DEVELOPING OUTCOMES-BASED MODEL COURSES USING IDENTIFIED EVIDENCE-BASED PRACTICES

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Abstract

The current state of the practice is for maritime education and training (MET) to use outcomes-based educational methods. Additionally, stakeholders increasingly require outcomes assessment as a means of accountability oversight. Recently, through the work of the Sub-Committee on Human Element, Training, and Watchkeeping (HTW), the International Maritime Organization has taken another step in developing its outcomes-based training policies. In this regard, a correspondence group was tasked with creating a taxonomy of action verbs to support model course development. This paper summarizes that work, provides a review of several of the many educational taxonomies across the five main domains of learning (cognitive, affective, psychomotor, interpersonal, and meta-cognitive), and examines a method for evaluating learning domain coverage for the Organization's model courses. The evaluation method presented provides a sound tool that could be used in revising existing model courses, validating current model courses, and designing future model courses. The IMO's foundational model course in firefighting is used to test/illustrate this method. While this particular model course appears to be practical and requires trainees to learn how to fight fires through practice, the mapping of domain coverage using the model indicates only 18.2% of the time allotted in the course is devoted to the acquisition of psychomotor competencies and interpersonal knowledge and skills. This study also analyzed the frequency of action verb usage in the performance criteria for the competencies in the model course and found 84.2% of the performance criteria use only four action verbs (i.e., list, state, describe, explain) which are usually devoted to knowledge (cognitive) acquisition. These findings indicate that the model course in firefighting is not-balanced in its learning domain coverage and has misplaced emphases. Using a taxonomy or taxonomies for the learning domain(s) of interest, action verbs can be chosen from the taxonomy to ensure that future revisions of this and other model courses or designs of new model courses, will have the appropriate balance between the content (and time allocated) on one hand, and the desired learning domain(s) and outcomes on the other. Additionally, this paper explores the matter of constructive alignment – how teaching methods and learning assessment can be adopted to match the outcomes they are intended to support.

Key Words

Pedagogy
MET (Maritime Education and Training)
STCW
Model Course
Outcomes Assessment

Introduction

The International Maritime Organization (IMO) has offered a program of model (training) courses since the adoption of the International Convention on Standards for Training, Certification, and Watchkeeping (STCW), 1978, as amended. Based upon contributions from IMO member states, these model courses serve as important resources for training program/curriculum development. Each model course includes an introduction, a course framework, a general outline, a detailed outline, the instructor manual, and a section dealing with assessment and evaluation.

In 2019, China, the International Association of Maritime Universities (IAMU), and the International Maritime Lecturers Association (IMLA), jointly proposed including an action verb taxonomy [1] (to assist in preparing learning outcomes for course syllabi) as a revision to the IMO guidelines for model courses [2]. In response, the IMO Sub-Committee on Human Element, Training, and Watchkeeping (HTW) chartered a correspondence group to create a taxonomy of action verbs for use in developing learning outcomes for model courses. The correspondence group consisted of representatives from the IMO member states of China, Germany, Netherlands, Sweden, and United States and representatives from the following non-governmental organizations: International Chamber of Shipping (ICS), IMLA, Global Maritime Education and Training Association, and the IAMU[1]. After four rounds of discussion and revision, the correspondence group developed a set of action verbs drawn from Bloom's taxonomy [3] for the cognitive learning domain, Dave's taxonomy [4] for the psychomotor learning domain, and Krathwohl's taxonomy [5] for the affective learning domain. The correspondence group recommended that this taxonomy of action verbs and a set of guidelines for writing learning outcomes be included as an appendix to the guidelines for model course development [6][2]. These recommendations have not yet been taken up as an agenda item by the HTW subcommittee. The seventh session of HTW was cancelled in 2020 and held virtually in 2021 as a result of the COVID-19 pandemic and the agenda has focused on other more pressing issues such as the "crew change crisis."[3] As a result, it is anticipated that HTW will consider the work of this correspondence group in 2022.

This effort by HTW marks a significant advancement of the model course policy toward enabling true outcomes-based learning for seafarers. At the same time, it also marks the beginning of the potential for much advancement in the andragogy of maritime education and training (MET) as it pertains to IMO model courses and beyond[4]. This paper will expand upon the correspondence group work by examining the action verb usage in an existing model course. A process for content-domain mapping [7] will be applied to a representative IMO model course to establish the validity or authenticity of the particular qualification such that the content of the course and its associated assessments address what was intended by the IMO and relevant stakeholders. Additionally, moving beyond the realm of action verbs and acknowledging the need for constructive alignment in courses [8], [9], the paper will also examine which learning activities and assessment methods are best suited for particular

[1] The first two authors served as IAMU representatives to this HTW correspondence group.
[2] A copy of that correspondence group report HTW 7/7 is available to the public at IMODOCS.
[3] COVID-19 caused a "crew change crisis" in that, seafarers aboard ships were unable to be repatriated after the completion of their contracts. Similarly, seafarers were unable to join their ship due to travel restrictions. During the peak of this crisis in September 2020, this impacted nearly 800,000 seafarers. By March of 2021, an estimated 400,000 seafarers were impacted.
[4] While this paper will focus on model courses, the concepts can be applied to outcomes-based policy within the STCW Convention itself and to a variety of other areas within MET more broadly.

learning outcomes within each level in a particular domain of learning. This is viewed as an essential next step in the trajectory of outcomes-based model course development.

Overview of Taxonomies

During and following a series of conferences in the late 1940s and early 1950s, a group of researchers and educators created a taxonomy of educational objectives. This seminal work was published in 1956 and entitled Workbook I: Cognitive Domain [4] and is commonly referred to as "Bloom's taxonomy" after the educational psychologist who led the group and edited the publication. While this group of researchers and educators had originally envisioned creating similar taxonomies for the psychomotor and affective domains, it was not until 1964 that Workbook II: Affective Domain [3] was published. Since then, hundreds of taxonomies have been developed and proposed as alternatives, often to address advances in our psychological understanding of learning. This section will explore some of the most prominent taxonomies that span five key learning domains: cognitive, affective, psychomotor, interpersonal, and meta-cognitive.

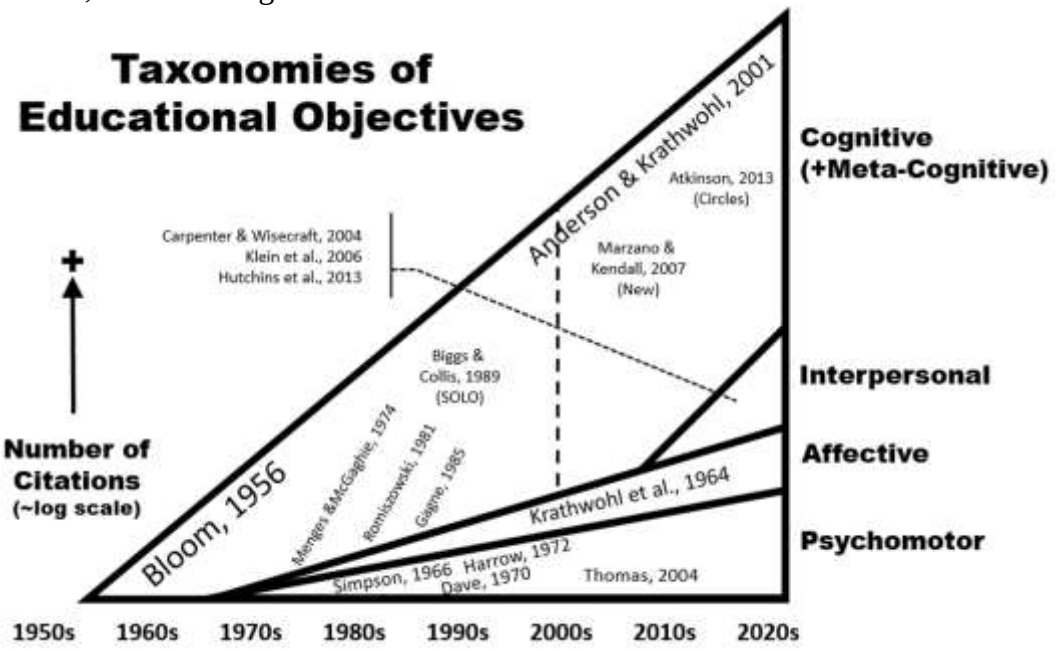

Figure 1: Developmental Progression of Taxonomies of Learning Objectives[5]

A taxonomy is an orderly classification of concepts. Figure 1 shows a classification of taxonomies of educational learning outcomes. It illustrates the chronological development of taxonomies within the five key domains of learning (listed on the right side of the figure) – cognitive first, followed by affective, and then psychomotor (often thought of as the primary trio). Later on meta-cognitive was incorporated and more recently interpersonal was developed. In addition, some taxonomies are encompassing and address several domains of learning. In Figure 1, the relative size of the triangles approximates the number of times the initial publication of the taxonomy in an article or book was cited by other works. By far, the cognitive taxonomies have dominated the educational community[6]. The most prominent are Bloom's taxonomy and the revision of Bloom's taxonomy (separated by the dashed line in figure 1).

[5] Inspired by Reebee Garafolo's classic graphic *Genealogy of Pop/Rock Music* (shown on pp. 90-91 of [29]), this figure is Paul Szwed's preliminary effort to capture a taxonomy of taxonomies.

[6] According to Google Scholar data from 1 May 2021, Bloom's original taxonomy for the cognitive domain was cited by 38,219 other works and the revised Bloom's taxonomy was cited by 23,333 works. In comparison,

While the work of the HTW correspondence group had the narrow focus of developing a taxonomy of action verbs to assist with creating learning outcomes, a much broader approach to how learners learn can be taken. For example, the UK-based Learning & Skills Research Centre (LSRC) published a comprehensive 160-page report [10] about how thinking skills are organized and evaluated 55 different frameworks to classify the skills and abilities used in thinking in order to make recommendations for teachers, learners, and even policy-makers.[7] Notably, the work's focus on older-adolescent and young-adult learners (i.e., post-16 years of age), is an appropriate target for MET because many mariners start their training during those ages.

Upon examining the 55 different thinking skills frameworks, the LSRC researchers found that the frameworks could be classified into four different categories or "family groups:"

- Models and theories of personality, thought, and learning (which they labeled as "all-embracing family"[8] and contained six frameworks),
- Models and theories of instructional design (which they labelled as the "designer family" and contained 12 frameworks),
- Models and theories of critical or productive thinking (which they labeled as the "higher-order family" and contained nine frameworks), and
- Models and theories of cognitive structure and/or cognitive development (which they labelled as the "intellect family" and contained eight frameworks).

For most of the frameworks, they provided a description, intended use, an evaluation of the scope and structure, an evaluation of the theory and analysis, and an evaluation of the communicability and practicality. Since the scope of this study is principally focused on instructional design, the focus here will be narrowed to what the LSRC group has referred to as the "designer family." This group of learning skills models and theories provide frameworks for both formulating learning objectives and also for designing instruction for developing pathways to higher-order learning.

The LSRC researchers subdivided the instructional design taxonomies (i.e., the "designer family") into two subcategories. This first subcategory provides "frameworks for formulating and classifying educational goals in terms of the thinking and learning processes which can be inferred from observed behavior and task performance." The first subcategory included the seminal work of Bloom and his colleagues [3], Ausubel and Robinson [11], Gagné [12], Hannah and Michaelis [13], Stahl and Murphy [14], and Anderson and Krathwohl [15]. This subcategory is exemplified by Bloom's revised taxonomy. The second subcategory focused on designing instruction to develop higher-order thinking. The works in this subcategory include Biggs and Collis [16], Gouge and Yates [17], Presseisen [18], and Quellmalz [19]. These authors focused on building conceptual frameworks to "understand how thinking skills are orchestrated for purposes such as decision making, problem solving, critical and creative thinking (and often extends beyond cognition to meta-cognition)." This subcategory is exemplified by Bigg's and Collis' SOLO taxonomy.

Simpson's original taxonomy for the psychomotor domain was cited by 1,327 works (between 1 and 2 orders of magnitude fewer, even when annualized).

[7] For a more compact summary of their findings and recommendations, see a published paper by some of the authors. [30]

[8] According to the authors, the so-called "all-embracing" family is not named as such because it spans all learning domains, but rather it accounts for emotions and beliefs in addition to thinking and learning. In other words, the frameworks within this family embrace many and multiple domains of learning.

The selection of particular taxonomies is complex and context dependent. For example, the HTW correspondence group focused on three specific taxonomies of learning objectives (namely Bloom [4], Dave [5], and Krathwohl et al. [3] for the cognitive, psychomotor, and affective domains respectively). Similarly, the IAMU working group that developed the Body of Knowledge for the Global Maritime Professional (GMP) [20] focused on two specific taxonomies of learning objectives (namely Bloom [4] and Simpson [21] for the cognitive and psychomotor domains respectively). In an entirely different modal context, the International Civil Aviation Organization (IACO) (which like the IMO is a specialized agency within the UN) used five taxonomies in a guide for instructional methods [22].

Learning Outcomes

Taxonomies are an important tool for course designers in developing learning outcomes.[9] Learning outcomes are an essential aspect of course design in that they inform almost every other decision made – from selection of learning activities to selection of assessment methods to determine achievement of the outcomes. A common structure used for creating learning objectives includes joining the following three components:

- A stem[10],
- The action verb phrase, and
- Identified performance (i.e., the object of the action from the verb phrase).

A typical learning outcomes statement[11] might take the following form: "Upon successful completion of this module, students (learners) will be able to diagnose a machinery casualty situation and select the appropriate corrective action." In this example, there are two action verbs following the stem: diagnose and select followed by the corresponding identified performances. Such "double-barreled" outcomes statements are not typically preferred because there are four potential results (i.e., improper diagnosis/improper selection, improper diagnosis/proper selection, proper diagnosis/improper selection, and the desired result of proper diagnosis/proper selection). Not unlike dealing with type I and type II errors in statistics, each of these results might require a different teaching/learning intervention. Therefore, this example would better be stated as two separate learning outcome statements.

While learning outcomes are an essential element of course design, this paper will now focus again on the action verbs (which could be argued to be at the heart or kernel of the learning outcomes statement) and study how a typical model course effectively employs action verbs to achieve learning across the intended domains of learning. Future work should be conducted on examining the effectiveness of the learning outcome statements (contained in the performance criteria within the knowledge, understanding and proficiency columns of the relevant tables) in IMO model courses.

Methodology

To demonstrate how educational taxonomies may be applied to IMO model courses specifically and the STCW outcomes-based policy and validation processes more generally,

[9] While the HTW correspondence group was tasked with developing a taxonomy of action verbs to be used in creating learning outcomes statements for model courses, they also included guidelines for how to write outcomes statements once an effective action verb has been selected.

[10] The stem frames the learning outcome statement. "(Upon successful completion of the course/module), students will be able to:" is an example of a common stem.

[11] Guidelines on preparing learning outcome statements abound and the above structure was based upon the work of the (US) National Institute for Learning Outcomes Assessment (NILOA) [32].

this study examined a typical model course using a method proposed by researchers at Cambridge Assessment to evaluate and validate courses and curriculum for applied qualifications [23]. This method for examining learning domain coverage uses a five-step process as described in Figure 2.

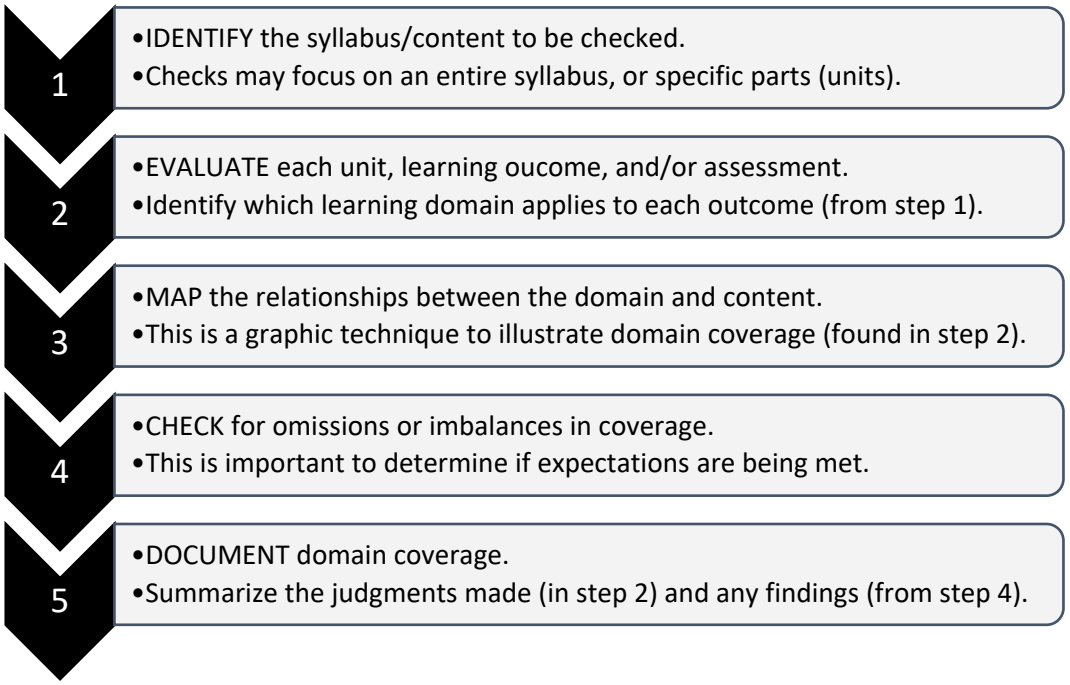

Figure 2: Method for Mapping Learning Domain Coverage

Step 1

This study examined the baseline training for fire prevention and firefighting. Specifically, the study examined the IMO Model Course 1.20 Fire Prevention and Firefighting (2000 edition – electronic)[12]. This model course was selected because it is the essential fire safety training needed by all seafarers (and prospective seafarers) prior to employment on sea-going ships. The model course is broken down into three primary competencies:

1. Minimize the risk of fire
2. Maintain a state of readiness (to respond to emergency situations involving fire)
3. Fight and extinguish fires

This study examined all of the required knowledge, understanding and proficiency performance criteria of each subpart for all three of the competencies (as specified in the detailed teaching syllabus – Part C of the model course).

Step 2

The reference study [23] evaluated nine educational taxonomies for suitability and selected two that came closest to the intended purpose of mapping domain coverage of applied qualification courses. The reason two were selected is that none of the nine evaluated were inclusive enough (i.e., they did not sufficiently span the five domains of learning). They found that Marzano and Kendall's new taxonomy [24], [25] when supplemented by Hutchins' taxonomy of interpersonal skills [26] spanned four domains of knowledge (as described in Table 1).

[12] The model course is designed to satisfy the minimum standard of competence in fire safety per Section A-VI/1 (paragraph 2 and table 1-2) of Chapter VI of the STCW Convention, as amended in 1995.

Table 1: Summary of the Four Learning Domains

Domain	***Categories***
Information: Declarative knowledge, vocabulary, factual knowledge (i.e., the *what* of human knowledge)	• *Principles* – Specific types of generalizations focusing on cause-effect or correlation relationships. • *Generalizations* – Statements for which examples can be given. • *Time sequences* – Include key events that happened between two points in time. • *Facts* – Give information about people, places, things, and events. • *Vocabulary terms* – Phrases learners understand accurately.
Mental Procedures: Procedures dealing with how to do something is situation X, follow action Y (i.e., the *how-to* of human knowledge)	• *Macro-procedure* – Highly robust mental processes that involve the execution of many interrelated sub-procedures. • *Tactics* – A set of several mental general rules with a general pattern for the order in which the rules are executed. • *Algorithm* – Mental procedures comprised of single steps which are consistently and automatically applied. • *Single rule* – Such as "if-then" (p. 13 of [25]).
Psychomotor Procedures: Physical procedures, such as being able to serve in tennis.	• *Complex combination rules* – Groups of simple combination procedures interacting and happening simultaneously. • *Simple combination rules* – Groups of foundation procedures interacting and happening simultaneously. • *Foundation procedures* – The ability to use your body.
Interpersonal Knowledge/Skills: Knowledge and skills used when people are interacting with one another.	• *Interpersonal communication skills* – Express and assimilate information in social settings (involving listening, speaking, writing, and sending/receiving non-verbal signals in an empathetic, attentive, responsive, and confident manner). • *Relationship building skills* – Develop and keep relationships with others, and build strong beneficial alliances as well as manage and resolve conflicts. • *Peer-leadership skills* – Coaching, counselling, motivating, and empowering group members. • *Social/behavioral agility skills* – Monitor and interpret own and other's behaviors (and modify self-presentation social interaction to influence and control the interaction).

In the study informing this paper, qualified evaluators examined each of the 152 knowledge, understanding, and proficiency performance criteria[13] contained in the IMO fire safety model course and judged whether it was an informational task, mental procedure, psychomotor procedure, or interpersonal knowledge or skill (i.e., in which of the four domains in Table 1 it belonged). These judgments were collected using a five-step elicitation process and after training, the evaluators were instructed to select only the primary domain for each performance criteria. For each of the four learning domains, a representative example of performance criteria was provided:

- ***Information***: Lists fire hazards in the galley (performance criteria 1.8.2).
- ***Mental Procedure***: Explain procedures for recharging empty extinguisher (performance criteria 3.3.5).
- ***Psychomotor Procedure***: Demonstrate the correct use of portable fire extinguishers (performance criteria 3.11.1).
- ***Interpersonal Knowledge/Skills***: Take part in team exercises, communicating while wearing breathing apparatus (performance criteria 3.18.4).

Inter-rater reliability was computed for the judgments of the three qualified evaluators.[14] In cases where there was agreement among most of the evaluators (i.e., all or two agreed on the

[13] In the IMO fire safety model course (MC 1.20), there are 3 introductory performance criteria, 29 performance criteria in competency 1, 52 performance criteria in competency 2, and 68 performance criteria in competency 3.
[14] The three authors served as the evaluators in this study. All three have extensive experience with MET (maritime education and training), knowledge of outcomes assessment and taxonomies, and two have had direct experience with firefighting training.

domain category for a performance criteria), that domain was listed for a particular performance criterion. In the rare cases where there was no agreement among the evaluators (due to either differences in interpretation or "domain-spanning" by performance criteria), no domain was listed for a particular performance criteria.

Step 3

Next, the domain coverage was tabulated for each of the three competencies and for the course overall. However, because the number of performance criteria for each sub-competency varied from a single criteria to as many as eight, a weighting scheme was devised. Using the approximate time (in hours) specified for the completion of the sub-competencies (as specified in the course outline and timetable – Part C of the model course), allocated times were applied to each of the performance criteria. For example, under the first competency for minimizing the risk of fire, the model course specified one half-hour (0.5 hours) to complete the sub-competency of fire hazards (1.8). Since there are five performance criteria within this sub-competency, it was assumed that the half-hour would be uniformly distributed and each performance criteria would be allocated 0.1 hours according to the model course outline and timetable.

Using this time allotment (as specified in the model course), the time and proportion of time allocated to each learning domain for the course, each competency, and also each sub-competency could be determined. A table was created to illustrate the mapping of the amount of time "allocated" to each learning domain for each competency. Steps 4 and 5 are interpretations of the results found in steps 1 through 3 and will be addressed in the discussion section.

Results

After completing the method for mapping learning domain coverage (see Figure 2), each of the three the IMO model firefighting course competencies yielded different learning domain coverage.

Table 2: Breakdown of Time (in Hours) Allocated to each Competency (IMO Model Course in Firefighting) with Mapping to Relevant Learning Domain

Competence	Information	Mental Procedure	Psychomotor Procedure	Interpersonal Procedure	Approximate Time (Hours)
0. Introduction and safety	0.50				**0.5**
1. Minimize risk of fire	2.43	0.07			**2.5**
2. Maintain state of readiness	2.91	0.09			**3.0**
3. Fight and extinguish fires	5.40	0.87	2.54	0.19	**9.0**
	11.24	**1.03**	**2.54**	**0.19**	**15.0**
	74.9%	**6.9%**	**16.9%**	**1.3%**	**100%**

Table 2 provides a mapping of competency/content to the learning domain affiliated with the performance criteria within that competency. Roughly three-quarters (74.9%) of the time spent in this IMO model course in firefighting is devoted to learning within the information domain. Learning within the psychomotor domain accounts for 16.9% of the time spent in this model

course. The remainder of the time is spent on learning mental procedures (6.9%) and interpersonal knowledge and skills (1.3%).

The inter-rater reliability of these judgment may be interpreted as showing substantial agreement among the three evaluators (Fleiss' kappa = 0.702). However, when decomposed, as shown in Table 3, it was observed that the inter-rater reliability was not uniform among each competency.

Table 3: Inter-Rater Reliability when Assessing Learning Domains of Performance Criteria in the IMO Model Course for Firefighting

	Fleiss' Kappa, K	**Degree of Agreement**
Introduction	1.000	Perfect
Competency 1	0.138	Slight
Competency 2	-0.037	Poor
Competency 3	0.891	Almost Perfect
Overall	0.702	Substantial

In addition to the Cambridge Assessment method for evaluating knowledge domain coverage in a syllabus [23], this study also examined action verb usage in the development of the performance criteria (which serve as detailed learning outcomes). Figure 3 provides an illustration of how often verbs were used in the 152 knowledge, understanding, and proficiency performance criteria contained in the IMO fire safety model course.

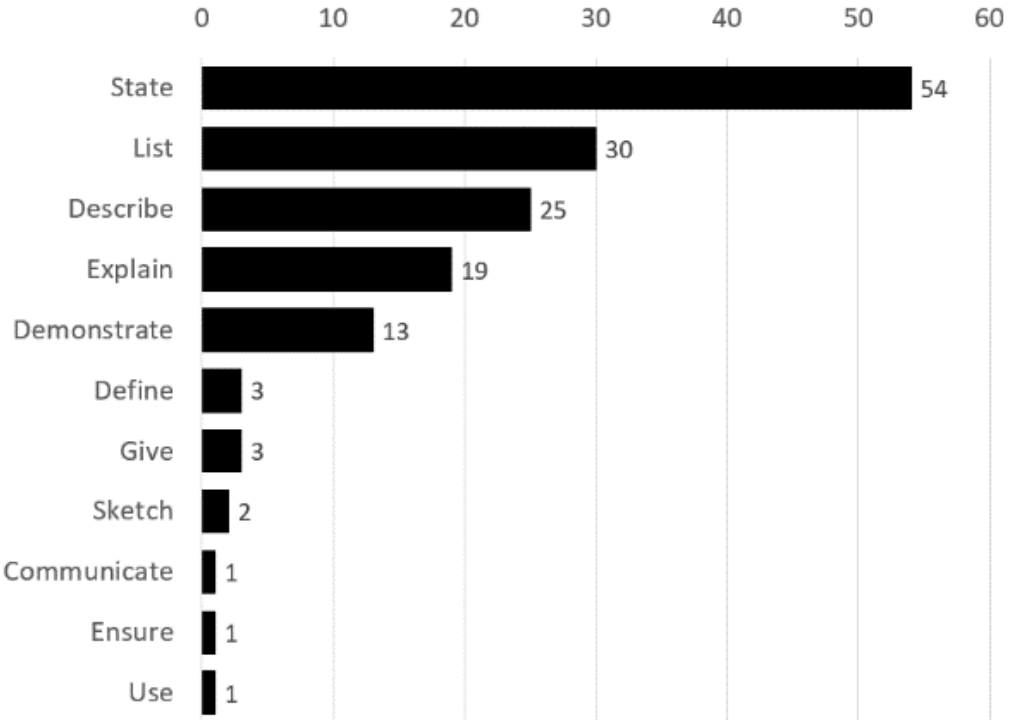

Figure 3: Frequency of Action Verb Usage in IMO Model Course in Firefighting

Additionally, the percentage agreement was calculated for each verb (such that 100% meant perfect agreement and 0% meant no agreement). Most verbs had perfect or almost perfect agreement among raters. However, three verbs accounted for the majority of disagreement

among the raters (even when adjusted for usage). The performance criteria containing the verbs explain, use, and ensure had percent agreement of 53%, 0%, and 0% respectively.

Discussion

The overarching aim of the model course as stated in the course framework (Part A) is to provide the minimum standard of competence in fire prevention and firefighting. In the course objective (on p. 4 of the IMO model course 1.20 for fire prevention and firefighting, it states, *inter alia*:

> "… a trainee will be competent to take appropriate measures for the safety of personnel and of the ship and use fire appliances correctly. The trainee will also have a knowledge of fire prevention."

There are two main parts to this course objective: to act (or take appropriate measures) and to know (or have a knowledge). Based upon the order in which those two are presented (actions first and knowledge second) and the use of the word "also" (which means in addition), it can be inferred that demonstrated behavior (or actions) are the primary objective and the knowledge is a secondary objective. Therefore, the learning domain coverage of this course in firefighting would appear to be out of balance with the intent of the course as expressed in the course objective (found on p. 4 of the course framework – Part A of the model course). One would expect a majority of the performance criteria to be devoted to the learning of psychomotor procedures (and interpersonal knowledge/skills). However, only about 20% of the course time (that associated with performance criteria in the psychomotor procedures and interpersonal knowledge/skills domains) is focused on the primary action-oriented objective of the course, whereas more than 80% of the course (that associated with performance criteria in the information and mental procedure domains) is devoted to knowledge, the secondary course objective.

Additionally, within the IMO model course there are twelve overarching objectives provided along with some of the competencies (pp. 13-14 of the detailed teaching syllabus – Part C of the IMO model course). The vast majority of these overarching objectives could be classified as action-oriented. Therefore, based both on course objectives and the overarching objectives of the three competencies within the course, it seems the course is intended to be action-oriented, or applied, yet the performance criteria are predominantly knowledge-oriented based on the mapping performed. As a result, it appears the course content is out-of-balance with its intended outcomes.

This was likewise supported by the action verb analysis for the performance criteria. Here too, the first four most used verbs (i.e., state, list, describe, and explain) account for 84.2% of the course time (see Figure 3). These action verbs are typically associated with the information and mental procedures learning domains rather than psycho-motor or interpersonal knowledge/skills domains.

Further, while moderate inter-rater reliability would be expected when mapping educational outcomes [27], even though there was substantial agreement among the raters overall, there were varying levels of reliability within the competencies of the IMO model course in firefighting. Upon examining which action verbs had most disagreement, it became apparent that only a few verbs (explain, use, and ensure) accounted for the majority of the disagreement. It is unclear what the source of this disagreement was, whether it was truly low reliability among raters or perhaps low reliability in the ways in which the verbs were used. Further study

would be warranted, but using such a method might be an important tool for course designers and validators to determine sources of low reliability.

This study suggests that the content-domain mapping performed would be a valuable instrument for both IMO model course designers and for those who validate model courses. In this case, to address the balance issue, it is recommended that future revisions of this particular IMO model course should incorporate more performance criteria from the mental procedure and psychomotor procedure learning domains. This can be accomplished by selecting a taxonomy that focuses on the psychomotor domain[15] and redefining the performance criteria using suitable action verbs from the appropriate level within the taxonomy.

Similarly, the course outline tables for the model courses are biased toward being knowledge-oriented rather than action-oriented, affect-oriented, interpersonal-oriented, or meta-cognitive-oriented. The column where time approximations are placed has the following header "Lectures, demonstrations, and practical work." While practical work is often viewed as action-oriented, lectures and demonstration are often a passive form of learning, and thus knowledge-oriented. It might be beneficial for the model course template to either provide a broader array of learning methods (to encompass more domains of learning) for a column header and/or to provide a resource for designers that describes which teaching methods are best suited for different domains or levels within a domain. For example, Nilson maps effective teaching methods for each level of learning outcomes in Bloom's revised taxonomy (see Table 11.1 on p. 107 of [28]).

Finally, while the work of the HTW correspondence group is a necessary advancement toward outcomes-based learning for seafarers, it is not sufficient. In addition to developing evidence-based methods for creating learning outcomes, constructive alignment suggests similar attention must be devoted to matching learning activities and assessment methods to the learning domain of the learning outcomes. For example, in this IMO model course for firefighting, particularly in the third competency which requires training, practices, and drills using firefighting equipment including in smoke filled spaces, little guidance has been provided on how to design the learning activities and assess the learning and performance of the competencies. The Instructor's Manual (Appendix D of the model course) has some general discussion of activities and suggests the development of lesson plans, but the sample lesson plan provided focuses on knowledge-oriented classroom instruction instead of the primary action-oriented objective of the course. Moving from an emphasis on knowledge acquisition only to providing examples across all domains of learning (such as more emphasis on behavioral learning in this model course) and greater description of how to teach and assess the breadth of learning would be a tremendous advancement in the outcomes-based policy within model courses and the development of STCW-related competencies in general.

[15] Examples would include the action verb taxonomy created by the HTW correspondence group, Marzano & Kendall's new taxonomy (used in this study), or any of the other taxonomies, such as those developed by Simpson, Harrow, Dave, or Thomas.

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