

Applying Bloom's Taxonomy in Orthopedic Clinical Education: Examples for Daily Practice

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Abstract

Bloom's taxonomy has been widely used in setting curricula and guiding the main educational outcomes. However, its use in daily teaching activities has been limited. In the context of orthopedic clinical education, applying Bloom's taxonomy can help surgical educators design effective learning experiences for students. The taxonomy consists of six levels, starting from the basic level of remembering knowledge and moving up to higher levels of understanding, application, analysis, evaluation, and synthesis. Bloom's taxonomy in orthopedic clinical education can help learners develop a deep understanding of the subject matter and acquire the necessary skills to excel in their future clinical practice.

Keywords: Orthopedic education; Bloom's taxonomy; Learning objectives

Introduction

Bloom's taxonomy is commonly used as a framework that categorizes different levels of cognitive thinking and learning in educational institutions [1]. It is often used in educational settings to guide curriculum development and assessment [2]. However, it is much less often used to guide day-to-day educational activities [3].

In the context of orthopedic clinical education, applying Bloom's taxonomy can help surgical educators design effective learning experiences for students. The taxonomy consists of six levels, starting from the basic level of remembering knowledge and moving up to higher levels of understanding,

application, analysis, evaluation, and synthesis [4].

At the knowledge level, learners are expected to acquire and memorize factual information about orthopedic basic and clinical knowledge. This is commonly achieved through traditional methods such as reading textbooks or attending lectures. At the comprehension level, learners should be able to understand and explain the concepts and principles behind orthopedic knowledge and clinical practice. This can be done through interactive discussions, group activities, and multimedia resources. At the application level, learners focus on applying their knowledge and understanding to real-world clinical scenarios. This can be achieved through hands-on experiences such as clinical rotations, simulated surgeries, and case-based learning.

Moving up to the analysis and evaluation levels, learners should be able to critically analyze and evaluate orthopedic knowledge in clinical scenarios. This can be achieved through comparing results, self-assessment activities, critical appraisal of research articles, peer feedback, and reflective writing assignments. Analysis and evaluation cognitive skills are overlapping and commonly performed simultaneously since analyzing requires judging the quality and value.

While at the synthesis level, learners integrate and synthesize their knowledge and skills to develop innovative solutions to orthopedic clinical challenges. At the curriculum level, this can be achieved through conducting research projects, learning collaboratively, and solving new/unusual clinical problems. Overall, applying Bloom's taxonomy in orthopedic clinical education can help learners develop a deep understanding of the subject matter and acquire the necessary skills to excel in their future clinical practice.

Application

Applying Bloom's taxonomy in medical education is not new. However, educators often focus on the lower levels of taxonomy at the knowledge acquisition and comprehension [5]. Clinical educators should aim at the higher levels of cognitive learning levels rather than the mere regurgitating, remembering, and recalling information [6]. Focusing on lower-level cognitive learning might compromise the quality of medical education, resulting in limited ability to apply principles of safe clinical practice [3]. Hence, developing by applying higher levels of Bloom's taxonomy to develop higher-order thinking skills should be the aim in clinical education [7]. Designing predefined learner-centered selected objectives for teaching

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sessions enhances the outcomes of learning and enables measuring objectives [8].

We believe that providing models and examples of daily orthopedic clinical educational training activities based on Bloom's taxonomy will enhance the understanding and application of the taxonomy among orthopedic educators. Hence, in this paper, we provide two common clinical scenarios and the aspects where various levels of the taxonomy can be applied.

Clinical Examples

We chose two examples, pelvic fracture and compartment syndrome, which are of moderate to high complexity to ensure including all the six levels of Bloom's taxonomy. The principles of application in the example of pelvic fracture can be used in most scenarios of fractures. While in the case of compartment syndrome, the application focuses on complex cases.

Case 1: pelvic fracture

At various clinical settings, cases of pelvic fractures can be a teaching scenario at multiple learning levels for trainees. Here is a description of teaching levels available throughout the case.

Remembering

As with teaching most clinical scenarios, learners commonly start with listing and describing the characteristics of pelvic fractures, types of pelvic fractures, and common causes of pelvic fractures.

Understanding

Learners are encouraged to associate their remembering with understanding how pelvic fractures happen, possible complications resulting from pelvic fractures, the healing process, and the options of treatment.

Applying

The main and essential purpose of remembering and understanding knowledge should be to enable applying it to solve problems such as using various clinical skills and radiologic tools to diagnose, confirm, and characterize pelvic fractures, treating pelvic fracture, and using the appropriate approach of surgical intervention.

Analyzing

Learners should practice analyzing unusual findings, complications, and outcomes of treatment. Analyzing the evidence

in literature or viewpoints in controversial situations or cases. Analyzing and evaluating can be applied to the content such as clinical scenarios, and to the quality of knowledge such as validity reliability and accuracy.

Evaluating

Senior learners should exercise evaluating progress and response to treatment, the value of different diagnostic or intervention tools, or the prognosis of certain scenarios.

It is important to refer here that analyzing and evaluating are closely related and may overlap since analysis in general aims to evaluate.

Creating

Opportunities of synthesizing knowledge are not widely available as the lower levels of cognitive learning. Hence, they should be carefully identified and incorporated in teaching so learners can exercise creating knowledge. In pelvic fractures, learners can be encouraged to think of new fixation approaches or prosthesis, introducing new hemostatic agents, or establishing new recovery protocols.

Depending on the level of learning and performance, learners can be taught at lower or higher levels of Bloom's taxonomy. Junior learners usually start creating fund of knowledge and broad base of information at remembering, understanding, and probably some applying skills. While senior trainees should aim to learn how to use their knowledge at applying and analyzing, moving to verifying and building on the knowledge through evaluating and synthesizing.

Case 2: compartment syndrome

In cases of compartment syndrome, there are more diagnostic and evaluation elements that mandate integrating various cognitive levels than the simple orthopedic cases. Identifying, diagnosing, and confirming the presence of compartment syndrome could be challenging. Hence the case could be used for teaching various and higher cognitive levels. Below is a description of Bloom's taxonomy cognitive levels pertinent for the pelvic fractures.

Remembering

Starting with the foundation of knowledge, it is important to learn and review signs and symptoms of compartment syndrome, common sites of the pathology, predisposing factors and causes of the syndrome.

Understanding

As always, understanding the acquired knowledge is essential

to ascend the clinical skills ladder. For pelvic fracture, understanding can be practiced through discussing the pathophysiology, complications, and principles of treating compartment syndrome (options of treatment/objectives of surgical treatment).

Applying

To direct learning to applying the acquired and understood knowledge in the case of pelvic fracture, consider discussing the diagnostic workup when required, clinic evaluation and identification of high index of suspicion, operative treatment, and technique of releasing the high compartment pressure.

Analysis

Proceeding to analyzing knowledge, trainees can be encouraged to discuss borderline clinical presentations of compartment syndrome, suspicion of complications, the evidence in the literature about the prevention measures.

Evaluating

As discussed earlier, evaluation is closely related to analyzing. Evaluation usually follows and/or compliments analysis most of the time when analysis is used. It is not easy to completely separate the two levels of cognitive processing. Evaluating unusual clinical presentations or complications of pelvic fractures and the value of different diagnostic work or surgical intervention can be practiced under this cognitive learning level.

Synthesizing

Under synthesizing knowledge, learning efforts should be encouraged to address establishing protocol of management or prevention (if not available) from new or up-to-date evidence; creating new scale for predicting compartment syndrome development; or introducing sensitive devices for early detection of the syndrome.

In teaching compartment syndrome, as in teaching pelvic fractures and other orthopedic clinical scenarios, the focus should be adjusted on the cognitive level appropriate for learners. Junior learners should master the first two levels and start applying them through level three. While senior learners should spend little time on the first two levels and work more on applying knowledge ascending toward analyzing, evaluating, and synthesizing when possible.

Conclusions

Orthopedic educators can enhance their day-to-day clinical teaching by utilizing Bloom's taxonomy in educational activi-

ties. This is an extended use of Bloom's taxonomy from the classical curricular level designing. To facilitate this teaching practice, simplified clinical examples from the daily practice are made available to open the doors for broader and deeper applications. Furthermore, using practical clinical scenarios will familiarize educators with the application of the taxonomy and lead to an overall better training and assessment.

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Conflict of Interest

None to declare.

Author Contributions

WSO contributed to the concept of the article, as well as to writing, reviewing, and editing the manuscript. FT contributed to the idea of the article, as well as to writing, reviewing, and revising the manuscript.

Data Availability

The authors declare that data supporting the findings of this study are available within the article.

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