The Initial Design of Learning Outcomes in the Sport Training Application

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Abstract Teaching and learning activities should be designed and developed based on a pedagogical approach. These activities occur within a particular context and are designed to achieve intended learning outcomes through a series of tools and resources. This paper shows an initial design of learning outcomes that will be specifically designed for reusability to support automation and computer-assisted discovery for sport training application.

Keywords Learning outcomes · Motor skill · Sport training

1 Introduction

Skills lie at the heart of athletes' performances. Athletes develop their skill through the regular practice of training. Training involves continual practice of the motion and is typically composed of repetitions of movements [1].

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The coach assists the athletes to enhance their skill by determining the training objectives or intended outcomes during the period of instruction [2]. The coach determines the training materials and techniques or tactics to be used in the coaching activities to achieve particular learning outcomes. The procedures usually integrate conditions for performing the skill, providing training with feedback, and reflecting the athletes for a given type of learning outcome. Behaviorists recognized these examples as rules and practice with feedback.

Planned, coordinated, and progressive coaching are needed for the athlete to develop successfully toward the intended outcomes [3]. Systematic coaching activities that particularly focus on task analysis are derived from the behaviorist perspective. A behaviorist approach to learning provides simple and clear coaching activities. Task analysis involves a detail analysis of complex skills by detailing each muscle, nerve, and tendon involved in a given motion to generate an accurate technique and tactic analysis that is congruent with the learning outcomes [4]. This analysis generates precise and detailed instruction that allows the coach to conduct the coaching activities pertaining to the athletes' achievement on the intended learning outcomes and thus allows the athletes to effectively develop their skills and abilities [4].

Thus an effective planning in sport training allows the congruity between techniques and tactics to be taught (represented in learning outcomes), and supports the assessment of learning outcomes and the teaching and learning activities used to foster their achievement.

2 Learning Outcomes in Motor Skill Domain

Motor skills, although often not specifically targeted by educational objectives in higher education, are components of a distinct type of learning outcome. This motor skill which concerned with the area of muscle development and coordination is essential for teaching and learning of human performance. Cognitive domain typically involves with declarative, procedural, or conditional knowledge. Learning outcomes in the motor skill domain, however, involve precise, smooth, continuous, and accurately timed performances, characteristically associated with surgical training, pilot training, and sport training.

Figure 1 shows several taxonomies of learning outcomes in the motor skill domain [5–7]. Generally, these taxonomies describe a hierarchical model of skill development from simple observation to mastery level.

However, several limitations of current learning outcomes are as follows:

- cannot be applied without having certain, and sometimes quite expensive as well as systemic conditions in place [8],
- lack of adequate evaluation and instructional resources that could adapt to the multitude of student interests in creating context-based learning [9], and

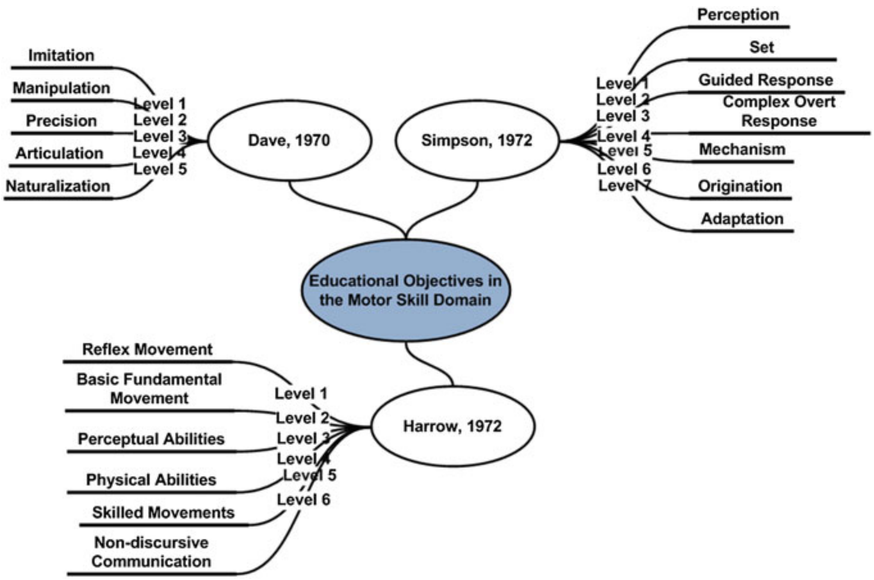

Fig. 1 Current learning outcomes

- additional research will be needed to assess the impact of individual readiness and the role of trust, which was not a review for enabling the learning experience [10].

3 Proposed Model of Learning Outcomes

A rigor literature leads to the findings of learning outcomes model that are relevant to this study. All the 6 identified learning outcomes are illustrated in Fig. 2, these categories namely sport pedagogy, teaching and learning, sport training and coaching, e-learning, computer-based learning, and sport competence.

Sport pedagogy is about the creation of athlete's learning outcomes, literacy, and enthusiasm. Teaching and learning on the other hand provides guidance, service, and substance in the progress as well as dissemination of the research-based teaching and learning resources. Meanwhile, sport training and coaching concerns improve technique, performance, and expertise in a particular area. While e-learning comprise all forms of electronically supported learning and teaching or pedagogy, sport competence refers to skills that athletes could understand and appreciate until the end of the program.

Considering their reliability and frequency, 19 variables that best-suit learning outcome components in the motor skill domain were selected. And these variables are as follows: Intended learning outcome is the evidence learner understand,

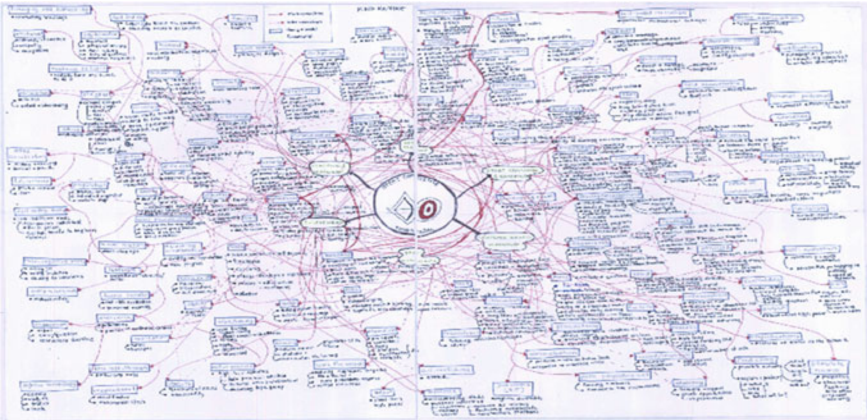

Fig. 2 Proposed model of learning outcomes

know, and be able to do until the end, situation of each steps during training, tool such as equipment or machine as well as a physical object that can be used to achieve a goal [11] proficiency level is that portion of the current situation, physical the body activity [12], completion time is the period of task performs, motivation refers to the desire to do something, feedback reaction to the performance [13] capability to do something well [8], confident is that feeling be able to perform the task [9], accuracy as an ability to assess the result to the true value, reliability ability of a system to achieve and maintain its functions, validity such as a condition to being acceptable [10], environment refers to conditions of the activity surrounding [14], the design of the plan or program, process to bringing about a result, skill to make something, interaction with the system or coaches [12], and role to delegate the working conditions [10]. Therefore, to ensure an internal consistency between items for each dimension remained, the reliability analysis was done. This is to ensure that the answers given by each respondent (individual) are the same.

4 Pilot Study

Adopting from literature, 212 questions were developed, featuring 19 independent variables. And a pilot study involving all level of expert archers was carried out using Cronbach Alpha to test reliability of the said instruments. The study undertook a pilot study with respondents consisted of all levels of expertise archers. The study completed the pilot study in order to achieve the reliability of the instrument. To assess the reliability, Cronbach's Alpha is used. Table 1 shows the overall results of this reliability test.

Table 1 Reliability test

Factor	Dimension	Items	Cronbach's alpha value	Status
1	IOL	18	0.735	Accepted
2	Situation	15	0.795	Accepted
3	Tool	15	0.925	Accepted
4	Proficiency level	15	0.832	Accepted
5	Completion time	15	0.865	Accepted
6	Interaction	15	0.903	Accepted
7	Motivation	15	0.940	Accepted
8	Feedback	15	0.927	Accepted
9	Capability	15	0.919	Accepted
10	Physical	8	0.915	Accepted
11	Confident	8	0.887	Accepted
12	Accuracy	6	0.576	Rejected
13	Reliability	7	0.469	Rejected
14	Validity	8	0.636	Rejected
15	Environment	6	0.418	Rejected
16	Design	8	0.687	Rejected
17	Process	8	0.700	Accepted
18	Subject matter	4	0.699	Rejected
19	Role	4	−0.078	Rejected

5 Results

Table 1 shows the Cronbach Alpha result of all items tested. And the overall value used is 0.985 (Pallant [15]). This result suggested that there were 7 dimensions to be rejected in this test as they showed values less than 0.7.

Corrected item—total correlation analysis performed as the suggested items were related to the study. This was necessary to refine the dimensions needed for the next experiment. The pivotal result of this test is summarized in Table 2. Result from the second test corroborates the importance of the said 7 items, and therefore, they accepted, not rejected for the study. Eighty-two dimensions were deleted from the first 212 entirety leaving only 130 dimensions that positively correlated in the study.

Table 2 shows that 7 dimensions are acceptable when corrected item total correlation was used. Eighty-two of the items were deleted to make 130 items of 212 items total. From it, we can observe how well the items in a group are indeed correct after unwanted item deleted. There are 7 dimensions used to measure aspects of accuracy, reliability, validity, environment, design, interaction, and role. From reliability testing inspection to ensure that each item was measuring the same characteristics that have done. Next, a scale to measure aspects accessibility have shown there is no internal consistency based on Cronbach's Alpha coefficient that was 0.576 (accuracy), 0.469 (reliability), 0.636 (validity), 0.418 (environment), 0.687 (design), 0.699 (subject matter), and −0.078 (role). Thus, the 197

Table 2 Cronbach alpha if item deleted

Factor	Dimension	Cronbach's alpha value	Item deleted	Status
1	IOL	0.863	8	Accepted
2	Situation	0.912	8	Accepted
3	Tool	0.925	4	Accepted
4	Proficiency level	0.832	8	Accepted
5	Completion time	0.865	6	Accepted
6	Interaction	0.903	4	Accepted
7	Motivation	0.940	1	Accepted
8	Feedback	0.927	3	Accepted
9	Capability	0.919	1	Accepted
10	Physical	0.915	3	Accepted
11	Confident	0.887	No item deleted	Accepted
12	Accuracy	0.862	3	Accepted
13	Reliability	0.857	5	Accepted
14	Validity	1.000	5	Accepted
15	Environment	0.889	4	Accepted
16	Design	1.000	6	Accepted
17	Process	0.818	5	Accepted
18	Subject matter	0.700	No item deleted	Accepted
19	Role	0.706	2	Accepted

items that have a coefficient Alpha Cronbach with values above 0.07 removed to provide a Cronbach Alpha coefficient for better. As a result, the Cronbach Alpha coefficient increased to 0.7 and above. Table 2 shows the value of alpha for each item in the dimensions.

While there were 12 dimensions used to measure aspects of ILO, situation, tool, proficiency level, completion time, interaction, feedback, capability, physical activity, confident and process from reliability testing inspection to ensure that each item was measuring the same characteristics that have done. Next, a scale to measure aspects accessibility found that there is a good internal consistency with Cronbach's Alpha coefficient that was 0.735 (ILO), 0.795 (situation), 0.925 (tool), 0.832 (proficiency level), 0.865 (completion time), 0.940 (interaction), 0.927 (feedback), 0.919 (capability), 0.915 (physical activity), 0.887 (confident), and 0.700 (process). Table 2 shows the value of Alpha for each item in the dimension.

6 Discussion

The study affirms that the selected 19 variables are useful to measure athletes' learning outcomes in sport competence model. Results attest as such since the items were proven to account for 77.8 % reliable as well as good fit to the data. This brought to our attention that the act of developing a learning outcome model

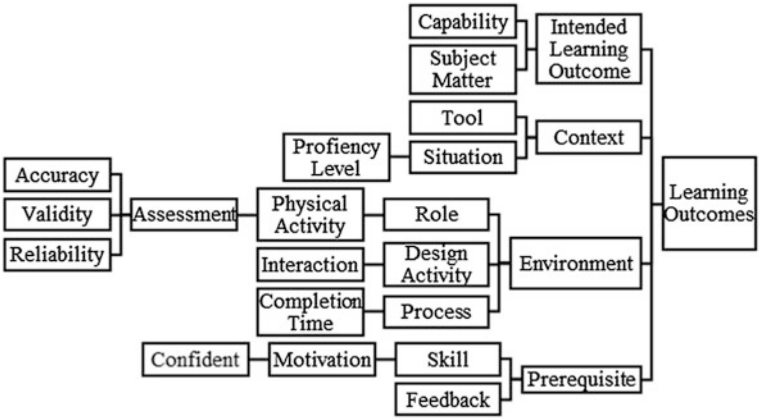

Fig. 3 Refine model of learning outcome

is indispensable. Having selected all the important categories from the results, a refine model of learning outcome in the motor skill domain is presented in Fig. 3.

It is highly recommended that the learning outcomes in the motor skill domain is used preliminarily to measure athlete's competence learning outcomes relating to motor skills. With overall score above 0.7, the study strongly views the following 19 competencies as significantly important to athletes concerning learning outcomes. Moreover, each model with a mean score above 0.7 could be regarded as being of considerably more influence by participants; 19 competencies accepted from the list. The list acceptable are as follows: (1) intended learning outcome, (2) situation, (3) tool, (4) proficiency level, (5) completion time, (6) motivation, (7) feedback, (8) capability, (9) physical, (10) confident, (11) accuracy, (12) reliability, (13) validity, (14) environment, (15) design, (16) process, (17) subject matter, (18) interaction, (19), and role.

7 Conclusion

The paper argues for the design of learning outcomes in the motor skill domain for sport training application. Future work will focus on expressing the learning outcomes as a series of UML models for the purposes of higher engineering education and training in sport applications. Thus, this learning outcome will achieve better reasoning and classification expression with regard to knowledge management and sharing.

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