Title

Theory-Informed Course Design: Applications of Bloom's Taxonomy in Undergraduate Public Health Courses

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Acknowledgements

The programs of the Faculty Development Center (FDC) at the University of Maryland, Baltimore County, were instrumental in the development of the course designs described in this paper. The authors would like to thank Dr. Jennifer Harrison of the FDC for her review of this paper and helpful suggestions.

Funding

None

Abstract

The public health workforce needs an array of knowledge and skills to effectively address current and future public health challenges. While existing competency models establish educational objectives for public health degree programs, there is insufficient guidance on how academic programs should develop these competencies and workforce assessments continue to identify skills gaps in areas such as critical thinking and problem analysis. In this paper, we describe an approach to designing undergraduate public health courses based on the hierarchy of cognitive processes in Bloom's taxonomy. Course activities are sequenced to provide students with opportunities to attain increasing mastery of course content and analytical skills, from remembering new concepts to applying them in case studies and creating original analyses and proposals. This simple approach has been applied to three separate courses taught by multiple instructors over three years, and has received positive feedback from students. By explicitly communicating the theoretical basis for course activities, this approach also promotes metacognitive knowledge in students that can foster their continued learning success.

Introduction

There is strong recognition that the public health workforce needs an array of knowledge and skills to effectively address current and future public health challenges, and that academic programs play a critical role in preparing the workforce with needed skills (Drehobl et al., 2014; Koo & Miner, 2010). Undergraduate public health competency guidelines from the Association of Schools and Programs in Public Health (ASSPH) and the Council on Public Health Education (CEPH) detail foundational knowledge competencies as well as technical and practical skills students need to be prepared for public health work (Council on Education for Public Health, 2018; Petersen et al., 2013). Core knowledge areas include statistical concepts, healthcare systems, social and ecological determinants of health, and population health dynamics (Council on Education for Public Health, 2018). Critical skills include the abilities to find, use, assess, synthesize, and communicate public health information (Council on Education for Public Health, 2018), to engage in collaborative teamwork with diverse stakeholders, and to analyze alternative viewpoints (Petersen et al., 2013). Additional workforce recommendations expand the list of required public health competencies within areas such as analytical skills, leadership, systems thinking, and change management (Council on Linkages Between Academic and Public Health Practice, 2014; National Consortium for Public Health Workforce Development, 2017).

While there are increasing data and recommendations regarding the educational outcomes required of public health degree programs, there is insufficient guidance on how academic programs can achieve these outcomes (Merzel et al., 2017). Surveys of public health employees identify multiple competency gaps, particularly for critical analysis skills such as assessing the factors that influence public health problems and analyzing public health policy impacts (Sellers et al., 2015). Providing educational exercises that foster the development and

practice of advanced critical thinking skills is a challenge across disciplines (Willingham, 2019). In this paper, we describe an approach to designing undergraduate public health courses to achieve advanced competencies that is informed by the cognitive processes hierarchy of Bloom's taxonomy (Anderson et al., 2001). We present a summary of the pedagogical literature supporting this approach to course design, and describe how it has been applied in multiple courses in an undergraduate public health major at the University of Maryland, Baltimore County (UMBC).

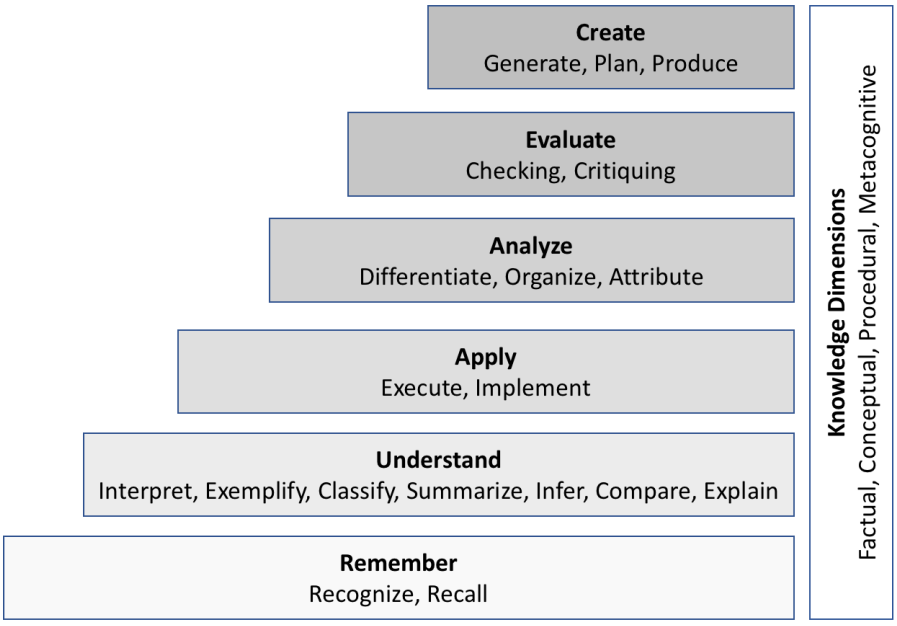
Bloom's Taxonomy and Related Instructional Approaches

"The Taxonomy of Educational Objectives," commonly referred to as Bloom's taxonomy, was originally published in 1956 to inform and standardize assessments of educational achievement, and describes a hierarchy of cognitive processes (Bloom, 1956). Bloom's taxonomy is in effect a theory of how students learn, with mastery of lower-level cognitive skills required before higher-order skills can be obtained (Krathwohl, 2002). Although Bloom's taxonomy has informed the development of some competency models in public health (Calhoun et al., 2012; Koo & Miner, 2010; Markenson et al., 2005), it is less commonly applied in classroom teaching in public health compared with other disciplines, such as biology (Crowe et al., 2008) and engineering (Britto & Usman, 2015).

Revised in 2001 (Anderson et al., 2001), the current version of Bloom's taxonomy identifies 19 cognitive processes grouped within six categories, alongside four dimensions of knowledge (Figure 1). In this article we refer to the groupings of cognitive processes as levels, to emphasize their hierarchical order. The simplest cognitive process level is *remember*, which relates to retention of new facts and concepts. The following levels require "meaningful learning," which involves transferring knowledge and skills to understand new concepts and

solve new problems. The processes in the *understand* level require students to actively use knowledge to explain, classify, summarize, or interpret new concepts. Students progress further in their mastery of more abstract concepts and complex skills when they engage in processes under the *apply*, *analyze*, and *evaluate* levels. The highest and most complex level of the taxonomy is *create*, which requires students to form original hypotheses, develop new procedures, or invent devices. The six levels of the taxonomy offer a framework for instructors to design course objectives and activities that foster the practice of increasingly complex cognitive processes as well as assessments that demonstrate which cognitive skills students have attained. By fostering student progression up the hierarchy, instructors can ensure that students first master the basic subject matter knowledge necessary for successfully engaging in critical thinking exercises (Willingham, 2019).

Figure 1. Bloom's taxonomy cognitive process levels.[1]



[1] Adapted from Anderson et al. (2001). While Anderson et al. refer to different cognitive processes as categories, this article uses the term level to indicate the hierarchical relationship between them.

In order to provide students with opportunities to practice and demonstrate the more complex cognitive processes in Bloom's taxonomy, instructors must incorporate active learning into their classroom activities and assignments (Anderson et al., 2001). Active learning has been defined as "instructional activities involving students in doing things and thinking about what they are doing" (Bonwell & Eison, 1991), and provides students with opportunities to apply knowledge through exercises such as case-based learning, role playing, and simulations. Compared to traditional lectures, active learning has been shown to improve exam scores and reduce the rate of course failure in undergraduate science courses (Freeman et al., 2014). Other reported benefits of active learning include improved retention of new concepts, greater skill development, and enhanced ability to apply learned material (Prince, 2004). Some forms of active learning, such as case- and problem-based approaches, have been used extensively in legal, medical, and business education programs (Walker & Leary, 2009). Case-based learning is now increasingly being adopted in the biological and social sciences (Yadav et al., 2007), and the National Science Foundation supported an effort to expand resources for case-based teaching through the National Center for Case Study Teaching in Science (Walker and Leary 2009; NCCSTS 2010). Following this trend, examples of active learning in public health curriculums are also increasing (Begg et al., 2014; Leon et al., 2015; Sibbald et al., 2016; Yeatts, 2014).

The knowledge dimensions of Bloom's taxonomy were added in the 2001 revision, and also represent a hierarchy, from concrete to abstract knowledge (Anderson et al., 2001). While the first three knowledge dimensions—factual, conceptual, and procedural—align with the recommended competencies for undergraduate public health programs (Council on Education for Public Health, 2018; Petersen et al., 2013), the most abstract dimension—metacognitive knowledge—is not currently reflected in curriculum guidelines. Metacognitive knowledge encompasses students' knowledge of effective learning strategies as well as self-knowledge

about their own cognition and its impact on their learning (Anderson 2001). Research indicates that many students have low knowledge of metacognitive strategies and often engage in the least effective strategies—such as rereading and highlighting—in their own studying (Dunlosky et al., 2013). Instruction on effective metacognitive strategies, like active reading and self-testing, can be incorporated into college courses to improve student performance (McGuire, 2015; Zhao et al., 2014). In addition, instructors can embed metacognitive learning in course discussions in a variety of ways, such as prompting students to reflect on the extent that they met learning goals and the strategies that most assist their learning (Tanner, 2012). Although the absence of metacognitive knowledge in public health competency models is a missed opportunity to foster the continuous learning skills that public health professionals need (Plough, 2014), incorporating Bloom's taxonomy into public health courses can help address this gap.

Example Applications of Bloom's Taxonomy to Course Design in an Undergraduate Public Health Program

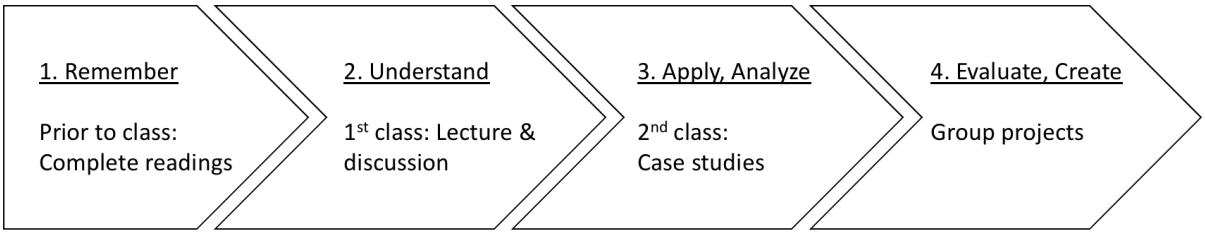
Overall approach to theory-informed course design

In 2017, the lead author undertook the redesign of an undergraduate public health research methods course applying the cognitive process hierarchy from Bloom's taxonomy. Following positive student feedback, the same approach was applied to restructure three additional undergraduate public health courses. Each course meets its respective learning objectives across the six levels of Bloom's taxonomy through four main activities that repeat with each new unit: 1) advance readings; 2) lectures with discussion; 3) in-class case studies; and, 4) cumulative assignments. Classes in this format meet twice a week, with each week addressing a new unit or major topic.

For each unit, students are expected to achieve the ***remember*** level of Bloom's taxonomy through required readings and videos that are completed in advance of class. A reading quiz, or optional hand-written notes, provide accountability for completing the reading and reinforce the information recognition and retrieval processes within the remember dimension. The first class meeting for each unit is a lecture and discussion designed to achieve the ***understand*** level. The instructor guides the class through a review of important concepts for the unit with new examples and opportunities for students to compare, explain, and summarize concepts (all processes under the understand domain) through brief "think-pair-share" style discussions. During the second class meeting, students complete a structured case study designed to ***apply*** and ***analyze*** the unit's concepts. Case studies are completed in small groups, and constructive dialogue within groups, including peer-to-peer teaching, is encouraged. At the end of the case study session, the whole class reconvenes in a guided discussion of the answers. Finally, students work in assigned groups to complete group projects, which incorporate course content from multiple units. The group assignments require students to ***evaluate*** course concepts and ***create*** original proposals or reports. Midterm and final exam questions are designed to measure students' attainment of the apply, analyze, and evaluate levels of the taxonomy.

The theoretical basis for the course design is explained to students at the first class meeting (Figure 2). During discussions of the course structure, the majority of students indicate that they have not previously seen Bloom's taxonomy. To ensure that the course design is understood, students are reminded of the purpose of each activity, and its relation to the cognitive dimensions in Bloom's taxonomy, throughout the first month of class. The following examples illustrate how this course structure has been applied to individual units within three separate public health courses—Research Methods, Global Health, and Program Planning and Evaluation.

Figure 2. Presentation of course design.



Research methods course example: Unit on ethical conduct of human subjects research

"Research Methods in Health" is a 300-level core course for the undergraduate public health and health administrator major at UMBC that is typically taken in the sophomore or junior year. The course is designed to prepare students to locate and evaluate health research evidence for applications in their future courses and careers. Ethical conduct of human subjects research is an early unit in the course. The pre-class assignments for *remembering* research ethics concepts consists of reading the ethics chapter in the course textbook, viewing the U.S. Public Health Service video, "Evolving Concern: Protection for Human Subjects," and completing a reading quiz or optional hand-written notes. The first class meeting develops *understanding* by refreshing students on the definitions and origins of the Belmont principles, presenting multimedia descriptions of historical ethical violations, and guiding students through brief discussions of how the historical examples represent deviations from the Belmont principles.

At the second class meeting, students are presented with a structured case study that prompts them to *analyze* the ethics of a published clinical trial of rotavirus vaccine in India whose methods received criticism for utilizing a placebo when efficacious vaccines existed. Student groups are instructed to consider themselves to be an ethical review board, to review the study's methods, and to *apply* the Belmont principles in making an ethical determination

whether or not to approve the study. After the instructor leads a class discussion of the initial determinations made by each group, students receive the published criticism and reconsider their initial analysis of the ethics of the study. The class session ends with a discussion of the World Health Organization's guidance on the use of placebos in vaccine trials. Later in the course, students have the opportunity to *evaluate* and *create* using the concepts in this unit by developing a plan for handling ethical concerns within their cumulative research proposal assignments.

Global health course example: Unit on nutrition

The same theory-informed course design is applied to an elective 300-level global health course open to all undergraduate students. The course covers the "global citizen level" competencies in the Consortium for Universities of Global Health framework (Jogerst et al., 2015), including global burden of disease and social, environmental, economic, and policy determinants of health. Several health areas are also presented as individual units that address the burden and determinants for that area, including nutrition, maternal and child health, and infectious and neglected tropical diseases. Within the nutrition unit, students achieve the *remember* level of Bloom's taxonomy by reading the nutrition chapter in the course textbook. Students watch two videos before class, a 2016 Frontline virtual reality documentary on conflict-induced famine in Sudan and a TedTalk on the introduction of an iron cooking supplement to reduce anemia in Cambodia. As new global health stories are available in the media, video assignments may be updated to ensure the content is timely. The first class meeting includes a lecture and brief paired discussions that facilitate *understanding* nutrition concepts.

The case study for the second class meeting of the nutrition unit was developed from publicly available materials from the World Health Organization (WHO) and Doctors without

Borders/Medicins Sans Fronteirs (MSF). Student groups read about an MSF nutrition clinic and therapeutic feeding program in Balochistan province, Pakistan. Students are then presented with a list of six fictional pediatric patients with age, height, weight, and other symptoms, and asked to *apply* the wasting and stunting definitions to classify each child's nutritional status and recommend treatment following the WHO's severe acute malnutrition management guidelines. In the second part of the case study, students read real patient testimonials published on the MSF website and *analyze* the social and economic determinants of health contributing to the malnutrition Balochistan. Students revisit the nutrition concepts in the cumulative assignment when they *create* a policy brief that summarizes the health burden and determinants of a chosen country across all health areas covered in class. The briefs require students to *evaluate* the relationships between concepts in class and consider how the various determinants of health (culture, diet, environment and sanitation and hygiene) shape health outcomes in each area.

Program planning and evaluation course example: Unit on impact models

Another 300-level elective offered to UMBC's public health students is a course covering the fundamentals of planning and evaluation for public health programs. This course, geared towards juniors and seniors, is designed to provide students with entry-level professional skills to contribute to health needs assessments, intervention selection and program design, program monitoring, and outcomes evaluations. For the unit on program impact models, students read assigned chapters from the Kellogg Foundation's *Logic Model Development Guide* and complete a quiz or reading notes that facilitate achievement of the *remember* level. As a skills-based course delivered to undergraduate students with limited public health program experience, both the lectures and the case studies emphasize practical application using real world examples. During the first class meeting of the impact models unit, the instructor leads

students through a review of the readings, introduces contrasting definitions and approaches to impact model design, and facilitates discussion of differing approaches to achieve *understanding.* At the second meeting, groups are shown a brief video describing a safe motherhood program developed by the International Committee of the Red Cross in Liberia. The case study presents students with a draft impact model for the program that does not meet the model development guidelines for the course. Students are asked to *analyze* the model's strengths and weaknesses and then to *apply* the impact model guidelines in revising the model. The class' cumulative assignment is a program proposal that requires students to *create* an original impact model for a program that addresses a health need in a county in Maryland.

Course Outcomes

Between Spring 2017 and Fall 2019, 16 course sections were offered in this format, including three separate classes taught by five different instructors with a range of 20 to 40 students per section. Student evaluation of courses at UMBC are measured using an online 32-question survey based on the validated Student Evaluation of Educational Quality (SEEQ) instrument (Marsh, 1982). The instrument includes a range of questions that cover the instructor's style and communication, the breadth and challenge of the content delivered, and the value of exams and assignments. Three questions in the survey assess student perspectives of course design features relevant to our approach, and one question rates the overall quality of the course. Across the 16 course sections, students consistently provided above-average ratings for the development and explanation of course materials, the agreement between course objectives and activities, and the extent to which course activities contributed to learning (Table 2).

Student have also provided qualitative feedback on the course structure and active learning exercises through open-ended questions in the course evaluation system. The majority of

student comments about the course design are positive, with students appreciating that the courses have a clear structure, and that there is variety in the activities during class time (e.g., alternating between lecture and group work). Many students comment that case studies and cumulative projects help to reinforce course concepts, and that having application exercises within the same week that the concepts are introduced is beneficial. Students also appreciate that group work sessions provide greater opportunities to ask questions, learn from each other, and share their opinions. Finally, students value the interaction with instructors during group work sessions and receiving interim feedback on cumulative assignments in class, before they are submitted for grading.

While less common, students have also raised concerns about the course design in evaluation comments. The most frequent concerns relate to challenges with dysfunctional groups or group members that don't contribute. Students express particular frustration with group challenges on graded cumulative assignments, rather than ungraded case studies. Some students have suggested spending a greater portion of the first class meeting each unit with discussion rather than lecture, while a small minority requested more lecture time at a slower pace.

Considerations for this Approach

This paper describes an approach to course design that utilizes Bloom's taxonomy to plan course activities that foster students' application and mastery of course concepts. Many of the individual pedagogical approaches described here are commonly used in undergraduate and graduate instruction in public health and other science and social science disciplines. What is less common, particularly in public health courses, is for each unit to contain a sequence of activities aligned with Bloom's taxonomy, and for the theoretical basis for course activities to be explicitly presented to students in a way that facilitates their own metacognition. This approach

is simple and can be adapted for many public health courses to achieve undergraduate and graduate public health competencies. Courses with a similar degree of structure, including more frequent small-value assignments and active learning activities, have reduced failure rates in biological sciences (DeSalvo et al., 2016; Zhao et al., 2014). Further development of this approach within the undergraduate major at UMBC will include clarifying objectives for each unit and activity, and linking those objectives to the larger program learning objectives and competency model through curriculum mapping (Hale, 2007).

Although the literature has demonstrated many benefits to case-based teaching, developing structured cases that address course concepts requires considerable effort and creativity (Prince & Felder, 2007). Case studies need to build on the content covered in the course readings and lectures to be an effective tool in achieving Bloom's higher dimensions of learning. The case studies described here, and the majority of case studies used in our courses, are original case studies that draw from published research, policy and program documents, and other publicly-available resources. While new resources for case study teaching in public health, like the National Center for Case Study Teaching in the Sciences, are increasingly available to instructors, the need for consistency in terminology and concepts throughout the course can present difficulties in using "off the shelf" cases without revision. Ensuring that case studies remain relevant over time can be challenging, particularly with rapidly changing content areas like global health. Although instructors with heavy course loads may need several semesters to develop or adapt a complete set of case studies for their courses, this burden can be shared with colleagues teaching other sections, and even with students (Panel 1). Once a set of case studies and cumulative assignments is available for a course, new instructors for that course will likely find that the preparation time is reduced compared with lecture-based courses, since well-developed case studies provide a complete lesson plan.

The active learning activities in these courses are conducted in small groups, primarily during class meeting times. When students are engaged, these group work sessions provide the benefits of vibrant discussions, peer teaching, and development of the interpersonal skills public health professionals need, such as effective communication and teamwork. When class sections are small (e.g., under 40 students), instructors have the opportunity to visit each group during class time, allowing students to ask questions in a smaller, more comfortable setting, which facilitates more direct interaction with the instructor. In larger classes, lab sessions with experienced teaching assistants may provide the same level of interaction and feedback. At the same time, the perennial challenges with group work exist, including unequal distribution of work and occasional conflict between group members. Course policies to address these issues, such as peer evaluations, do not always prevent student frustrations regarding group work dynamics. This team-based learning is also more challenging to implement in hybrid and online course offerings (see Panel 1 for recommendations about adapting this design to online courses).

A potential risk to undergraduate course designs that favor active learning over didactic lectures, is that students can respond negatively to active learning (Tharayil et al., 2018). Despite the evidence in favor of active learning, students are prone to underestimating the effectiveness of more challenging exercises involved with active learning. In a controlled experiment, undergraduate students assigned to didactic lecture had higher perceived learning—but lower actual measured learning—compared with students assigned to active learning classes (Deslauriers et al., 2019). One explanation for this phenomenon is that students misperceive the greater cognitive effort involved in active learning as a sign of poorer learning (Deslauriers et al., 2019). Our approach helps to ameliorate this risk—as demonstrated through positive student feedback—by providing students with a rationale for active learning

exercises as well as greater metacognitive knowledge about cognitive processes and effective learning strategies.

Conclusions

As public health degree programs are called on to help prepare students with the broad and complex skills required of the public health workforce, incorporating evidence-based teaching strategies that foster higher-order cognitive processes is essential for achieving this mandate. The same standards that we expect of public health programs—that they implement evidence-based interventions and be grounded in a theory of change—should also be expected of the academic programs training future public health professionals. Sharing theory-based course designs with public health students, as is done in our examples, may also better equip students with the metacognitive knowledge to direct their own continued learning that will be needed throughout their careers as they address emerging challenges in the field of public health.

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Table 1. Example Applications of Bloom's Taxonomy to Undergraduate Public Health Course Designs

Course	Unit	Cognitive Process Dimension from Bloom's Taxonomy		
		Remember / Understand	Apply / Analyze	Evaluate / Create
Research Methods in Health	Research Ethics	• *Reading:* Textbook chapter and U.S. Public Health Service video "Evolving Concern: Protection of Human Subjects" • *Individual assignment:* Reading quiz or written notes • *In-class activity:* Lecture and discussion	• *In-class case study:* Groups conduct a mock IRB panel review of India rotavirus vaccine trial using placebo control	• *Cumulative Assignment:* In later weeks, groups address ethical considerations for quantitative (survey) and qualitative (focus group discussion) research proposals
Global Health	Nutrition	• *Reading:* Textbook chapter, PBS Frontline video "On the Brink of Famine," TedTalk "How one luck fish can treat anemia" • *Individual assignment:* Reading quiz or written notes • *In-class activity:* Lecture and discussion	• *In-class case study:* Groups apply diagnosis and treatment criteria for wasting and stunting to fictional patients in a health clinic in Pakistan and consider the social and economic contributors to malnutrition in the community	• *Cumulative Assignment:* Students complete policy briefs that assess the nutrition indicators and determinants (among other health areas) of a selected country
Program Planning and Evaluation	Impact Models	• *Reading:* Kellogg Foundation's "Logic Model Development Guide" • *Individual assignment:* Reading quiz or written notes • *In-class activity:* Lecture and discussion	• *In-class case study:* Groups critique a published impact model for a safe motherhood program in Liberia according to the class's impact model development guidelines	• *Cumulative Assignment:* Students design a program to address a health concern in a Maryland county, and develop an impact model for the program

Table 2. Student Evaluation Responses Related to Course Design

Question	# Responding	% Agree / Strongly Agree
Course materials were well developed and carefully explained (Q10)	227	86%
“Proposed objectives agreed with those actually taught so I knew where the course was going” (Q11)	226	90%
“Readings, homework, laboratories contributed to appreciation and understanding of the subject” (Q29)	228	90%
Compared with other courses I've had at UMBC, I would say that this course is good/very good (Q30)*	228	81%

*Response options for this item are “very poor,” “poor,” “average,” “good,” and “very good.”

Panel 1. Recommendations for Implementation

Communicating the Bloom's-informed course design to students

- Regularly repeat the explanation of Bloom's taxonomy, and how course activities relate to the cognitive levels
- Include learning objectives at the beginning of lectures, case studies, and cumulative assignment instructions that incorporate verbs from Bloom's taxonomy. Bloom's verb charts are available on multiple teaching resource sites.
- Provide "signal" reminders of the Bloom's level of each activity through headings within lectures or icons on assignments. For example, each assignment could include a small diagram of the pyramid-depiction of the taxonomy, with the corresponding level for the activity highlighted.
- Incorporate brief reflective metacognitive exercises for students on the cognitive process level they think they've achieved before and after class units.

Incorporating the "understand" level in classroom and online lectures

- Embed knowledge quizzes during lectures using relevant technologies (e.g. Clicker questions, Poll Everywhere, Zoom polls, Panopto quizzes)
- Incorporate brief "think-pair-share" discussions in classroom lectures and discussion board posts or break out rooms in online classes. Discussion questions that allow students to relate course concepts to their own experiences can be particularly engaging.
- Reduce the breadth of lecture content in order to make time for more in-depth attention and discussion on key or difficult concepts.

Utilizing case studies for "application" and "analysis" levels of Bloom's taxonomy

- Share the work of developing case studies with colleagues and students. Offer assignments where students create case studies.
- Identify sources for existing teaching case studies, such as the National Center for Case Study Teaching in Science, the Centers for Disease Control's applied epidemiology case studies, and Western University's annual public health casebooks. Revise existing case studies to ensure consistent terminology across course materials.
- Maintain a folder to save articles and reports that could be used as a basis for new case studies. Using reference materials reduces the time required to develop case studies and ensures that case studies are relevant to public health practice. For example, articles in the "practice" section of the *American Journal of Public Health* provide detailed information about public health programs addressing a range of health issues and populations.
- For undergraduate courses, ensure that case study exercises are highly structured, with discussion questions requiring two sentences or less to complete. If a table or graph must be completed, provide the formatting in the case study (e.g., blank table).
- Limit the background reading for case studies to less than 10 minutes; completing case study readings in class ensures all students are equally prepared to participate.

- Provide a refresher of key definitions and formulas within the case study.
- For online courses, students can work together in online breakout rooms during class meeting times. Additionally, instructors may require students to submit completed case studies prior to class sessions where the answers are discussed.

Implementing cumulative assignments at the "evaluate" and "create" levels

- Design assignments that approximate real world deliverables in public health research and practice settings (e.g., research proposals, program implementation blueprints, policy briefs, health education materials, op-ed articles) .
- Provide early review and feedback on student plans for cumulative assignments, to increase students' success. For example, students can submit 2 to 3 brief concepts (e.g., research questions, program ideas) for review and approval before starting the cumulative assignment.
- Use in-class group work to engage students in discussion of the strengths and limitations of alternative approaches for their cumulative assignments to foster understanding of the strategic decision-making involved in public health work. For online classes, these discussions can take place during synchronous class breakout rooms or virtual office hours.
- When possible, provide opportunities to revise cumulative assignments based on peer and instructor feedback.
- Incorporate grading strategies that address student concerns about the potential effect of poor group dynamics, such as collecting peer evaluations of group members and weighting individual assignments (e.g., exams) more heavily than group assignments

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