.

2. Decoding the 'Trinity' of Domains in Bloom's Taxonomy

Developed within a neo-behaviorist framework, Bloom's taxonomy deals with the process of learning in terms of *'learning domains'*. Basically, the behaviorist theory dissects phenomena and analytically studies them in bits and pieces, and this why we have three domains of learning in Bloom's taxonomy of educational objectives.

2.1 The Cognitive Domain

As shown below, there are radical changes in the revised taxonomy of the cognitive domain. Learning is an active process of change and for this reason ***ing-forms*** replace the abstract terms of the old taxonomy. Additionally, the upper two levels (*synthesis* and *evaluation)* are switched, *synthesis* changes to *creating*, and '*comprehension'* to '*understanding'*.

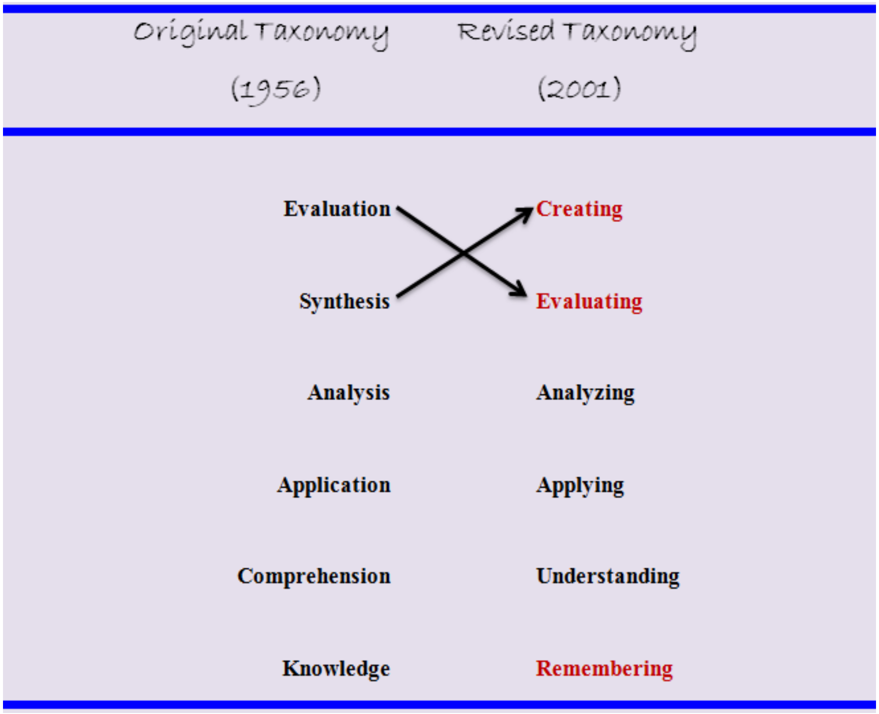

Figure 2.1. Old vs. Revised Taxonomy

Yet, the key change is that Bloom's revised cognitive domain has now two components: *the cognitive process dimension* and *the knowledge dimension*. This is a giant step away from the old taxonomy which suffers from odd epistemological misperceptions of both *knowledge* and *cognition*. The new taxonomy celebrates a brave new world where *knowledge* is no longer seen as a level of learning but a dimension which embraces the six levels of cognitive processes of learning and goes beyond.

Table 2.1. The Revised Cognitive Domain in Bloom's Taxonomy

Two Dimensions of the Cognitive Domain			The Cognitive Process Dimensions					
			Remembering	**Understanding**	**Applying**	**Analyzing**	**Evaluating**	**Creating**
The Knowledge Dimensions	Factual Knowledge	Knowledge of terms, specific details, etc.						
	Conceptual Knowledge	Knowledge of principles, generalizations, models, etc.						
	Procedural Knowledge	Knowledge of algorithms, techniques, procedures, and when to use the appropriate ones.						

	Metacognitive Knowledge	Knowledge of one's own cognition and knowledge about cognitive tasks in relation to subject-matters.						

(Adapted from: Krathwohl, Airasian, Cruikshank, Mayer, Pintrich, Raths, and Wittrock, 2001)

Table 2.2. A Sample of Action Verbs in each of the Six Cognitive Levels

Cognitive Level	**Description**	**A Sample of Action Verbs in each Cognitive Domain**
Remembering	Exhibit memory of previously learned material by recalling facts, terms, basic concepts, and answers.	recognize, choose, identify, select, match, label, name, read, quote, recite, state, reproduce, outline, recall, repeat, locate, define
Understanding	Construct meaning from instructional messages, including oral, written, and graphic communication by organizing of facts and ideas comparing, translating, interpreting, giving descriptions, and stating main ideas.	classify, explain, select, tell, illustrate, express, give example, show, **categorize**, paraphrase, defend, interpret, **distinguish**, **interrelate**, extend, indicate, paraphrase, restate, estimate, indicate, convert, represent, translate generalize
Applying	Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way.	organize, **grade**, calculate, divide, subtract, modify, use, compute, add, multiply, prepare, solve, change, dramatize, solve, produce, **design**, complete, sketch, operate
Analyzing	Examine and break information into partsby identifying motives or causes. Make inferences and find evidence to support generalizations.	identify, detect, discriminate, **interrelate**, breakdown, develop, infer, relate, **distinguish**, **categorize**, separate, subdivide
Evaluating	Present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria.	assess, **grade**, judge, contrast, measure, defend, critique, test, examine, rank, rate, compare, contrast, determine, justify, support, criticize, conclude
Creating	Compile information together in a different way by combining elements in a new pattern or proposing alternative solutions.	combine, compose, develop, rewrite, prescribe, propose, reconstruct, hypothesize, formulate, generate, produce, transform, devise, **design**, integrate, drive

But we should always be careful about the ***semantics*** of the verbs used in each of these cognitive levels. One *verb* might carry different senses that indicate different levels or types of learning, and this why there is a considerable overlap between the verbs across the six levels. Take for instance the verb '*grade*, which is in two levels of cognitive processes: *applying* and *evaluating*. If, for instance, one is using a system of grading that is already there (*whether it is criterion-referenced or norm-referenced*), this falls within the level of *applying*. But if one has to look into the various methods of evaluation to develop and use a valid grading system, this could be treated within the level of *evaluating*. A second example is the verb *'design'*. Basically, there are two key senses of 'design' as shown in **Figure 2.2**. The first sense (*in the case of the Twin Towers*) means to develop or invent a new plan (*targeting the level of creating*), whereas the second sense (*in the case of the building under construction in my neighborhood in Khartoum-Sudan*) means to use a plan already there without adding essentially new details (*targeting the level of applying*). While some architects and civil engineers might be involved in the second sense of 'design', *those who develop new models in architecture or engineering* are virtually involved in the first sense of 'design'.

Twin Towers (Malaysia)

A Building in my Neighborhood (Khartoum-Sudan) Under Construction

Figure 2.2. Two 'Senses' of the Verb 'Design'

2.2 The Affective Domain

J. B. Machen, President of the University of Florida (2004–2014), celebrates the significance of *affective learning* in one of his very famous statements in which he proclaims: "I graduate 15,000 students a year. If I could turn out *half of them* with a sensitivity to sustainability and turn them loose on the world, that's a hell of a contribution" (Carlson, 2006). Still, the *scalar implicature* of Machen's statement alludes to the challenges encountered in realizing his worthwhile intention. Though research indicates that the affective domain is "the gateway to learning", argue Pierre and Oughton (2007), this area is often underestimated and the cognitive and psychomotor domains "take precedence." The affective domain, observe Markle and O'Banion (2014), is the "least applied and least understood of the taxonomy trilogy". First, affective learning "cuts across all learning domains, incorporating cognitive and behavioral learning in addition to exploring values and feelings" (Allen and Friedman, 2010). The table below, adapted from the earliest version of the taxonomy, would give a glimpse of the complexity of this domain of learning. Almost all verbs which describe activities targeted or measured at each level of the affective domain do basically describe cognitive learning and some have psychomotor dimensions.

Table 2.3. The Affective Domain in Bloom's Taxonomy

Category or 'level'	***Behavior descriptions***	**'Key words' (verbs which describe the activity to be trained or measured at each level)**
1) Attention	Being aware of or attending to something in the environment	ask, choose, describe, follow, give, hold, identify, locate, name, point to, select, sit, erect, reply
2) Response	Showing some new behaviors as a result of experience	answer, assist, aid, comply, conform, discuss, greet, help, label, perform, practice, present, read, recite, report, select, tell, write
3) Value	Showing some definite involvement or commitment	completes, demonstrate, differentiate, explain, follow, form, initiate, invite, join, justify, propose, read, report, select, share, study, work
4) Organization	Integrating a new value into one's general set of values, giving it some ranking among one's general priorities	adhere, alter, arrange, combine, compare, complete, defend, explain, formulate, generalize, identify, integrate, modify, order, organize, prepare, relate
5) Generalization	Acting consistently with the new value	act, discriminate, display, influence, listen, modify, perform, practice, propose, qualify, question, revise, serve, solve, verify

(Adapted from: Krathwohl, Bloom, and Masia, 1964).

Second, even in the cases we truly value and clearly articulate the learning outcomes in the affective domain, contends Shephard (2008), it is "notoriously difficult to assess performance and give credit for achievement." This is due to the challenges of "determining a student's values so that changes may be monitored" (p.94).

2.3 The Psychomotor Domain

This is the most controversial area in Bloom's taxonomy. From the early days of developing the taxonomy, there have been a lot of debates and doubts on crafting learning outcomes in the psychomotor domain. Bloom's original committee never attempted to write down the third handbook on the psychomotor objectives. Plus, Bloom, Engelhart, Furst, Hill, and Krathwohl (1956) write in the first handbook that "although we recognize the existence of this domain, we find so little done about it in secondary schools or colleges, that we do not believe the development of a classification of these objectives would be very useful at present" (pp. 7-8). Nevertheless, several psychomotor domains were constructed by Simpson (1966), Dave (1970), Harrow (1972), and other educationalists. Generally, this domain of learning involves psychomotor skills such as coordination, grace, speed, manipulation, strength, distance, and actions which demonstrate the fine motor skills such as use of precision instruments, or actions which evidence gross motor skills such as the use of the body in dance or athletic performance.

The simplest psychomotor taxonomy is the one from Jordan, Carlile, and Stack (2008), which the authors ascribe to the original Bloom's taxonomy of 1956.

Table 2.4. Jordan, Carlile, and Stack's (2008) Model of the Psychomotor Domain

Category or 'level'	***Behaviors***
Procedural task knowledge	Stating procedures, listing sequence of actions, following instructions
Partial performance	Performing individual elements of a psychomotor skill
Coordinated performance	Combining individual elements of a psychomotor skill
Conscious control	Displaying competence with concentrated effort
Mastery	Acting automatically with smooth and effortless expertise

(Adapted from: Jordan, Carlile, and Stack, 2008, p. 29, based on Bloom and Krathwohl 1956)

More psychomotor taxonomies were developed by different researchers on the basis of the original classification attributed to Bloom's taxonomy. Below are the three major contributions made:

Table 2.5. Simpson's (1966) Model of the Psychomotor Domain

Category or 'level'	***Behavior descriptions***	**'Key words' (verbs which describe the activity to be trained or measured at each level)**
Perception	*awareness*	recognize, notice, touch, hear, feel, choose, describe, detect, differentiate, distinguish, identify, isolate, relate, select
Set	*readiness*	arrange, prepare, get, begin, display, explain, move, proceed, react, show, state, volunteer

Guided Response	*attempt*	imitate, try, copy, trace, follow, react, reproduce, respond
Mechanism	*basic proficiency*	make, perform, shape, complete, assemble, calibrate, construct, dismantle, display, fasten, fix, grind, heat, manipulate, measure, mend, mix, organize, sketch
Complex Overt Response	*expert proficiency*	coordinate, fix, demonstrate, calibrate, construct, dismantle, display, fasten, fix, grind, heat, manipulate, measure, mend, mix, organize, sketch
Adaptation	*adaptable proficiency*	adjust, integrate, solve, alter, change, rearrange, reorganize, revise, vary
Origination	*creative proficiency*	design, formulate, modify, re-design, trouble-shoot, arrange, build, combine, compose, construct, initiate

Table 2.6. Dave's (1970) Model of the Psychomotor Domain

Category or 'level'	*Behavior descriptions*	'Key words' (verbs which describe the activity to be trained or measured at each level)
1. Imitation	*Copy action of another; observe and replicate*	copy, follow, replicate, repeat, adhere, attempt, reproduce, organize, sketch
2. Manipulation	*Reproduce activity from instruction or memory*	re-create, build, perform, execute, implement, acquire, conduct, operate
3. Precision	*Execute skill reliably, independent of help, activity is quick, smooth, and accurate*	demonstrate, complete, show, perfect, calibrate, control, achieve, refine
4. Articulation	*Adapt and integrate expertise to satisfy a new context or task*	solve, adapt, combine, coordinate, revise, integrate, adapt, develop, formulate, modify
5. Naturalization	*Instinctive, effortless, unconscious mastery of activity and related skills at strategic level*	construct, compose, create, design, specify, manage, invent, originate

The basic difference between Dave's and Simpson's models could clearly be seen in the number of levels in each. Simpson's (1966) psychomotor domain incorporates two levels (perception and set), prior to the level of guided response (imitation), which is the first level in Dave's (1970) model. Obviously, however, both models incorporate some sort of cognitive learning (*perception, set/ imitation*). Hence, we have to be extremely cautious when we use verbs in these levels of the psychomotor domains as specified by Simpson and Dave. What is more confusing is that a lot of the verbs used in the psychomotor domains overlap with those in cognitive and affective domains. Harrow's model, however, attempts to focus on psychomotor learning in terms of the development of psychomotor forms, and thus uses very few action verbs to describe psychomotor learning as shown below:

Table 2.7. Harrow's Model of the Psychomotor Domain

Category or 'level'	***Behavior descriptions***	**Verbs which describe the activity to be trained or measured at each level)**
1) Reflex Movement	*involuntary reaction*	react, respond
2) Basic Fundamental Movements	*basic simple movement*	grasp, walk, stand, throw
3) Perceptual Abilities	*basic response*	catch, write, explore, distinguish using senses
4) Physical Abilities	*Fitness*	endure, maintain, repeat, increase, improve, exceed
5) Skilled Movements	*complex operations*	drive, build, juggle, play a musical instrument, craft
6) Non-discursive Communication	*meaningfully expressive activity or output*	express/ convey feeling and meaning through movement and actions

Still, in Harrow's third level, cognitive learning emerges and in the last level of 'non-discursive communication', psychomotor and affective learnings merge. *However, in all the psychomotor domains proposed, there is no definitive construct of the psychomotor learning that sets the distinction between this type of learning and cognitive or affective learning.* As well, there is no clear boundary between psychomotor actions and general physical actions not targeted in the psychomotor domain.

One example which clearly illustrates the distinction between general physical actions and psychomotor learning is the case of sign language which uses hands, arms, and body language to communicate meaning. Sign language is a complex cognitive system of natural language that shares strong similarities and parallels with spoken languages. The figures below illustrate the postulation that ‘sign language’ is a form of cognition rather than a psychomotor skill:

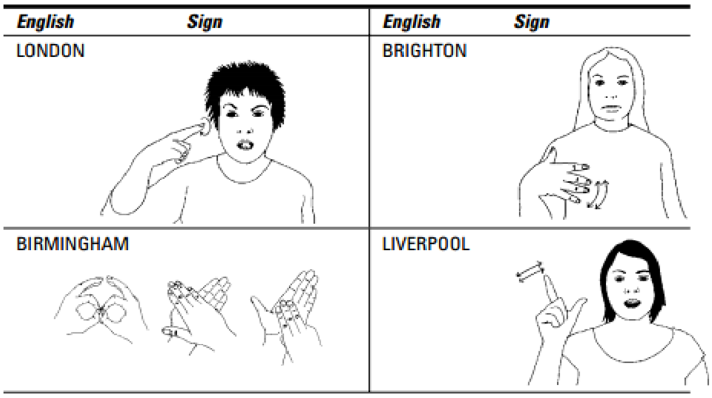

Figure 2.3. Names of Four Cities in British Sign Language (BSL) (City Lit Faculty of Deaf Education and Learning Support, 2008, p. 184)

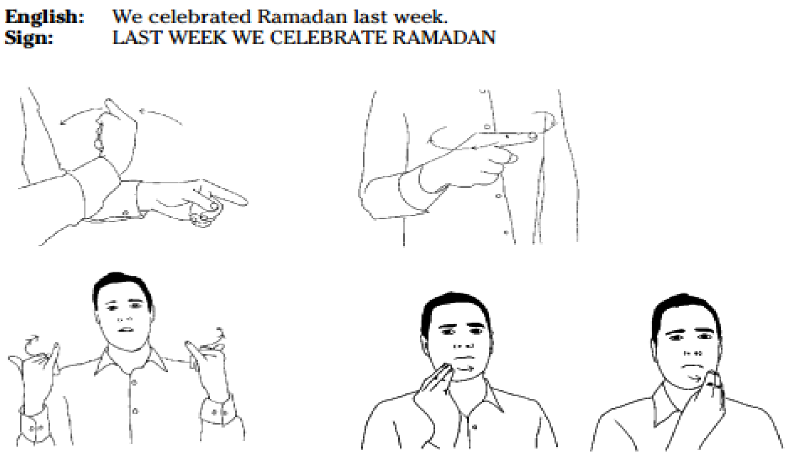

Figure 2.4 We celebrated Ramadan last week in BSL (City Lit Faculty of Deaf Education and Learning Support, 2008, p. 184)

A second instance could be illustrated by the verb ‘***type***’ which can be used to target different modes of learning. Below are two distinct learning outcomes which use the same verb but with different senses that target two different domains of learning:

1) **Learning Outcome (1);**

   In this module, candidates will be able to **type** around 325 to 335 character per minute (CPM). **[*A learning outcome that basically targets a psychomotor skill*].**

2) **Learning Outcome (2):**

   In this module, candidates will be able to **type** real-life sentences on three keyboards: English, Hebrew, and Arabic. **[*A learning outcome that basically targets a cognitive skill*].**

2.4 A Unified Template for Learning

In her abstract to the classification of educational objectives in the psychomotor domain, Simpson (1966) stresses the fact that "much work is needed in terms of the relationships among the three domains" and in terms of an inclusive "action-pattern" model that is beyond the cognitive, affective, and psychomotor domains. Simpson's statement echoes voices which aspire to create a domain that reflects a holistic or "organismic" view of the "nature of an individual's abilities and performance". Within this view, a "human being thinks, feels, and moves as an integrated whole, and thus within an individual the abilities to do these things are inextricably linked" (Goldberger, 1980, p.1). In his memorable *'Death in the Afternoon'* Hemingway writes: "*The dignity of movement of an ice-berg is due to only one-eighth of it being above water*". This is exactly the case of human learning. An iceberg is one unified piece of which seven eighths remain unseen. But they are those seven eighths which are the source of the 'dignity' of movement of the iceberg. Whenever we could see and measure the one eighth of skill, cognition, or affective attributes, we have to acknowledge the hidden part of the iceberg. Let's take, for instance, the case of learning how to drive a car to uncover the unnoticed bulk of the iceberg in any learning process across the three domains.

Learning how to drive a car is essentially learning of a psychomotor skill which could be analyzed in terms of 1) *procedural task knowledge, 2) partial performance, 3) coordinated performance, 4) conscious control,* and *5) mastery*.

Table (2.8). Stages of psychomotor development: Car driving (Adapted from Jordan, Carlile, and Stack, 2008, p. 176)

Stage of development	**Starting a stationary car**
Procedural task knowledge	Knowing how to start a car
Partial performance	Able to depress the clutch
Coordinated performance	Able to use clutch and gear stick-shift together
Conscious control	Able to perform complete sequence of action while thinking about it
Unconscious mastery	Able to start a car without thinking about it

Obviously, this psychomotor skill has both very strong cognitive and affective bases. The cognitive basis of this psychomotor skill is clearly seen in the first step of *procedural task knowledge*. The excerpts below from 'North Carolina Driver's Handbook' (2014), with a slight reordering of '*components of test requirements'* for a driver license, remarkably illustrate the fact that both the cognitive and affective domains are the genesis of psychomotor learning.

The Excerpts

(1) Health Requirements

Individuals may not be licensed if they suffer from a mental or physical condition that might keep them from driving safely

(2) Traffic Signs

All the information on the traffic signs test is in this handbook. To pass the signs test, you must identify the traffic signs by color and shape and explain what each means.

(3) Knowledge Test

The knowledge test is about traffic laws and safe driving practices.

(4) Driving Skills

The driving test is an on-the-road demonstration of your driving ability. You must perform this test after you have passed all the other tests. During the on-the-road test, you will be given an opportunity to perform basic driving patterns and to show your ability to drive safely with traffic (p.9).

Whereas components (2) and (3) are cognitive, component (1) is essentially affective. Assessment of the core skill (*on-the-road driving test*) must happen only if the affective and cognitive requirements are satisfied. The figure below vividly illustrates the integration and unity of the trilogy in learning '*how to drive a car'*, using the iceberg awesome analogy.

Figure 2.7. Integration of Domains of Learning: The Iceberg Analogy

Jean Piaget (1896-1980), the pioneer of cognitive constructivism, notes that "at no level, at no state, even in the adult, can we find a behavior or a state which is purely cognitive without affect nor a purely affective state without a cognitive element involved" (cited in Clark and Fiske, 1982, p.130). Osborne (1986) acknowledges that development of manipulative skills needs a blend of the mind and muscle and that the early stages of psychomotor learning are guided by cognitive processes (p. 54). Plus, Osborne isolates five "*Psychomotor Skill Variables*" which are:

1) Motivation,
2) Demonstrations,
3) Physical practice,
4) Mental practice, and
5) Feedback/Knowledge of results (p. 54).

Psychomotor learning, as seen in Osborne's five variables, is embedded in a matrix of both affective and cognitive learning. Osborne (1986) further adds:

> As noted by Johnson (1979), the early stages of psychomotor skill acquisition are primarily cognitive in nature. During this stage, teachers need to help their students think

> through the mechanics of performance. Although mental practice has been found to enhance skill acquisition at any time (Beasley & Heikkinen, 1983), it is most effective during the cognitive stages (Johnson, 1979). The fairly large body of research on mental practice indicates that when interspersed with physical practice, it is most effective in improving performance, followed by physical practice only and mental practice only. Research has also shown that mental practice alone, if it follows a demonstration or videotape of the skill being performed, does enhance skill acquisition (p. 55).

All these statements about the unity of the trinity of domains of learning might better be captured in the model below:

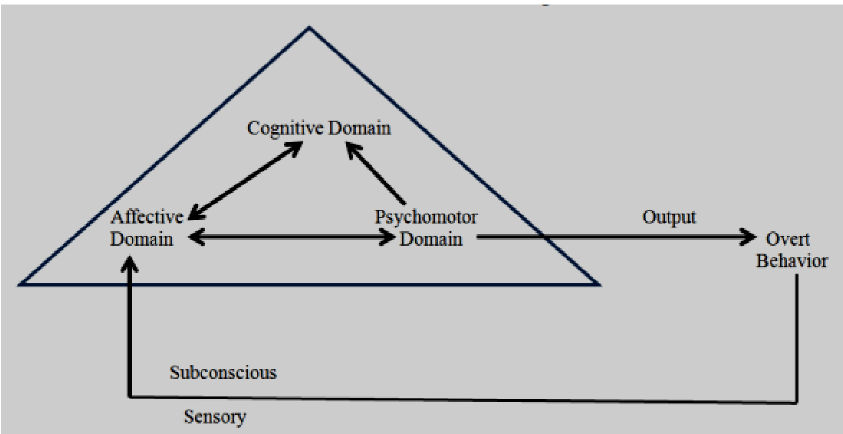

Figure 2.6. Eiss' Model for Learning: An Inclusive Template of Learning (Adapted from Micklich, 2012, p. 166)

From this model, it is very clear that "thinking skills, affective skills, and psychomotor skills are often interrelated. Communication skills, for example, include both cognitive and psychomotor elements" (Banta and Palomba, 2015, p. 68). My view regarding the relationship between both psychomotor and affective learning and *cognition* is that the growth and intensity of psychomotor skills increase with detachment from cognition, whereas the progress and intensity of affective attributes increase with movement towards cognition. The figure below visually illustrates this hypothesis:

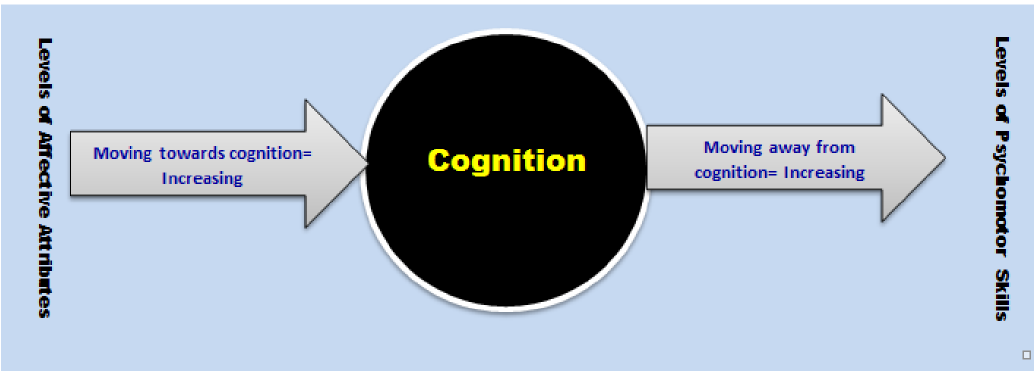

Figure 2.7. Intensity of Psychomotor Skills and Affective Attributes in Relation to Cognition ®

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3. Backward Design for Quality Assessment

Backward design is not a new concept. In 1948 Ralph Tyler articulated a similar approach to curriculum design (McTiche and Wiggins, 2004, p. 25). Bloom's taxonomy and its revision by Anderson and Krathwohl lays out the different educational aims and what they require of assessment. Robert Gagné (1977) and Robert Mager (1988) "have long taught people how to analyze different outcomes and what they require of learning; more recently, William Spady (1994) popularized the idea of 'designing down' from exit outcomes" (Wiggins and McTighe, 2011, p. 7). Nevertheless, the model of backward design is mainly associated with Wiggins and McTighe and their seminal book 'Understanding by Design'.

In the relevant literature, Wiggins and McTighe's backward design is always linked to Biggs' constructive alignment. Constructive alignment builds on both constructivist learning theories in psychology in which learners construct their own learning and interpret the world by themselves, and the principle of alignment in curriculum in which learning outcomes, teaching methods used, and assessment tasks are aligned to each other and all are "tuned to learning activities addressed in the desired learning outcomes" (Biggs, 2007). In cconstructive alignment, learning outcomes "specify the activity that students should engage … as well as the content the activity … The teacher's tasks are to set up a learning environment that encourages the student to perform those learning activities, and to assess student performances against the intended learning outcomes" (Biggs and Tang, 2011, p. 97).

The theory of backward design goes one step beyond constructive alignment to specify the order of executing the three components aligned. Compared with the Tyler's model, Wiggins and McTighe's model (introduced in 1998) is simpler and more explicit in stating the role of assessment:

Table 2.8. Tyler's Model vs. Wiggins and McTighe's Model

Tyler's (1949) Four Fundamental Questions	Wiggins and McTighe's (1998) Stages in the Design Process
1. What educational purposes should the school seek to attain? ↔	1. Identify desired results
2. What educational experiences can be provided that are likely to attain these purposes?	
3. How can these educational experiences be effectively organized?	
4. How can we determine whether these purposes are being attained? ↔	2. Determine acceptable evidence
	3. Plan learning experiences and instruction

(Reproduced from Cho and Trent, 2005, p. 105).

Wiggins and McTighe (2005) explicitly maintain that assessment evidence should clearly be set before planning learning experiences and instruction. The process starts with the end - *the desired outcomes*- and then derives the curriculum from the evidence of learning (*assessment*). The diagram below illustrates the pathway of the backward design model:

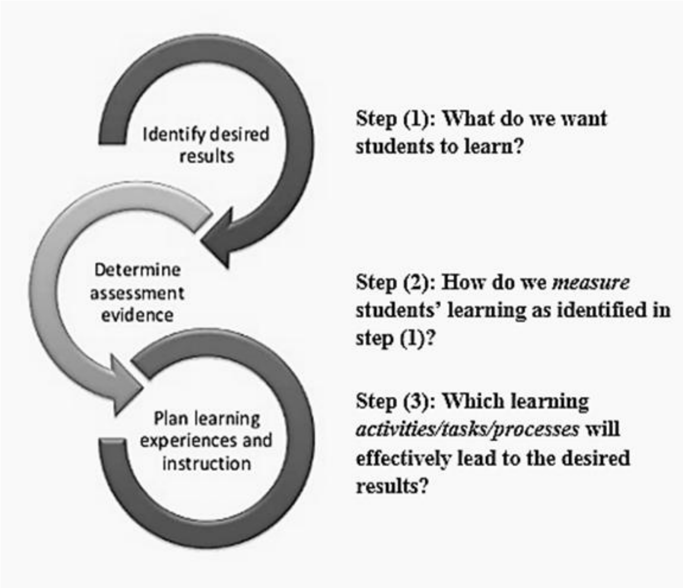

Figure 3.1. The Model of Backward Design (Adapted from Espinosa, 2013)

4. Vygotsky's Zone of Proximal Development and Learning Outcomes

The Russian psychologist Lev Vygotsky (1896-1934), often referred to as the '*Mozart of psychology*', is a milestone in the contemporary educational theory. His socio-cultural approach is one of the distinctive models that have significantly shaped the theory of learning in today's world. Zone of proximal development (ZPD) is probably the most widely used Vygotskian's term in the literature of educational psychology. Vygotsky stresses the role of guidance in developing learner's abilities, when the teacher guides the learners "towards performing actions or tasks which are just beyond their current capacity". With such guidance, learners can perform beyond their own ability – within certain limits. Vygotsky defines these limits as the 'Zone of Proximal Development', which is the gap between the level of tasks that can be performed with more knowledgeable other's (MKO) guidance and scaffolding, and the level of tasks that could independently be solved (Dolya, 2010, p.9).

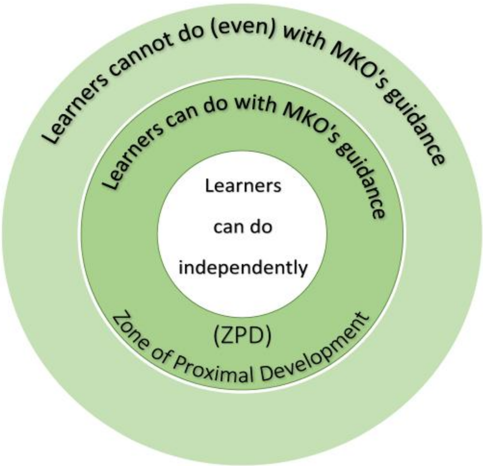

Figure 4.1. Vygotsky's Zone of Proximal Development

Writing effective learning outcomes should target this ZPD in order to make both assessment tasks and instructional activities valid and useful. If learning outcomes focus on what *the learner can do unaided* or what the *learner cannot do even with guidance*, then the whole endeavor will be meaningless.

5. Crafting Learning Outcomes

5.1 Learning Outcomes vs. Objectives

Learning outcome-based curriculum represents a drastic move from traditional models which focus on inputs such as textbooks, content, and teaching hours, to a 'student-centered' learning, which emphasizes students' learning (output) in terms of students' cognitions, skills, and affective attributes. In the relevant literature there is a proliferation of definitions of the terms *objectives* and *learning outcomes*. Basically, no distinction is postulated between the two terms as they are often used interchangeably by most educationalists and researchers in the field.

As first suggested by Tyler (1933), objectives "should be explicitly formulated in terms of the changes in student behavior which they were intended to bring about" (Guilbert, 1984, p. 134). Bloom, Engelhart, Furst, Hill, and Krathwohl (1956) define objectives as "the changes produced in individuals as a result of educational experiences" (p.12). In their outstanding revision of *'Bloom's Taxonomy of Educational Objectives'*, Anderson, Krathwohl, Airasian, Cruikshank, Mayer, Pintrich, Raths, and Wittrock (2001) maintain that

> regardless of how they are stated and what they are called, *objectives* are present in virtually all teaching. Stated simply, when we teach, we want our students to learn. What we want them to learn as result of our teaching are our objectives (p. 3).

In the footnotes on the same page, they additionally add that throughout the book they "use the term *objectives* to refer to intended student learning outcomes. Thus, *objectives*, *curriculum standards*, and *learning goals* all refer to intended student learning". They further add that "*objective* is not the only term used to describe an intended student learning outcome" (p. 18). In the conclusion of their meticulous analysis of the question of objectives, Anderson, Krathwohl, Airasian, Cruikshank, Mayer, Pintrich, Raths, and Wittrock (2001) succinctly state that their model is a tool that helps to convey what we intend students to learn as a result of instruction or "instructional objectives" which are written in "a standard format for stating objectives: "The student will be able or learn to, verb noun," where the verb indicates the cognitive process and the noun generally indicates the knowledge" (p. 23).

Nonetheless, due to the negative connotations of the term '*objectives*' which result from the paradigm shift to student-centered learning, some experts suggest that the term 'objectives' should be abandoned altogether. Moon (2002), for instance, maintains that

> basically the term 'objective' tends to complicate the situation, because objectives may be written in terms of teaching intention or expected learning… This means that some descriptions are of the teaching in the module and some are of the learning… This general lack of agreement as to the format of objectives is a complication, and justifies the abandonment of the use of the term 'objective' in the description of modules or programs (p. xx).

In the 4th edition of their seminal book, *Teaching for quality learning at university*, in detail Biggs and Tang (2011) propose what they believe to be the distinction between objectives and learning outcomes:

> In the first edition of this book, we used the term 'curriculum objectives' or just 'objectives' for the intended outcomes of a course. We now think the term 'intended learning outcome' (ILO) is better because it emphasizes more than does 'objective' that we are referring to what the student has to learn rather than what the teacher has to teach. 'Intended learning outcome' clarifies what the student should be able to perform after teaching that couldn't be performed previously – and there may well be outcomes that are a positive outcome of teaching that weren't intended. The term 'objective' was intended to have the latter, student-centered, meaning but ILO makes it absolutely clear that the outcomes are from the student's perspective. The term 'objective' also may recall in older readers the problems associated with 'behavioral objectives'.

From this detailed discussion, it is unambiguously clear that there is no 'real' difference between the terms 'objectives' and 'learning outcomes' in the relevant literature though some researchers and educationalists have unconvincingly attempted to use the two terms in entirely different senses. In fact, there is no clear logic or benefit in writing separate '*objectives*' and '*learning outcomes*' for any particular course or module. On the contrary, this will be a source of both conceptual confusion and practical discrepancies.

5.2 Components of a Learning Outcome

Mager (1975) postulates a rigorous template for writing learning outcomes. His ABCD model includes the following components:

1) Audience: describes the intended learners or end users of the instruction.

2) Behavior: describes the learners' ability in terms of cognitive, psychomotor, and affective domains.
3) Condition: Tools and contexts for completion of the behavior.
4) Degree: States the standard for acceptable performance (time, accuracy, proportion, quality, etc.)

Yet, Mager's (1975) ABCD model for writing instructional objectives is pretty complicated. The model, for instance, confuses learning outcomes with assessment tasks. In Mager's model, the acceptable degree of performance (*which is part of the assessment component*) should clearly be stated in the learning outcome. But experience shows that these two elements must be ***aligned*** not ***merged***. In most cases, specifying the threshold for performance or achievement for a particular learning outcome couldn't be explicitly or directly put in the statement of the learning outcome itself. This is because specifying this component is in most cases entails complex variables dependent on other parameters. In 2013, I surveyed online learning outcomes for sixty-two courses across different disciplines at different universities and institutes worldwide. In almost none of these learning outcomes or objectives did Mager's standards for acceptable performance materialize.

Another approach to writing learning outcomes is suggested by Guilbert (1984) who isolates six qualities of any sound learning outcome. In Guilbert's model, a learning outcome must be:

(1) Relevant: it should be based on the particular construct targeted;
(2) Unequivocal: it unambiguously describes, *in terms of 'to do'*, the specific domain targeted;
(3) Feasible: it is doable within the time and facilities available to the students. This criterion is line of Vygotsky's ZPD. Guilbert (1984) succinctly writes: "Remember, too, the basic condition for feasibility: the minimum (practical, communication and intellectual skills) to qualify for the course. This is the *prerequisite level*" (p. 138).
(4) Logical: it must be internally consistent;
(5) Observable: there must be a way to measure progress towards the target;
(6) Measurable*: it must include an indication of acceptable level of performance* on the part of the student (139).

Realizing the difficulty of incorporating *measurability* within the statement of the learning outcome itself, Guilbert purposively uses the word '*indication*' to refer to what we must include in the learning outcome of the acceptable level of performance targeted. From all this discussion it could be suggested that the core statement of a learning outcome must contain a specific action (*action verb*) and an object (*usually a noun*):

1) The verb which specifies the actions associated with the intended process.
2) The object which describes what the students are expected to acquire or construct. (Anderson and Krathwohl, 2001, pp. 4–5)

This 'minimalist' approach would yield a simple, practical, and rigorous template of crafting useful learning outcomes. Such a schema truly embodies the power of a learning outcome which lies in selecting the appropriate *verb* that identifies and exactly describes what students can do to meet the learning goal. A learning outcome would better drive learning when the *verb* used indicates relevant instructional activities and correlates with valid assessment tasks.

5.3 Writing Learning Outcomes: A Real-World Experience

In 2012-2013, while revamping the applied linguistics program at Yanbu University College-(KSA), one of the courses that were entirely restructured is [STAT 101- Introduction to Statistics]. The course used to follow a very traditional plan which used Mendenhall, Robert. Beaver, and Beaver's '*Introduction to Probability and Statistics*', with no learning outcomes stated or mapped to the applied linguistics program. In the process of revamping the course, we clearly stated that the rationale for a course on statistics in the applied linguistics program is to help students acquire sufficient skills in handling statistical analyses within the context of **1. Research methods in linguistics, 2. Language testing,** and **3. Senior project**, three of the core courses in applied linguistics program. In order to come up with useful learning outcomes, all potential stakeholders were consulted with varying weights as shown below:

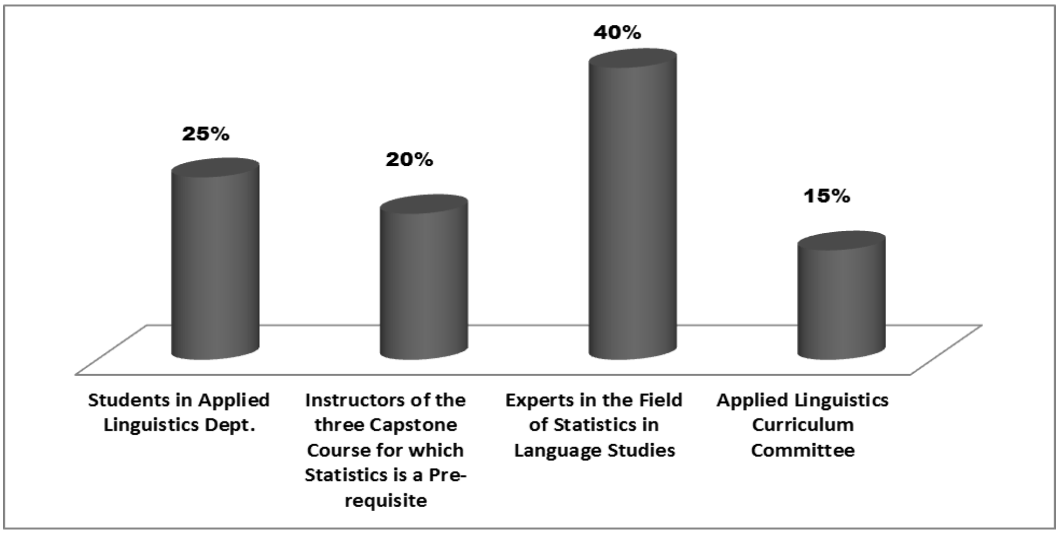

Figure 5.1. Stakeholders' Weights in Writing Learning Outcomes for Statistics in Linguistic Analysis

There is no space here to look into the contributions of each of the stakeholders in the diagram above. But one sample from applied linguistics students who took the traditional course of statistics, and who later recognized the use of statistics in doing linguistic research and educational assessment, would reflect the need and the value of listening to students' voices in crafting learning outcomes in a student-centered learning:

> When I took the Statistics course, using 'Introduction to Probability and Statistics as our course book, it was my first encounter with statistics. I remember at the start of the course we kept nagging about our mathematical competence; we said we did not have the mathematical 'problem solving' skills. The instructor used at the beginning PowerPoint presentations as the teaching method, then changed back to old school after our continuous grumbling. Regarding the content of the course, it was divided

> into two parts. The first part was about descriptive statistics. We took the difference between a population and a sample; we practiced how to calculate mode, median, mean, range and standard deviation. The problem was that it was not linked probably to our specialization, linguistics. The examples were 'business' oriented. We kept arguing how would this course help us when it comes to linguistics. We did not say it in plain words for the instructor, but hints were everywhere! Though we did not have the full passion for the course, but the instructor kept saying: "You have the right learning attitude." Descriptive statistics was fun for us, but with no real implication when it comes to linguistics. The second part of the course was about inferential statistics. To be honest, I do not remember anything but the number of cards in a card game, and the sides of a dice. We really struggled with the second part of the course. We did not find any real benefit; I do not know whether I should blame our ignorance or the course itself! I thought that it should be more related to our major. The bottom-line, we studied for the grades, and we had that postulation that the course benefits will end by passing it. There were no authentic practical side of statistics, only theories and applying them on paper. All in all, I think the course should be linked to linguistics and our future research. The only positive thing I took from the course is that now I have terms (keywords) to google and link to linguistics; special thanks are due for YouTube!! (Mohammed A. Aljohani, personal communication via email, April 4, 2013).

This feedback sums up the views of almost the twenty-four applied linguistics students (males and females) surveyed through an open-ended questionnaire in 2012-2013. The results of qualitative analysis were instrumental in crafting the learning outcomes for the new statistics course. In some cases, students' needs-analysis should be the starting point to design perquisites for capstone courses in a program.

Table 3. 1: A Sample of Learning Outcomes: STAT 327- Statistics for Linguistic Analysis (Dept. of Applied Linguistics, Yanbu University College, KSA**)**

The Cognitive Domain
1) **Use descriptive statistics in collecting, organizing, and summarizing relevant linguistic data.** 2) **Use inferential statistics to test hypotheses in linguistic analysis and educational assessment.** 3) ****Run SPSS for basic operations: data entry, naming variables, etc.** 4) **Choose the right procedures for testing relevant hypotheses on SPSS and explain rationales for choices made.** 5) **Interpret SPSS results for hypothesis testing and explain the basis of each interpretation.** 6) **Assess the statistical procedures used in one relevant quantitative research article to replicate its statistical procedures in real-life scenarios.**
The Psychomotor Domain
7) Perform various basic operations on SPSS with fair precision and speed.

The Affective Domain
8) Adapt relevant learning strategies to group-work and collaborative learning. **9) Share insights gained through personal reflection and group work.**

** Psychomotor learning is involved as well.

5.4 Backward Design: A Real-World Case

A sub-learning outcome of the second major learning outcome in table [3] -[Use inferential statistics to test hypotheses in linguistic analysis and educational assessment]- is explicated and integrated below within the framework of backward design:

Dimensions	**Details**
1) What do we want the students to learn? **(*Learning Outcome*)**	Assess the use of the correction for guessing formula in scoring MCQs in real-life situations. ***(Evaluating)***
2) How do we check the students' learning? **(*Assessment*)**	• ***Summative Assessment:*** Students will survey stakeholders to assess the pros and cons of the formula for correction for guessing after all the series of learning activities/tasks below are assessed. • ***Formative Assessment*** Will be embedded into the learning activities (Assessment for/as learning)
3) Which learning activities/tasks will lead to the desired results? **(*Learning Activities*)**	A series of activities/tasks will be assigned to students in order to attain the intended learning outcomes: Students will 'google' it to identify the correction for guessing formula: $CS = R - \frac{W}{N-1}$ ***(Remembering)*** 1) Students will cooperatively/collaboratively work to explain the different components of the formula: In the formula above: • **CS** means (corrected scores in a multiple choice test) • **R** means (scores for right answers in the test) • **W** means (scores for the wrong answers in the test; unanswered items are not counted) • **N** means the number of options in MCQ items ***(Understanding)***

2) Students will use the formulas to solve real-life problems:

In an objective test made of 120 MCQ items (where each item is made of two distractors and a key and each item is allocated one [1] mark), Elan scored 94 marks. Calculate Elan's true score using the correction for guessing formula.

(Applying)

3) Students break down the components of the formula in order to discover the relationships between them and detect the logic that underlies the formula and its components:

- This formula assumes that when you come to a specific recognition items (***like MCQs***), you either have the knowledge to answer it correctly or you do not. In this sense the formula builds on the classical test theory which assumes that:

  $Obtained\ Score = True\ Score - Random\ Errors$

- In the correction for guessing formula CS is the (True Score), R is the (Obtained Score), and $\frac{W}{N-1}$ is the (Random Errors).

- Basing on (2), we could derive the correction for formula guessing as below:

- $Obtained\ Score - Random\ Errors = True\ Score - \cancel{Random\ Err}$

  $Obtained\ Score - Random\ Errors = True\ Score$

  $True\ Score = Obtained\ Score - Random\ Errors$

- Why do we use the formula $N - 1$? N stands for the number of the options, and it is the number of the options which decides the magnitude of random guessing. Now, if we have for instance a 10-item T/F test, in each item we have only two options. The chance of randomly answering each item correctly is 50/50, or $^1/_2$, and thus if one answers 8 items correctly and 2 items incorrectly, the corrected score will be calculated as thus:

  - $CS = 8 - \frac{2}{2-1} = 8 - 2 = 6$
  - In case we have three options, the chance of answering any item correctly decreases to become $^1/_3$, and thus the corrected score would be calculated as follows:

	○ $CS = 8 - \frac{2}{3-1} = 8 - 1 = 7$ ***(Analyzing)***
4) What is the 'learning outcome' or 'cognitive level' that is beyond the students' zone of proximal development (ZPD) regarding the correction for guessing formula?	• Develop/generate your own formula for correction for guessing. • Creating (*the highest level in the cognitive domain*) is virtually beyond the students' ZPD.

6. Implications and Recommendations

Through analysis of the trilogy of domains of Bloom's taxonomy, the article aims to present some fresh insights into how to use this taxonomy along with Wiggins and McTighe's (2005) model of backward design and Vygotsky's ZPD, to draw a roadmap for crafting learning outcomes which is the keystone in effective course design. Critical analysis throughout the different sections indicates that due to its simple and flexible structure, Bloom's taxonomy is one of the most useful tools in course design. When blended with relevant models and approaches, the framework can lead to *effective design* in terms of learning outcomes, assessment tasks, and instructional activities. In conclusion, there are some implications and recommendations which may be useful in crafting learning outcomes that drive assessment tasks and instructional activities within the roadmap suggested in this article:

1) Writing learning outcomes is a highly dynamic multi-dimensional process. Bloom's taxonomy is not a panacea or an 'elixir' guaranteed to bring a magical effect. There are several contextual and pragmatic considerations which significantly contribute to crafting learning outcomes within any particular context.

2) Bloom's taxonomy is not an educational dogma. The taxonomy is never intended to be definitive but a framework in progress. Bloom himself warns against granting authority to the taxonomy that would "freeze" thinking about curriculum, assessment, and instruction (Munzenmaier, and Rubin, 2013, p. 17). Course designers should thus feel free to adapt the basic principles of the taxonomy and appreciate their implications in each particular context. As Posner (1988) aptly puts it, "a 'complete' curriculum planning model is not what the field needs. The field needs curriculum planners not only able to use various models but also aware of the implications of their use" (p. 94). In line with Posner's view, Anderson and Krathwohl (2001) aptly conclude that the taxonomy couldn't directly dictate "what is worth learning", but rather intended to help teachers "translate standards into a common language for comparison with what they personally hope to achieve, and by presenting the variety of possibilities for consideration, the

taxonomy may provide some perspective to guide curriculum decisions" (p. 7).

3) In crafting learning outcomes in a particular context, one domain of Bloom's taxonomy could be more dominant, and learning outcomes in a particular course or module might not be equally distributed in terms of the trilogy of domains. A key fact about all taxonomies is that their "levels are not equally valuable to us on an everyday basis… one level is more salient – i.e. more readily used and noticed – than the others." (Murphy, 2010, p. 15). Often some tasks may span multiple domains of learning as they require affective, cognitive, and psychomotor learning. In writing a learning outcome to describe the desired effect in each of these tasks, usually we choose to craft this learning outcome in terms of the dominant dimension.

4) The designation of 'knowledge' in the revised taxonomy of the cognitive domain has a colossal impact on the structure of the taxonomy and may generate new understandings of the function of Bloom's learning taxonomy. In my view, this revision may lead to the integration of the trilogy of domains and allows accommodation of the whole taxonomy into a new model which embraces recent insights and approaches to learning.

5) The classification of the taxonomy into *lower-order thinking* (LOT) and *higher-order thinking* (HOT) negatively affect the internal consistency of the taxonomy. Levels of the cognitive domain are interrelated and overlapping. Use of a particular level in the cognitive domain is determined by the context of use and other variables. It should be noted here that the phrases *'lower-order'* and *'higher-order'* thinking appear nowhere in the revised taxonomy, which speaks of levels of cognitive complexity rather than lower and higher thinking. Even the old taxonomy does not explicitly state this concept of LOT vs. HOT which later mars most of the literature about the taxonomy.

6) Though theoretically it might be easy to define psychomotor learning, this domain needs special care when it comes to isolate action verbs to write learning outcomes that involve psychomotor skills. There is a sort of indeterminacy in defining levels of psychomotor domain as well as verbs used to describe them as indicated in the three major psychomotor domains explored in this article.

7) Learning outcomes in the affective domain thrive most at the level of the program and capstone courses. Formative assessment and instruments of measuring consequential validity are the best tools for assessing affective learning.

8) Course designers should avoid the unnecessary confusion of creating two sections of *'objectives'* and *'learning outcomes'* prompted by the ***'myth'*** that there is a distinction between the two terms. Review of the relevant literature shows beyond doubt that the authors of Bloom's taxonomy make no distinction between the two terms. In fact, the revised cognitive domain uses the two terms interchangeably.

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