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Bloom's Taxonomy of Educational Objectives: A Psychomotor Skills Extension for Engineering and Science Education*

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Bloom's taxonomy of educational objectives has been a useful tool for many educators over several decades. Bloom's taxonomy divided educational outcomes into three distinct domains: the cognitive, affective and psychomotor; it provided a hierarchical taxonomy of outcomes in each of the cognitive and affective domains. Several psychomotor taxonomies have been developed for the K-12 level of basic skills development. These taxonomies are not particularly helpful in relation to development of professional level psychomotor-related skills. This paper presents a theory of the nature of knowledge and a taxonomy of psychomotor domain outcomes adapted to trade and professional level skills involving the practical performance of work.

Keywords: Bloom's taxonomy; psychomotor domain

1. INTRODUCTION

SOME DISCIPLINES in higher education aim to develop students' practical ability to perform tasks associated with the discipline as part of the educational process. These disciplines are fields in which normal practice of the field requires a combination of knowledge about the situation of work and ability to work with appropriate tools to do tasks, for example medicine and some engineering work, or to plan for tasks to be done by others, which is very common in many engineering roles. The kind of knowledge required to support these roles involves both the cognitive and psychomotor domains, and in some situations might involve the affective domain. Teaching psychomotor skills requires a situation in which students do practical tasks for the purpose of learning the effect of their action and to develop skill in the performance of the tasks.

The laboratory work required to teach engineering makes it more expensive than teaching in classroom-based disciplines because of the physical and labour resources required for laboratory work. Cost has forced many educational institutions to reduce the amount of laboratory activity provided in their programmes. In this situation it is appropriate to develop a clear pedagogical rationale for expensive classes to justify the amount of laboratory work offered to students. One dimension of a pedagogical rationale is a clear understanding of the capabilities which the student should develop and demonstrate through the laboratory activities, which in turn should be linked to the professional application of the knowledge and skills learned.

The author has been an engineering educator for many years and previously worked in design and fabrication of bore water pumping machines in a small company and the design of power lines for an electricity supply authority. Through these activities he has needed analytical skills related to engineering design and practical skills for fabrication of prototype products. This experience has led him to reflect on the nature of the hands-on skills required by an engineer in the effective discharge of the engineer's role.

The author has also supervised practical classes in electronics and observed student competence in laboratory tasks. These usually require students to patch circuits using pre-assembled practical boards that provided for multiple circuit configurations and the connection and use of measurement instruments. In one course, students were required to assemble and measure arrangements of radio frequency equipment, where both the circuit elements and instrumentation, comprising special purpose instruments and elements such as waveguides and slotted lines, were unfamiliar. Significant discrepancy was observed between student performance in the laboratory and in written assessments, including laboratory reports. The performance difference indicates that practical work is a different competence domain from the other assessments. This observation provides practical appreciation, although nothing more formal, of the division of educational outcomes into three domains, the cognitive, affective and psychomotor domains, in Bloom's taxonomy of educational outcomes [1, 2].

Bloom's taxonomy of educational objectives has been, and is still, a popular tool for the analysis

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and design of educational programmes. However, Bloom's taxonomy as published [1, 2] only addresses the cognitive and affective domains, but omits, with acknowledgement, development of the third, psychomotor skills, domain. Definition of this domain appears contextually dependent; with obvious differences between, for example, the foundational psychomotor development of young children, sporting capabilities and trade and professional skill development. The diversity of interests related to the psychomotor domain makes it difficult to formulate a context-free description of psychomotor skills. Psychomotor skills are important in many trade and professional fields, including engineering and technology, science and health-care, and it is necessary for education in these fields to develop and ensure that students develop the relevant skills.

The author has interpreted the psychomotor domain as concerning the whole of the interface between the person and the things and environment with which they interact, including physical action skills, the ability to use the five senses to perceive and the ability to decide and to do appropriate action. Technology is the whole complex of cultural activities and artefacts, including hardware, software and their social and technical context [3] produced through work. Work is a purposive act to make a thing or change a state of nature or provide a service which implements the intent of the person who does the work. Thus, work performs action demanding psychomotor skills to generate outcomes which are technology.

2. BLOOM'S TAXONOMY

Application of Bloom's taxonomy in university education is appropriate because it was developed to address needs at that level [4]. The division of three domains, cognitive, affective and psychomotor, was a reaction to the concern that there was too much emphasis on 'knowledge' and insufficient on application of the knowledge.

Rote learning has long been recognized as problematic: Montaigne commented on the link between rote learning and a content heavy curriculum in 1580 [5] and in mediaeval Egypt the Jewish community saw elementary education, with much rote learning, as disconnected from the development of life and professional skills [6]. Bloom's taxonomy provided a behaviourist theory-based approach to educational objectives identifying what the student could do as a result of the education [7, 8]. In the behaviourist view the competence of the student to act appropriately depends on capability development rather than providing information about things which may be uncorrelated with appropriate action.

The behaviourist roots of Bloom's taxonomy result in criticism from the current cognitivist perspective in psychology [8]. The behaviourist roots of Bloom's taxonomy led to its hierarchical structure which assumes hierarchical and cumulative learning. The hierarchical and cumulative concept assumes that success in lower levels is a prerequisite for advance to higher levels. The cognitivist approach to learning is more complex.

The behaviourist origin of the taxonomy also emphasizes the students' observable behaviour, implying the belief that education concerns modifying behaviour by addition of capability for particular action [9]. The criticisms of the behaviourist perspective posit that a taxonomy of educational objectives should consider the change effected rather than only the capability changes. However, in the pragmatic communities of the professions and trades, ability to act appropriately and to successfully do tasks is what is required for success and accorded respect [10]. The author recognises that this position side-steps the deeper issues in this debate because of the present focus on education in fields with a pragmatic tradition.

3. KINDS OF KNOWLEDGE

Education concerns the development of knowledge in the student. We consider some recent distinctions in the description of knowledge to provide background for understanding the distinctions made in the development of the psychomotor domain.

'Know that' is a formulation used to describe declarative knowledge, following Gilbert Ryle's distinction between 'knowing that' and 'knowing how' [11]. This distinction is significant in engineering, where both kinds of knowledge are required [12]. Declarative knowledge is knowledge of the kind that can be articulated in representations of ideas. It is primarily associated with the cognitive domain and may be associated in the teaching and learning strategies of some with surface learning strategies [13].

'Know how' describes the capacity to perform a function, which is distinct from the capacity to describe the area of knowledge or theory related to the function. Biggs [13] describes this kind of knowledge as 'functional'. Functional knowledge does not preclude ability to articulate what is known, but emphasizes ability to act. 'Know how' knowledge concerns performance of action, and so in many fields involves a combination of psychomotor skills and related cognitive knowledge as a subsidiary element.

Nissen [14] names a third kind of knowledge 'knowing', which Biggs [13] names as 'procedural knowledge' or 'skill'. This kind of knowledge emphasizes the knower's ability to choose and perform action appropriately and effectively. Ability to articulate anything about the matter of action or its situation or a theory about the action or its situation is irrelevant to 'knowing'. 'Knowing' contrasts with 'know how', where the emphasis is on ability to perform function, but 'knowing' is usually associated with some judgement foundation knowledge concerning such matters as when someone would do the action, or constraints or other factors impacting on the choice of whether or how to act. As such, 'knowing' is hierarchically superior to 'know how' in the psychomotor domain, with some elements of cognitive knowledge.

4. COGNITIVE AND AFFECTIVE DOMAIN TAXONOMY

The cognitive and affective domain taxonomies published by the original Bloom's taxonomy team [1, 2] are shown in Tables 1 and 2, with the addition of a mapping of the classifications to the kinds of knowledge described above. The hierarchical structure indicates that students develop progressively through the levels of attainment.

5. OTHER PSYCHOMOTOR DOMAIN EXTENSIONS

Several attempts at psychomotor domain hierarchies have been published. One of the original group who published Bloom's taxonomy, Krathwohl [15], presented a hierarchical taxonomy of the psychomotor domain. Later, Dawson [16] presented psychomotor and cognitive domain extensions to Bloom's taxonomy. The terminology and framing of these extensions, with considerable emphasis on locomotor skills, reflect their situatedness in children's education, at the K-12 level, rather than trade and professional education and training.

This paper presents a psychomotor domain extension formulated to meaningfully address the interest of trade and professional educators to ensure that their students develop the capability to work in their field. The psychomotor domain taxonomy addresses several matters:

1. The author's observation of significant differences in student ability to perform basic laboratory tasks, such as tracing wires or circuit patching. These tasks have a significant element of hand-eye coordination and manual dexterity, and are related to the student's professional area.
2. The appropriate physical form of the practical session work pieces. The laboratory tasks and

Table 1. Bloom's taxonomy, cognitive domain [1]

Cognitive Domain		
Primary Classification	**Sub-classification**	**Mapping to knowledge type**
1. Knowledge	1.1 Knowledge of specifics	Know that
	1.2 Knowledge of the ways of dealing with specifics	Know that
	1.3 Knowledge of the universals and abstractions in a field	Know that
2. Comprehension	2.1 Translation	Know that
	2.2 Interpretation	Know that
	2.3 Extrapolation	Know that
3. Application	3.1 Application	Know how
4. Analysis	4.1 Analysis of elements	Know how
	4.2 Analysis of relationships	Know how
	4.3 Analysis of organizational principles	Know how
5. Synthesis	5.1 Production of a unique communication	Know how
	5.2 Production of a plan, or proposed set of operations	Know how
	5.3 Derivation of a set of abstract relations	Know how
6. Evaluation	6.1 Judgements in terms of internal evidence	Knowing
	6.2 Judgements in terms of external criteria	Knowing

Table 2. Bloom's taxonomy, affective domain [2]

Affective Domain		
Primary Classification	**Sub-classification**	**Mapping to knowledge type**
1. Receiving	1.1 Awareness	Know that
	1.2 Willingness to receive	Not applicable
	1.3 Controlled or selected attention	Know how
2. Responding	2.1 Acquiescence in responding	Know that
	2.2 Willingness to respond	Not applicable
	2.3 Satisfaction in response	Knowing
3. Valuing	3.1 Acceptance of a value	Know that
	3.2 Preference for a value	Know how
	3.3 Commitment	Knowing
4. Organization	4.1 Conceptualization of a value	Know how
	4.2 Organization of a value system	Know how
5. Characterization by a value complex	5.1 Generalized set	Knowing

apparatus significantly impact the kind of learning that students can achieve, but are derived from the teacher's beliefs about what students should learn in practical sessions.
3. The need for graduates in many professions to personally perform hands-on work in experiments, development and prototyping proposed designs or in other professional practice. The skill level required must satisfy all licensing and other regulatory requirements, including occupational health and safety. In design professions the graduate may also need to specify the work processes to be followed by other people using the products designed, and to design the products to satisfy ergonomic concerns.
4. An important related issue is the relation of what students learn in physical, simulated and remote controlled environments. This issue is important because of the prevalence of simulated and remote laboratory environments used in teaching, motivated, in many cases, by cost concerns.

Although, in many work places the hands-on practical work of prototype fabrication or laboratory experimentation may be assigned to technicians or trades people, the ability to do practical work appropriately is important for the engineer because:

1. The establishment of skill-based capital, in a Bourdieuan sense, leads to the ascription of authority by subordinates [17];
2. The ability to effectively participate in practical implementation or experimentation enables the person to make an effective contribution to the work;
3. The ability to plan and direct hands-on activities of others assists planning or product design;
4. In the Small to Medium Enterprise sector, professionals need to personally perform practical tasks because of the lack of other employees with appropriate skills.

As a result, engineers with significant practical skill are valuable to their employers because they are more able to achieve useful outcomes.

6. PROPOSED PSYCHOMOTOR DOMAIN TAXONOMY

Technical education aims to provide a combination of cognitive, affective and psychomotor capabilities which enable the student to become an effective practitioner in their field [18, 19]. In technology education there is lack of clear articulation of the abilities, knowledge and aptitudes to be developed, even though there is a strong intuitive sense of what constitutes technical ability [20]. The difficulty of articulating technical ability indicates the value that a technical skills oriented psychomotor domain extension to Bloom's taxonomy would provide for the technical education community. The extension presented here is designed to assist educators to achieve the learning outcomes described in outcomes oriented accreditation processes such as used by Engineers Australia [21, 22] and ABET [23].

The usual justification for laboratory work in engineering degrees is that practical work improves the effectiveness of learning of principles taught in the classroom through the tangible instantiation of the phenomena. Kowin and Jones [24] have shown that practical work is useful to enhance cognitive learning. But emphasizing the laboratory only as an augmenter of cognitive learning misses the psychomotor aspect of laboratory learning, and so encourages exploration of other, cheaper, approaches to gaining similar cognitive augmentation, and omits the intrinsic value of the physical aspect of the laboratory experience. The value of handling real equipment in the laboratory is in the combination of development of skills in working with real equipment, parts and materials of the kind encountered in the students' field, and learning how tasks are done, and an appreciation of the magnitude, risks and other factors associated with working with the tangible equipment. In addition, students working with tangible equipment will learn about the manifestations of various influence effects and their impact on results and the irreversibility, and consequences, of equipment-damaging mistakes. The separation of the student from the equipment in a computer controlled laboratory will reduce this kind of learning, and most such laboratories include equipment protection so that the student does not experience the chilling realization that completion of a practical task is impossible because a component has been spoiled. The value of hands-on work with physical equipment is being recognized, and teams working together on physical apparatus have demonstrated measurable benefits related to teamwork compared with those without such experience [29].

The importance of the psychomotor aspect as one part of technical education is expressed in Clark [25]. Autio [20] provides an analysis of motor skills, dividing them into two areas of interest: spatiality and temporality. These are further divided into bodily orchestration, precision, vocalization, motor reactivity and dynamism. These dimensions of motor skills are generic, but do not seem to address the special and complex learned behaviours which are required to perform work tasks.

A proposed hierarchy of psychomotor skills relevant to practice in technological fields is presented in Table 3. This hierarchy builds from recognition of tools and materials which are the subject matter of manual skills through several levels of skill in handling and using the tools and materials to effect desirable outcomes and the ability to plan operations that will produce desirable results, to the evaluation of outcomes and planning means for improvement. At this highest

Table 3. Proposed psychomotor domain extension to Bloom's taxonomy

Psychomotor Domain		
Primary Classification	**Sub-classification**	**Mapping to knowledge type**
1. Recognition of tools and materials	1.1 Recognition of tools	Know that
	1.2 Recognition of materials	Know that
2. Handling tools and materials	2.1 Holding tools and materials	Know how
	2.2 Lifting tools and materials	Know how
	2.3 Moving or transporting tools and materials	Know how
	2.4 Setting-down tools and materials	Know how
3. Basic operation of tools	3.1 Holding tools ready for use	Know how
	3.2 Operating the tool	Know how
	3.3 Method to do each of the unitary actions with the tool	Know how
4. Competent operation of tools	4.1 Moving from one unitary task to another	Know how
	4.2 Reliably performing tasks to an acceptable standard	Know how
5. Expert operation of tools	5.1 Efficiently and effectively using the tools	Know how, Knowing
	5.2 Ability to focus on the broader context of the work	Knowing
6. Planning of work operations	6.1 Ability to conceive tool capability abstractly	Know that, Knowing
	6.2 Ability to envision the effect of a sequence of operations	Know that, Knowing
	6.3 Ability to develop novel work processes to achieve specified outcomes	Knowing
7. Evaluation of outputs and planning means for improvement	7.1 Ability to recognize the cause of product characteristics	Know that, Knowing
	7.2 Ability to pre-emptively judge the effect of modification of work process	Know that, Knowing
	7.3 Ability to recommend an improved work methods	Know that, Knowing
	7.4 Ability to critically review the effectiveness of methods to perform novel tasks	Know that, Knowing

level the ability relates to issues around the design of work processes and products, the traditional areas of contribution of many engineers.

6.1 Recognition of tools and materials

In technical work the most basic skills concern recognition of the tools and materials used for work. This competence is an important first step that enables awareness of the presence and state of the object and means of work. Recognition of tools and materials is important for work effectiveness and safety. The recognition stage involves learning the names and other descriptors of the tools and materials and so addresses a fundamental communication need. Safety depends on recognition and understanding of the elaborating descriptors because this enables association of the tools and materials with relevant health and safety information. This category belongs in the 'know that' class of knowledge because the emphasis is on the elements which can be declared in reference to the tools or materials.

Throughout this section the concept of 'tools and materials' can be used to refer to tools and materials of any scale ranging from hand tools at the small and simple scale to large or complex machinery offering both great work advantage and significant risk if used inappropriately.

6.2 Handling tools and materials

Tools and materials are appropriately handled in certain ways so methods for holding, lifting, moving and setting down tools and materials must be learned. The methods are important to ensure safety, security and effectiveness of the tools, materials, people and their environment. Separately identifying the verbs holding, lifting, moving and setting down as separate competencies may appear to be excessive partitioning. However, these are identified as separate competencies because each of these actions can present special issues with respect to work effectiveness or safety; one of the objectives is to develop safe and effective work practices. Where necessary, such as in linking physical semiconductor devices and their pin-out diagrams, the student should be able to appropriately correlate work tools and materials with their documentation. This stage of learning involves the 'know how' form of knowledge because the emphasis is on the ability of the student to perform the actions.

6.3 Basic operation of tools

The basic operation of tools concerns the ability to hold the tool appropriately for use, to set the tool in action and to perform elementary tasks that abstract work tasks into their most basic, unitary form. The tasks that can be performed at this level are the specific detail tasks which, when combined, enable significant work. An example of this class of knowledge is the elementary tasks of driving a motor vehicle, such as a handbrake start, which can be learned as standalone skills, but are not, alone, particularly useful. The skill of using a hand saw to cut has sub-elements including lifting the saw, moving it to the cut start position, operating the saw for the cutting and return strokes and the processes for completion of the cut, all of which must be done in a manner which avoid injury to people and damage to either the saw or the work piece. The work done at this stage is exercises defined to enable learning of technique, and is not deliverable as part of a product or service. This classification involves the 'know how' form of knowledge because the emphasis is on the ability to do particular set-piece type actions.

6.4 Competent operation of tools

This level concerns the fluent use of a tool for performing a range of tasks for which it was designed. This level advances from the preceding by involving performance of a sequence of set-piece tasks to produce useful outcomes, for example the whole set of sub-elements for cutting with the saw performed at the single instruction to cut the work piece. The work produced will be of a sound standard which could be delivered as part of a finished product or service. Competent tool use includes ability to produce consistent, effective and safe work outcomes. This level of learning emphasizes the "know how" form of knowledge because the emphasis is on doing the right thing within externally defined purposes.

6.5 Expert operation of tools

The ability to use tools to efficiently, effectively and safely perform work tasks on a regular basis. The expert tool user is able to produce the right outcome with attention being placed on the broader context of the work rather than the narrow context of the tasks performed. At this level of development the learner has advanced their "know how" form of knowledge with respect to the doing of tasks, and has begun to develop the "knowing" form of knowledge related to the fluent performance of action in an apposite manner.

6.6 Planning work operations

This level concerns the ability to transform a product specification into the set of processes or tasks required to deliver the product or service. The planning of work operations requires understanding of the work to be done, the repertoire of possible actions, including novel applications of tools and equipment, and the ability to make judgements about appropriateness of a method. The kind of planning intended under this heading concerns simple manufacturing, for example, a sequence of machining operations to make a part or a set of actions to perform a measurement, or some other unit of work for which there is some choice about what could be done. This level of capability demands a combination of 'know that' and 'knowing' forms of knowledge because it involves declarative knowledge related to the possibilities available and the ability to make apposite decisions.

6.7 Evaluation of outputs and planning means for improvement

At this level the practitioner can look at a product and review it for quality of manufacture, identify deficiencies and propose actions which would either correct or prevent the faults. This level of competence parallels the 'Evaluation' and 'Characterization by a value complex' levels in the other domains. This domain, like the others, is capped by a level of achievement involving critical review of action or proposed action. This level of achievement involves both 'know that' and 'knowing' kinds of knowledge because both declarative knowledge of possibilities and ability to act appositely is required.

7. DISCUSSION

The psychomotor domain hierarchy of Table 3 presents capabilities which become progressively more difficult and provide increasing utility. In addition, the skills associated with each level have a close association with the progress of learning physical and sensory skills, where it takes a combination of instruction, supervised experience and practice, to develop the ability to act appropriately. A possible criticism of the hierarchy is that many of the elements appear to be related to the cognitive and affective domains. However, the emphasis in the hierarchy, as presented, is the practical 'know how' and 'knowing' kinds of knowledge in contrast to the 'know that' knowledge associated with the simpler, declarative aspects of the cognitive domain [11]. This hierarchy concerns the ability of the individual to integrate sensory information inputs related to the present state of nature with the ability to act to make a desired change in the real world, normally regardless of the ability to articulate the issues. The ability to act involves a combination of knowing what to do and being able to perform the actions which make it happen in the desired manner.

The classification of outcomes described in Table 3 is a hierarchy in which the levels of achievement build upon each other. This arrangement is consistent with the underlying behaviourist foundations of Bloom's taxonomy [8]. In the psychomotor domain, as formulated in Table 3, there is a clear behavioural development in the stages of learning which makes it appropriate to use a behaviourist theory-based framework because the subject matter is fundamentally consistent with the framework. It is also noted in Table 3 that there is a development through the kinds of knowledge, with some foundational cognitive knowledge required and then a series of steps emphasizing 'know how', followed, at the higher levels by knowledge of the 'knowing' kind. This shows that as learning develops the person into higher levels of attainment there is a shift in the kind of knowledge with increasing emphasis on ability to do, and decreasing emphasis on description.

The perspective of education relating to competence to act has always been at the core of trade preparation through apprenticeship processes.

Traditional trade education has been organized so that the apprentice progresses through stages of instruction which have a reasonably close mapping to the hierarchy of Table 3 [26, 27]. The apprenticeship education process has always accepted that the ability to perform appropriate action is the key to success and the assessment of success, rather than the ability to articulate knowledge about the work situation.

In trades and professions where the practitioner practises through doing practical actions, such as medicine or dentistry, the necessity of an education process which includes the psychomotor skill development to enable appropriate action is clear. The need for development of practical, hands-on, skill is less obvious in the case of professions where the practitioner's role is largely to supervise others or to plan action, such as is the case in many engineering roles. However, in these occupations, it is useful for a supervisor to have direct appreciation of the kind of work which subordinates do, in particular to understand the relative difficulty of tasks to assist in the management of those who directly perform the work.

However, there is another kind of role performed by some engineers, in which they plan work operations that other people will do with equipment, either as part of the design process or in planning operations. This role involves planning the details of operating procedures for equipment, for which it is necessary to have the kind of knowledge developed through the hierarchy of Table 3. This establishes a need for engineers to develop their psychomotor skills in relation to equipment in order to effectively conduct their engineering role.

In trades training the kind of development of skills described in Table 3 has been commonplace. For example, apprentice fitters, in learning to use a file correctly were traditionally required to file a metal workpiece into a perfect cube. The product, itself was not useful, but the object was to develop high skill in the use of the file. However, the final trade examinations required ability to perform complex sequences of actions to achieve desired outcomes. The plumbing examinations in Melbourne, Victoria in 1928 required the apprentice to complete a number of plumbing tasks under time pressure, associated with being ready when the examination assistants brought the cart of molten lead [28]. The examination was based on inspection of the work products created, after opening so that the internal detail could be examined.

In the author's undergraduate electronic engineering practical work the normal practice was to require students to do design analysis to determine the appropriate resistor and capacitor values to suit a circuit performance objective. The students then selected components from a supply, using colour codes and component labels, followed by assembly on an SK-10 board, which also demanded wire stripping and other manual skills. After construction, students applied test instruments to determine circuit performance. These tasks included learning the relationship of the component pinout diagrams and the real component. Learning included the ability to relate component descriptions to physical form, and practical skills, such as correct connection and the fatigue effect of excessive flexing of component leads. The skills developed included the traditionally described reinforcement of theory provided in classes, and practical skills associated with handling components and using instruments.

8. CONCLUSIONS

This paper has deliberately constrained the psychomotor domain space by reference to the skills relevant to professional and trade practice rather than psychomotor capabilities in general. This scope constraint is reasonable for two reasons:

1. Bloom's taxonomy was originally developed to provide programme development and assessment guidance at the higher education level and is frequently used at that level of education;
2. The kind of professional and trade education relevant psychomotor skills identified pertain to ability to do work tasks rather than the basic psychomotor development of children as described in earlier psychomotor taxonomies.

Although Bloom's taxonomy has been criticized for implementing a behaviourist perspective on learning, in professional and trade education the purpose of education is to develop the student's ability to perform appropriate action in fields with a pragmatic view of what is necessary. Therefore, Bloom's taxonomy is particularly relevant in professional and trade education and is useful to assist curriculum and assessment design.

This work provides a tool to assist educators with the design of the practical component of engineering programmes. The expansion of the psychomotor domain skills enables clarity about the skills which are presumed and those to be learned, which in turn can enable comparison with the competencies expected of engineers and also the teaching methods to ensure that students learn the methods and techniques for their field appropriately. In turn, this can assist in the design of practical work which provides the greatest benefit possible to the student.

The contrast of this psychomotor domain hierarchy with those formulated around developing the capability of children in general life psychomotor skills suggests that there may be two meaningfully distinguishable psychomotor domains, one for general life skills and the other for specific professional skills. This matter requires further research.

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