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Original Research Article

Using an outcomes Logic model to design and evaluate An Anatomy course

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ABSTRACT

In curriculum planning, program development, and evaluation, outcomes drive the planning, development, and management of curriculum. Medical education is dynamic,and curriculum changes are often necessary to benefit both learners and institutions. Furthermore, diminished resources for medical education and accountability necessitate planning programs with a 'blueprint' in place. The outcomes logic model explicitly explains how a program achieves its objectives and explores the effect of the current program in terms of the resources required to develop or revise that program, the program activities, and the outputs on the target group, enabling the production of a blueprint for future development that is expressed as short-term, medium-term, and long-term goals with corresponding outcome measures. This blueprint serves as the foundation of the outcomes logic model. Team-based learning in anatomy is used as an example to illustrate the outcomes logic model. It outlines a step-by-step process for planning and implementing a new curriculum and serves as a framework for clarifying the program's goals, helping the program stay on track, and documenting the program's activities and impact.

KEYWORDS: curriculum planning, program development, logic model, evaluation

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INTRODUCTION

Program evaluation involves three stages: 1) before implementation, 2) during delivery of the program, and 3) following completion of the program [1]. Developers should decide whether the evaluation goal process based on inputs or outputs [2] and whether a model can be visualized such that, at any point during execution, developers can go back to reconsider and change the execution. The Outcomes Logic Model can serve the purpose. As a program grows and develops, so does its logic model. A program logic model is merely a snapshot of a program at one point in time; it is not the program's actual flow of events and outcomes. An outcomes logic model is a work in progress, a working draft that can be refined as the program develops [3].

Medical educators recognize that a program's outcomes begin with the planning, development, and management of the curriculum. Medical education and accountability

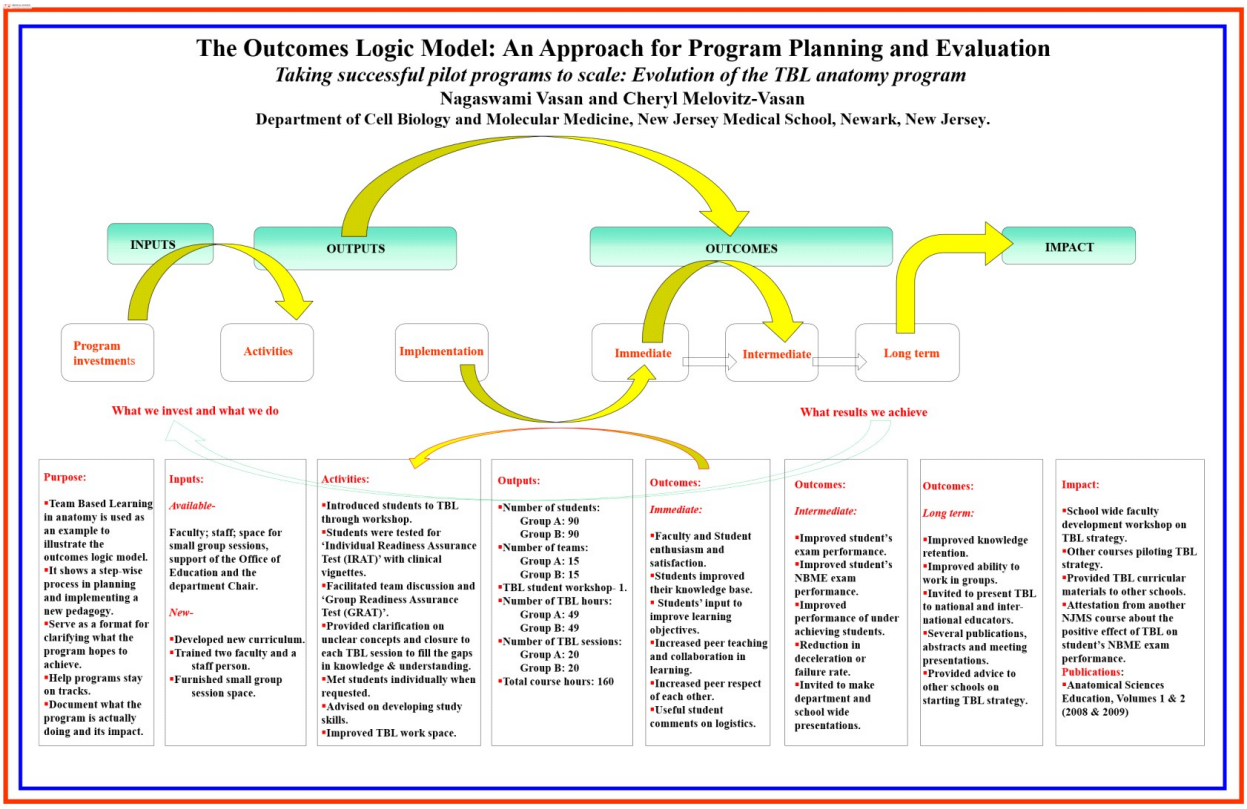

Fig. 1: A graphic representation of the outcome logic model clearly shows that it is non-linear and allows for cycle back.

necessitate planning programs with a 'blue-print' in place. The logic model explicitly explains how a program achieves its objectives [3]. In an integrated medical curriculum, several planning aspects are anticipated. Outcomes require the use of a structured and logical visual model to explain the route to the process [Figure 1]. This article offers a framework for designing and evaluating the anatomy program TBL by creating a visual model illustrating the entire process and enabling developers to cycle back and repeat as needed. The 'Outcomes Logic' model illustrates a sequence of cause-and-effect relationships to communicate the path toward a desired result. The logic model describes linkages among program resources, activities, outputs, and short-, intermediate-, and long-term outcomes related to specific program initiatives[3].

The logic model can identify significant performance measures once a program has been explained. Logic models are narrative or graphical illustrations of real-life processes that communicate the underlying assumptions upon which an activity is expected to lead to a specific result. Logic models illustrate a sequence of cause-and-effect relationships and provide a systems approach to communicating the path toward a desired result. Logic models link the problem (situation) to the intervention (inputs and outputs), and the impact (outcomes).

An outcomes logic model is a picture of how an organization does its work; it displays the theory and assumptions underlying the program. A logic model is essentially a visual representation of a cause-and-effect chain that links outcomes (both short- and long-term) to program activities and processes, as well as to the program's theoretical assumptions/ principles. [3]. It visually shows connections between a program's resources, activities, and expected outcomes, and clearly and succinctly shows how interventions affect behavior and achieve a goal. They serve as "road maps" that specify connecting pathways and the step- by-step relationship between planned work and intended results."The logic modeling process makes explicit what is often implicit" [4]. Logic models can be used in both new and existing programs. If an effort is well planned, a logic model can help get it off to a good start. Alternatively, if a program is already

underway, a logic model can help developers describe, modify, or enhance it [3].

Key components of an outcomes logic model include:

1.Inputs: These are the resources that you invest in your program. This can include financial resources, human resources (staff), materials, equipment, technology, partnerships, and the department and curriculum office. Inputs are what you use to carry out your program's activities.

2.Activities: These are the actions you take using the inputs. They can include workshops, training sessions, outreach efforts, and other interventions or strategies to address the identified problem or opportunity. Activities represent the work being done to produce specific outcomes.

3.Outputs: Are the direct results of your activities.They are clear evidence that your activities have occurred. Examples of outputs include the number of workshops held, the number of participants attending a training session, publications produced, and services delivered.

4.Outcomes: Outcomes are the changes or benefits that result from your program. Outcomes can be immediate, short-term changes, intermediate, medium-term changes, or long-term impacts. They can affect individuals, groups, communities, organizations, or systems. Outcomes are often categorized into:

· **Short-term Outcomes:** Changes in knowledge, attitudes, skills, or intentions.

· **Intermediate Outcomes:** Changes in behavior, practices, decision-making, policies, or social action.

· **Long-term Outcomes:** Broad, sustainable changes in conditions or status for individuals, groups, or communities.

5.Context: These are conditions or events outside the program's control that could impact its implementation and outcomes. External factors include economic conditions, social trends, policy environments, and other community or environmental influences.

A well-constructed outcomes logic model visually shows how a planned work leads to desired outcomes. It serves as a valuable tool for organization, implementation, evaluation, and communication, ensuring that all stakeholders have a shared understanding of the program's goals and methods. Like programs, logic models can and should change over time. A program logic model is merely a snapshot of a program at one point in time; it is not the program's actual flow of events and outcomes. A logic model is an evolving, working draft that can be refined as the program develops [3].

The use of outcome logic models offers benefits for program planning, evaluation, and communication. **Program planning:** Clearly establish program goals, design interventions, and determine necessary resources, activities, and expected outcomes. **Evaluation**: To track progress, measure effectiveness, and identify areas for improvement, compare planned outcomes with actual results. This allows for effective monitoring and evaluation by highlighting key indicators to assess program success.

Communication: To provide a transparent understanding of how a program operates and offer a visual tool to communicate its design and rationale to stakeholders quickly, as well as the impacts it aims to achieve. (See Table 1. Adapted from the Logic Model Development Guide, W.K. Kellogg Foundation, http://www.wkkf.org/Pubs/Tools/Evaluation/Pub3669.pdf; page 11).

A Logic Model Instrument for Educational Design and Evaluation

This article offers a framework for designing and evaluating the anatomy course during development and delivery, and across different outcome levels. Planning an evaluation early in the program development process is crucial to ensure that the necessary resources are available, to identify whether program objectives are being met, and to analyze critically why and how goals are being met [5]. Thoughtful evaluation enables evidence-based program restructuring to better meet learners' needs and provides guidance for successful program replication.

Methods and Analysis:

A well-constructed outcomes logic model

Table 1: Elements of the Logic Model for Program Evaluation

Element	Logic description (if . . . then)
Resources/inputs	Certain resources are necessary to operate the program
Activities	**If** you have access to the resources,
	then you can use them to accomplish planned activities.
Outputs	**If** you accomplish the planned activities, **then** you will deliver the product or service output that you intended.
Outcomes/benefits, as measured by indicators	**If** you accomplish your planned activities to the extent you intended in your outputs, **then** your participants (or organization) will benefit in certain ways.
Impact (long-term outcomes)	**If** the benefits to participants or organizations are achieved, **then** certain changes in organizations or systems might be expected to occur.
Source: Adapted from the Logic Model Development Guide, W.K. Kellogg Foundation, http://www.wkkf.org/Pubs/Tools/Evaluation/Pub3669.pdf; page 11	

visually shows how planned work leads to desired outcomes. It serves as a valuable tool for organization, implementation, evaluation, and communication. In this article, the authors provide a framework for the design and evaluation of the anatomy course in its development and delivery, and at various levels of outcomes. As we restructured the anatomy program, we used an outcomes logic model as a framework to guide course design and evaluation.

We restructured the anatomy program TBL usingan outcomeslogic model as a framework to guide course design and evaluation and provide a graphic representation of the relationship among program resources, the activities they support, and the outcomes they generate[3, 6, 7, 8, 9, 10, 11].

The following sections describe the five components of the logic model: inputs, activities, outputs, and short-term and long-term outcomes. Figure 1 displays the model's nonlinearity: the results we achieve depend on what we invest in and do. Also, the outcome is proportional to the activity created; program investments and implementation result in outcomes that reflect the project's immediate, intermediate, and long-term impacts [12].

Inputs: Institutional support included permission from the Department Chair and the Office of Medical Education.This started as a pilot program; results showed that student performance improved and that the students strongly supported TBL. At its inception, the Department granted a request for part-time assistance and a budget for incidental expenses. Eliminating anatomy and embryology lectures allowed students more time to fully prepare for each TBL encounter. Textbook reading assignments (including embryology) with topics and page numbers were provided for TBL study (TBL study guide) and for preparation for each TBL encounter.

Purpose: Adopted to illustrate development and delivery of the TBL in the anatomy course, the outcomes logic model showed a step-wise process in planning and implementing a new pedagogy, serving as a format for clarifying what the program hopes to achieve and helping programs stay on track, while also documenting program actions and their impact.

***Resources/Inputs*:**

· **Available:** Faculty, staff, space for small group sessions, and the support of the Office of Education and the Department Chair.

· **New:** Developed a new curriculum. Trained three faculty members and a staff member. Organized a space for small group sessions.

Activities:

· Introduced students to TBL through a workshop.

· Students were tested for the 'Individual Readiness Assurance Test (iRAT)' with clinical vignettes.

· Facilitated team discussion and 'Team Readiness Assurance Test (tRAT).'

· Provided clarification on unclear concepts and closure to each TBL session to fill the gaps in knowledge and understanding.

· Met students individually when requested to advise on developing study skills.

Outputs:

o Number of students: Group A: 90 Group B: 90

o Number of teams: Group A: 15Group B: 15

· TBL student introductory workshop: 1.

Number of TBL hours: Group A: 49; Group B: 49

Number of TBL sessions: Group A: 20, Group B: 20

Total course hours: 160

Outcomes/Benefits:

Immediate: Faculty and Student enthusiasm and satisfaction; Students improved their knowledge base; Students improved their iRAT and tRAT performances; Students' inputs to improve learning objectives; Increased peer teaching and collaboration in learning; Increased peer respect for each other; and Valuable student comments on logistics.

Intermediate: Improved students' final exam performance; Improved students' NBME exam performance; Improved performance of underachieving students; Reduction in both deceleration and failure rates; and Authors were invited to make department and school-wide presentations.

Long-Term: Improved knowledge retention; Improved ability to work in groups; Invited to present TBL to national and international educators; Several publications, abstracts, and meeting presentations; and provided advice to other schools on starting the TBL strategy.

Impact: School-wide faculty development workshop on TBL strategy; Other courses piloting the TBL strategy; Provided TBL curricular materials to other schools; Attestation from other NJMS course directors about the positive effect of TBL on students' exam performances; Publications: Anatomical Sciences Education, Volumes 1 and 2 [13,14].

RESULTS

Lessons learned: All the anatomy faculty initially participated, but after the first TBL session, only four continued, and others showed no interest for various reasons. In our experience, once the TBL reading assignment was set, it became reasonably easy for 3-4 faculty members to conduct the sessions. Creating appropriate reading assignments and learning objectives as substitutes for lectures is critical, time-consuming, and cannot be taken lightly. To provide appropriate reading assignments for each team encounter, the course directors reviewed the required textbook, anatomy atlas, and dissection guide, extracted pertinent material (pages) to assign to the class, and, when necessary, created notes for the students (in our case, all this took two faculty 6 months). The assignment for the TBL must be of appropriate length; students should have enough time to prepare and complete it, and the time should be proportional to the assignment. As a rule of thumb, a team encounter should not exceed 90 minutes to avoid unnecessary chatting. Individual Readiness Assurance Tests (iRATs) are required at each TBL encounter, and the questions must reflect the high-stakes course exams in terms of style and difficulty.

TBL undoubtedly creates excitement among students because it fosters deeper learning and interdependence. In our experience, since the iRAT and tRAT are graded respectively 2% and 1%, students come well-prepared, and there is 100% class attendance. Well-organized learning activities help students build baseline facts into a framework of conceptual interpretation and understanding.

DISCUSSION

The outcomes logic model is closely aligned with our needs and the Department Chair and the Deans of medical education also welcomed the visual model. Logic models visually link intended outcomes with the resources and activities involved in a program, illustrating relationships among program inputs, planned

efforts, measurable outputs or products, and short- and long-term effects for students or other learners.

Program evaluation is essential for systematically assessing educational initiatives, policies, and interventions to document and understand their effectiveness, importance, and impact on trainees and educators[15].

It involves collecting and analyzing data to provide evidence-based feedback on the program's strengths and weaknesses, progress toward key outcomes, and suggestions for improvement or adjustment. One effective method is to develop a logic model[16].

A well-designed logic model can guide decision-making on data collection, assessment milestones, and overall program evaluation, ensuring clear alignment between these measures and the desired results [18]. Figure 1 also illustrates that the model is nonlinear, meaning that the results we obtain depend on what we invest in and do. Additionally, the outcome is proportional to the activity created, and the program's investments and implementation lead to immediate, intermediate, and long-term impacts on the project [19].

CONCLUSION

This study presents both the outcomes logic model and TBL to show how the authors used the logic model to plan and implement TBL. It demonstrates that TBL can be implemented effectively in large classes with students from diverse educational backgrounds. Students value the TBL model because it increases their knowledge and performance. Research indicates that TBL is suitable for courses such as anatomy, which contain dense content and significant lab components. Team-based learning is also integrated into lab dissection teaching and learning.

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