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LAWFUL MEASUREMENT IN HEALTH TECHNOLOGY ASSESSMENT

WHAT SHOULD A GRADUATE PROGRAM IN HEALTH TECHNOLOGY ASSESSMENT TEACH?

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ABSTRACT

Graduate education in health technology assessment (HTA), health economics and quantitative therapy evaluation should provide students with more than proficiency in established analytical methods. It should provide the scientific knowledge required to determine whether numerical claims constitute measures, whether the arithmetic performed upon them is admissible, and whether resulting therapy-impact claims are empirically evaluable. International interrogations of more than 200 HTA knowledge bases and university-affiliated environments have identified a consistent program-content inversion: extensive representation of utilities, QALYs, cost-effectiveness analysis, ICERs, decision modelling and reference-case methods alongside little or no identifiable representation of the principles of representational measurement required to establish their quantitative legitimacy.

This paper proposes 20 essential topics that should constitute the minimum scientific foundation of a graduate program in quantitative therapy evaluation. The framework begins with the principle that measurement must precede arithmetic and progresses through attribute definition, the distinction between numerical assignment and measurement, scales of measurement, admissible transformations, representational measurement, ratio measurement and dimensional homogeneity. It then distinguishes two pathways for therapy-impact measurement: linear ratio measurement for manifest attributes and Rasch person-item conjoint measurement for latent attributes. The latter requires construction and evaluation of a defensible logit measurement continuum, including unidimensionality, fit, local independence, ordered thresholds, differential item functioning, invariance and specific objectivity. Both pathways culminate in prospectively specified therapy-impact claims capable of empirical evaluation, replication and falsification.

The paper further considers the responsibility of faculty and universities once these measurement requirements have been identified. Transition does not require immediate abandonment of established HTA methods. It requires that students be given the scientific knowledge necessary to evaluate those methods independently. Academic disagreement is appropriate; educational omission is not.

*Finally, the Maimon Research nine-unit HTA Transformation Program is presented as transition infrastructure supporting faculty preparation, curricular integration and continuing inquiry. The objective is not prescribed acceptance of a replacement framework, but a change in scientific sequence: define the attribute, establish measurement, determine admissible arithmetic, and only then construct the quantitative claim**.** The ultimate responsibility of graduate education is to equip students to decide for themselves whether contemporary HTA satisfies the standards of normal quantitative science.*

INTRODUCTION

Graduate education in health technology assessment (HTA), health economics and quantitative therapy evaluation requires a substantial commitment of money, time and career opportunity. A prospective student is therefore entitled to ask a straightforward question before enrolling: what scientific capabilities will this program actually give me?

The answer should extend beyond proficiency in the methods currently required by HTA agencies, reimbursement authorities and established professional practice. A graduate program should provide students with the scientific knowledge necessary to determine whether a numerical claim concerning therapy impact constitutes a measure, whether the arithmetic performed upon it is admissible, whether the claim can be evaluated empirically, and whether it can contribute to the growth of objective knowledge.

This distinction has become increasingly important. International interrogations of HTA knowledge bases and university-affiliated research and educational environments have repeatedly identified the same pattern. Representational measurement receives little or no identifiable recognition, while the methods of legacy HTA including utilities, QALYs, cost-effectiveness analysis, ICERs, decision modelling and the reference case are extensively represented. The problem is not lack of analytical sophistication. The academic environments examined possess substantial expertise in health economics, statistics, epidemiology, outcomes research, modelling and decision analysis. The problem is that this sophistication has developed without representational measurement providing the prior scientific framework governing the admissibility of the quantitative operations performed [1,2].

For the prospective student, this creates an important distinction between learning how to perform established HTA and learning how to evaluate whether established HTA is scientifically defensible. A university should provide both capabilities. Training someone to undertake a reference-case-compliant analysis and educating someone in quantitative therapy evaluation are not necessarily the same thing.

The starting principle is elementary: measurement precedes arithmetic [3,4]. Before numbers are added, subtracted, multiplied, divided or incorporated into models, the attribute represented by those numbers must be defined and its measurement properties established. The scale achieved determines the arithmetic that is admissible. Multiplication and division require appropriate ratio properties. Dimensional homogeneity must be respected. A numerical value does not acquire these properties merely because an analytical model requires them.

Therapy-impact claims then require two different measurement pathways. Manifest attributes require appropriate linear ratio measurement. Latent attributes require construction of a measurement continuum, for which Rasch person-item conjoint measurement provides the required framework [5]. Students should understand both pathways and how they support empirically evaluable, replicable and potentially falsifiable claims.

The purpose of this paper is therefore practical. It proposes 20 topics that a prospective student should expect to find in a scientifically adequate graduate program in HTA or quantitative therapy evaluation. They are not jurisdiction-specific. Measurement requirements do not change because a program is located in the United States, Europe, Australia, Canada, Asia or elsewhere.

The 20 topics can also be expressed as 20 questions. Before committing to a graduate program, the prospective student should be able to ask: Does this program teach me this?

THE INTERNATIONAL PROGRAM-CONTENT PROBLEM

The need for such a checklist arises from the accumulated program-content evidence. Across the university-affiliated HTA and health-economics environments examined internationally, the same inversion has repeatedly been identified: extensive representation of legacy HTA methods alongside little or no explicit representation of the scientific measurement principles required to determine whether their arithmetic is admissible. These papers, over 200, are detailed in the Maimon Research website [6] .

The importance of this result lies in its consistency. It is not confined to a particular country, reimbursement system or university tradition. Nor can it readily be attributed to inadequate quantitative expertise. Many of the environments examined are internationally recognized centers of health economics, economic evaluation, outcomes research, epidemiology, modelling, public health and healthcare policy. Extensive analytical sophistication exists alongside the apparent absence of the measurement framework required to establish the quantitative status of the numbers being analyzed.

This appears to have created a process of curricular reproduction. Faculty commonly teach the framework in which they themselves were educated. Graduates subsequently enter academia, government, HTA agencies, consulting and industry; some become faculty themselves; and textbooks, guidelines, professional organizations and reference cases reinforce the established framework. Measurement inversion can therefore persist without anyone consciously deciding that representational measurement should be excluded.

The purpose of the present paper is not to assign retrospective responsibility for that history. It is to ask what an adequate graduate program should contain now that the measurement problem has been made explicit.

Representational measurement should not simply become another optional topic added to an already crowded curriculum. If measurement determines which quantitative operations have empirical meaning, it must precede and govern the arithmetic subsequently taught. A lecture on scales of measurement followed by an otherwise unchanged legacy curriculum would not resolve the problem.

The 20 topics proposed below therefore constitute a minimum scientific framework against which a prospective student can evaluate a graduate HTA program.

TWENTY ESSENTIAL TOPICS FOR A GRADUATE PROGRAM IN QUANTITATIVE THERAPY EVALUATION

The following 20 topics represent a coherent body of knowledge rather than a menu from which individual subjects might be selected. Each contributes to the progression from defining an attribute, through establishing a measure, to constructing an empirically evaluable therapy-impact claim. An informed prospective student should therefore establish whether these topics are addressed in the graduate program being considered.

1. Measurement must precede arithmetic

Why this is essential. Measurement establishes the properties of the numerical representation before arithmetic is undertaken. Those properties determine which mathematical operations are admissible. Arithmetic cannot retrospectively transform numbers into measures or supply measurement properties that were never demonstrated. A graduate student in quantitative therapy evaluation should therefore understand from the outset that the scientific sequence is attribute definition, measurement and only then arithmetic. Reversing this sequence substitutes numerical manipulation for measurement and undermines the quantitative status of subsequent claims.

2. Definition of the target attribute before measurement

Why this is essential. Every therapy-impact claim concerns an attribute. Before selecting an instrument, assigning numbers or performing arithmetic, the student must be able to state precisely what is to be measured. Survival, hospital utilization, pain, fatigue and physical functioning represent different attributes and may require different measurement approaches. Failure to define the attribute creates ambiguity about what the resulting numbers represent. Attribute definition is therefore the necessary starting point for selecting a measure and constructing a defensible therapy-impact claim.

3. The distinction between numerical assignment and measurement

Why this is essential. Numbers may be assigned to observations for identification, ordering, classification or convenience without creating a quantitative measure. The fact that responses are represented by integers does not establish equal units, a meaningful zero or permissible arithmetic. Graduate students must therefore understand the difference between producing a numerical score and measuring an attribute. Without this distinction, numerical representations can acquire an appearance of quantitative precision while lacking the properties required to support the mathematical operations subsequently performed upon them.

4. Nominal, ordinal, interval and ratio scales

Why this is essential. The traditional hierarchy of measurement scales identifies fundamentally different numerical structures. Nominal values classify, ordinal values establish order, interval scales support meaningful differences, and ratio scales additionally support meaningful ratios where their defining requirements are satisfied. These distinctions are not introductory terminology to be mentioned and forgotten. They determine what can legitimately be done with numerical values. A graduate should be able to identify the scale properties of a proposed measure before deciding which arithmetic operations are meaningful.

5. Admissible transformations and permissible arithmetic

Why this is essential. A measurement scale is characterized by transformations that preserve the empirical relationships represented by its numerical assignments. These admissible transformations determine which mathematical statements remain invariant and therefore meaningful. Understanding this relationship prevents students from assuming that every mathematical operation available in software is scientifically permissible. Graduate education in quantitative therapy evaluation should establish the connection between scale structure, admissible transformation and arithmetic so that students can justify the operations applied to measures rather than simply calculate numerical results.

6. The axioms and requirements of representational measurement

Why this is essential. Representational measurement requires numerical relationships to represent corresponding empirical relationships in the attribute being measured. This depends upon conditions such as ordering, additivity, solvability, cancellation and related requirements appropriate to the measurement structure. These principles distinguish measurement from arbitrary numerical assignment. A graduate should understand why measurement requires evidence that the numerical system faithfully represents an empirical relational system. Without this foundation, there is no scientific basis for claiming that assigned numbers possess the quantitative properties attributed to them.

7. The requirements for ratio measurement

Why this is essential. Ratio measurement permits the widest range of arithmetic operations required for quantitative therapy-impact claims, but those operations are justified only when the defining properties of the scale have been established. Students should understand the requirements for invariant units, an appropriate non-arbitrary zero and meaningful ratio comparisons. Statements involving multiplication, division, proportions or claims that one quantity is twice another depend upon these properties. Ratio measurement should therefore be understood as a scientific requirement, not simply another label in a hierarchy of scales.

8. Dimensional homogeneity

Why this is essential. Quantities cannot be combined meaningfully merely because they are represented numerically. The dimensions represented by those quantities must be identified and the proposed arithmetic must preserve dimensional coherence. Dimensional homogeneity provides an elementary safeguard against constructing numerical expressions whose components have incompatible quantitative meanings. Graduate students should be able to examine every proposed therapy-impact calculation and ask what dimensions are being combined, what the resulting quantity represents and whether the operation produces a scientifically interpretable measure rather than an arbitrary numerical construction.

9. The distinction between manifest and latent attributes

Why this is essential. Therapy evaluation involves both directly observable and latent attributes. Hospital days, treatment administrations and survival time are manifest; pain, fatigue, anxiety and physical functioning are latent and cannot be directly observed. This distinction determines the appropriate measurement pathway. A graduate should not approach both categories with the same measurement strategy. Recognizing whether an attribute is manifest or latent is therefore a pivotal decision: it determines how a ruler can be constructed and how a quantitative therapy-impact claim can subsequently be expressed.

10. Linear ratio measurement for manifest attributes

Why this is essential. Manifest attributes capable of direct quantitative representation can be measured using linear ratio scales when the necessary properties of unit and zero are satisfied. Examples may include days hospitalized, treatment administrations or units of resource utilization. Students should understand how such measures are defined, why their units remain invariant and what arithmetic they support. This provides the first of the two measurement pathways required for therapy evaluation and establishes how changes in directly observable attributes can support meaningful quantitative therapy-impact claims.

11. Construction of therapy-impact claims for manifest attributes

Why this is essential. Measurement becomes scientifically useful when it supports an evaluable claim. Students should learn how a manifest attribute is translated into a protocol-defined therapy-impact claim specifying the target population, comparator, timeframe, unit of measurement and expected outcome. The claim should state in advance what observation would support or fail to support it. This moves graduate education beyond descriptive numerical analysis to hypothesis-driven therapy evaluation in which a measured impact is capable of being independently assessed, replicated and potentially rejected by empirical evidence.

12. Why ordinal observations and summed scores do not constitute latent measures

Why this is essential. Questionnaire response categories commonly represent ordered observations, but assigning integers to those categories does not establish equal intervals between them. Adding such integers together does not, by itself, create a measure with invariant units. Graduate students working with patient-reported outcomes must understand this distinction. Otherwise, arithmetic performed on summed scores may be interpreted as measurement without the necessary quantitative structure having been demonstrated. Recognizing the limitations of ordinal observations is the starting point for legitimate measurement of latent attributes.

13. Rasch person–item conjoint measurement

Why this is essential. Latent attributes cannot be directly observed and require a measurement framework capable of constructing a quantitative continuum. Rasch measurement locates persons and items conjointly on the same latent-attribute scale, providing a basis for transforming ordered observations into measures. Graduate students should understand the logic of this relationship rather than treating Rasch as merely another statistical technique. Its importance lies in constructing a ruler for an otherwise unobservable attribute so that differences in attribute possession can support quantitative therapy-impact claims.

14. Construction of a Rasch logit measurement continuum

Why this is essential. Understanding Rasch measurement requires more than knowing its name or operating software. Students should learn how response data are used to estimate person and item locations, how the provisional continuum is constructed and how logits provide the common metric upon which persons and items are located. This establishes the practical bridge between ordinal observations and latent measurement. A graduate should understand where the resulting measures come from, what they represent and why construction of the ruler precedes its use in evaluating therapy impact.

15. Requirements for a defensible Rasch ruler

Why this is essential. A fitted Rasch model does not automatically establish a defensible measurement instrument. Students should understand the empirical requirements that the ruler must satisfy, including unidimensionality, item fit, local independence, ordered response thresholds, differential item functioning, targeting and stability. These requirements test whether the proposed instrument behaves as a measurement system rather than merely providing a statistical description of response data. A graduate should therefore be capable of evaluating whether a proposed latent ruler meets the conditions necessary for quantitative interpretation.

16. Invariance and specific objectivity

Why this is essential. A fundamental objective of measurement is that comparisons should not depend arbitrarily upon the particular measuring instrument or sample used. Rasch specific objectivity requires person comparisons to remain invariant across appropriate items and item comparisons across appropriate persons, subject to the requirements of the measurement model. Students should understand why this property is central to constructing a defensible latent measure. Without appropriate invariance, observed differences may reflect characteristics of the instrument or sample rather than differences in possession of the target attribute.

17. Attribute possession on a Rasch logit scale

Why this is essential. The purpose of latent measurement is to determine the extent to which a person possesses the specified attribute. Once a defensible Rasch ruler has been constructed, the person's response pattern locates that individual on the latent continuum. Graduate students should understand this concept of attribute possession because it changes the focus from questionnaire scores to measures of the attribute itself. Therapy impact can then be expressed as a change in possession rather than simply as a numerical change in an aggregated response score.

18. Therapy-impact claims for changes in latent-attribute possession

Why this is essential. A latent measure should ultimately support an empirically evaluable claim about therapy impact. Students should learn how changes in attribute possession are specified prospectively for a defined population, comparator and timeframe using the Rasch logit measure. The claim must identify the expected change and the evidence that would count against it. This connects latent measurement directly to hypothesis testing and replication. Rasch measurement thereby becomes part of a scientific protocol for evaluating therapy impact rather than an isolated psychometric exercise.

19. The two allowable measurement forms for quantitative therapy-impact claims

Why this is essential. A coherent graduate curriculum should bring the preceding measurement principles together into two pathways for quantitative therapy-impact claims: **linear ratio measurement for manifest attributes and Rasch logit ratio measurement for latent attributes**. The student should understand why the nature of the attribute determines which pathway is appropriate and why other numerical representations cannot simply be assumed to constitute measures. A graduate should leave able to identify the attribute, select the appropriate measurement form and defend the quantitative status of the resulting claim.

20. The requirements of normal science

Why this is essential. Quantitative therapy evaluation should culminate in claims capable of participating in normal scientific inquiry. The attribute must be defined, the measure must satisfy appropriate measurement requirements, and the claim must specify the population, comparator, timeframe and predicted therapy impact. Most importantly, the claim must be empirically evaluable, open to replication and capable of falsification. A graduate program should therefore produce students able not merely to generate numbers, but to construct quantitative claims that can succeed or fail when confronted by evidence.

THE CHALLENGE OF TRANSITION I: RESPONSIBILITY TO STUDENTS

The 20 topics described above imply more than revision of a syllabus. They require a change in the relationship between faculty, students and the quantitative framework that has traditionally defined graduate education in HTA, health economics, pharmacoeconomics and outcomes research. If measurement becomes the organizing principle of therapy evaluation, established methods can no longer be accepted simply because they are familiar, widely used, institutionally supported or required by existing HTA and reimbursement systems. Every quantitative claim must instead begin with the attribute, satisfy the requirements of measurement and employ only arithmetic justified by the properties of the measure.

This presents an unusual challenge for faculty, but that challenge should be understood in context. Many current teachers and researchers were themselves educated within programs in which representational measurement was not part of the scientific foundation of HTA. They subsequently developed research careers, publications, teaching materials and professional relationships within the framework they had been taught. Others are considerably earlier in their careers and may have much less invested in the established framework. Still others may teach utilities, QALYs, ICERs and decision models because these constitute accepted disciplinary practice rather than because they have ever considered their foundations in representational measurement.

The audience for transition is therefore heterogeneous. There should be no presumption of culpability, resistance or even prior awareness of the measurement problem. For many faculty members the entirely reasonable initial response may simply be: I was never taught this. That response should provide the starting point for transition.

The accumulated evidence from measurement inversion, curriculum inversion and program-content inversion suggests that the absence of representational measurement has been reproduced across successive generations of HTA education. Expertise in economic evaluation, statistics, epidemiology, decision analysis, outcomes research and modelling does not automatically provide expertise in representational measurement. The immediate requirement is therefore not that faculty abandon an established framework. It is that they acquire sufficient knowledge of attributes, scales, admissible transformations, ratio measurement, dimensional homogeneity and manifest and latent measurement to evaluate the challenge for themselves. The first stage of transition is not acceptance. It is informed inquiry.

This distinction is important. Faculty need not accept the conclusions advanced in this paper. They should be encouraged to challenge them. If utilities possess the measurement properties necessary to support QALYs, demonstrate those properties. If the multiplication of utility by time is scientifically admissible, demonstrate why. If incremental QALYs provide a legitimate denominator for an ICER, establish the measurement argument supporting the division. If alternative approaches to latent attributes provide the required invariant measurement structure, make that case. That is how normal science should proceed.

The responsibility to students, however, goes further. Once the measurement challenge has been identified, students should be provided with sufficient scientific knowledge to participate in that debate themselves. They should not merely be told what conclusion faculty have reached. They should be given the knowledge required to reach their own conclusion.

This changes the classroom. A student introduced to representational measurement may begin asking questions that are elementary but consequential:

What is the attribute? Is this actually a measure or merely a numerical score? What scale has been established? What transformations are admissible? If these numbers are being multiplied or divided, where have the required ratio properties been demonstrated? Is the attribute manifest or latent? If it is latent, how was the measurement ruler constructed?

Such questions should not be interpreted as challenges to faculty authority. They are evidence that graduate scientific education is working.

There is increasing reason to expect students to ask them. The information environment surrounding graduate education has changed profoundly. Prospective and enrolled students have access to social media, LinkedIn, open-access publications, searchable academic databases and large language models. They can investigate competing methodological arguments independently of the curriculum in which they are enrolled. A challenge that might once have remained confined to a specialist literature can now be discovered through a search undertaken in minutes.

The experience of the Maimon Research measurement critique of legacy HTA illustrates this change [6]. Papers addressing measurement inversion, curriculum inversion, program-content inversion, ratio measurement and the foundations of the QALY have attracted thousands of views, with individual papers in some cases receiving more than a thousand. These numbers do not demonstrate agreement with the arguments. They demonstrate exposure. There is an audience.

The measurement issue is therefore no longer something that can safely be assumed to remain outside the classroom. In colloquial terms, the cat is out of the bag. Students can encounter the challenge independently, and prospective students can increasingly investigate what a graduate program does and does not teach before deciding where to invest their money, time and future careers.

That creates a new responsibility for universities. The question is no longer simply whether faculty themselves accept representational measurement as necessary to HTA. The question is whether students should be denied access to the scientific principles required to evaluate that proposition because their teachers remain unconvinced by it.

Academic freedom provides the answer. Faculty should remain entirely free to disagree with the measurement critique. Universities should encourage criticism of representational measurement, Rasch measurement, the distinction proposed between manifest and latent measurement pathways, and the conclusions drawn for legacy HTA. Academic disagreement is not the problem. Educational omission is.

A university claiming to provide graduate education in quantitative therapy evaluation should ensure that students encounter the scientific knowledge necessary to understand both sides of the argument. Teaching the 20 topics does not require telling students that legacy HTA has failed. It requires giving them the intellectual equipment necessary to determine whether it has failed.

This responsibility cannot be satisfied simply by adding a lecture entitled *Measurement*. If students are taught that measurement precedes arithmetic, that proposition must have consequences throughout the program. If scale properties determine admissible operations, those restrictions must subsequently be respected. If manifest and latent attributes require different measurement pathways, assignments, research projects and evaluations must reflect that distinction. Integration rather than acknowledgement is the standard.

Nor does transition require the immediate dismantling of existing programs. Universities operate within real professional environments. HTA agencies, reimbursement authorities, pharmaceutical companies, consultancies and healthcare systems continue to require expertise in established economic-evaluation methods. Students need to understand those methods if they are to participate professionally in the current system.

A transitional curriculum can therefore support two capabilities. Students can understand the legacy framework and learn how it continues to be applied while simultaneously acquiring the measurement knowledge required to evaluate its scientific status and develop alternatives. Existing expertise need not be discarded. It must instead be placed within a broader scientific framework in which inherited methods are examined rather than presumed.

The transition can also begin modestly. A program does not have to reconstruct itself overnight. It can start by introducing a small number of foundational propositions at the beginning of the curriculum: a number is not necessarily a measure; measurement precedes arithmetic; scale properties determine admissible arithmetic; multiplication and division require appropriate ratio properties; and manifest and latent attributes require different measurement pathways. Then allow students to ask the questions.

This is also where those advocating transition acquire a responsibility of their own. It is insufficient simply to identify the failure of legacy HTA and leave faculty to reconstruct decades of established teaching unaided. Transition requires support**.** Faculty encountering these ideas for the first time should have access to a structured body of material that introduces the measurement framework, develops its implications progressively and allows the case against legacy HTA and the proposed alternative to be examined critically.

The appropriate relationship is therefore not one of accuser and accused. It is one of scientific colleagues confronting a foundational question from different starting points. Those who have developed the measurement critique should be prepared to act as transition friends: helping faculty understand the argument, answering questions, participating in discussions, supporting initial teaching and, equally importantly, exposing the proposed reconstruction to criticism.

There is no requirement for confession and no requirement for immediate conversion. The responsibility is prospective. What scientific knowledge should another generation of students receive?

Once the 20 topics identified in this paper are available, that question becomes difficult to avoid. Faculty may disagree about the conclusions students will reach after studying them. Universities may differ in the speed and form of transition. Existing HTA systems may continue requiring legacy analyses for many years. But continued disagreement cannot justify continued absence. Students should be given the measurement knowledge necessary to judge legacy HTA for themselves.

THE CHALLENGE OF TRANSITION II: SUPPORTING THE TRANSITION

The measurement problem has been identified. The scientific standards are available. An alternative measurement framework has been proposed. The remaining question is whether another generation of students will be taught the legacy framework as though none of this had happened.

It is precisely this transition that the Maimon Research nine-unit HTA Transformation Program is intended to support [7] The program provides a structured pathway for faculty, researchers and practitioners who wish to understand the measurement challenge and examine its implications for graduate education, research and quantitative therapy evaluation.

The program comprises approximately 45,000 words of structured instructional material. Its nine units move progressively from measurement preceding arithmetic through attributes, scales of measurement, admissible arithmetic and dimensional homogeneity to the distinction between manifest and latent attributes, linear ratio measurement, Rasch measurement, attribute possession and the construction of empirically evaluable therapy-impact claims. It can therefore support individual faculty preparation, provide a framework for reconsidering existing graduate teaching, or form the foundation for developing a postgraduate course in HTA organized around the requirements of lawful measurement and normal science.

The important point is that transition does not require wholesale curriculum reconstruction at the outset. The first change is one of scientific sequence. At the beginning of an existing course, students can be introduced to the measurement principles required to interrogate every quantitative method that follows. What is the attribute? Is it unidimensional? Is it manifest or latent? What scale of measurement has been established? What transformations are admissible? What arithmetic does the scale permit? Does the proposed analysis preserve dimensional homogeneity?

Students can then carry these questions with them as they encounter utilities, QALYs, cost-effectiveness analysis, patient-reported outcomes, decision models, reference cases and the other established components of legacy HTA. Representational measurement thereby becomes not another topic added to an already crowded curriculum but the organizing scientific framework through which the existing curriculum can be critically examined.

This is an important distinction. The purpose of introducing the material is not to require faculty or students to accept in advance that legacy HTA should be rejected. It is to make an informed comparison possible. Students should be capable of asking whether utilities, QALYs and the reference case satisfy the requirements of representational measurement and admissible arithmetic. They should equally be capable of examining the proposed alternative based upon manifest and latent attributes, ratio measurement, empirically evaluable claims, replication and falsification. The educational objective is informed judgment rather than prescribed belief.

Transition, however, requires more than providing faculty with instructional material. For many participants, representational measurement was not part of their own graduate education. Moving from understanding its principles to applying them in teaching and research inevitably raises questions. The program therefore includes continuing online Q&A support from Maimon Research while participants work through the units and begin applying the framework.

Questions can arise from particular attributes, proposed measures, Rasch applications, therapy-impact claims, protocols or curriculum development. The purpose of continuing interaction is not simply to help participants complete nine units. It is to help them develop the capability to use the measurement framework independently and, where appropriate, introduce it confidently to students and colleagues.

This support reflects a broader principle of transition. Those proposing a substantial change in the scientific foundations of HTA have a responsibility to help faculty examine that change. It is insufficient simply to identify measurement failure, point to the literature and leave individual teachers or departments to reconstruct their programs unaided.

Maimon Research can therefore act as a transition colleague. The starting point may be as modest as discussing a measurement question, identifying appropriate introductory material, helping faculty work through one of the 20 program-content topics, or considering how measurement principles could be introduced into an existing course. No prior acceptance of the conclusions is required.

Where universities, research centers, academic departments or professional groups wish to proceed further, additional activities can be developed around their particular requirements. These may include faculty discussions, seminars, workshops, small-group sessions, curriculum-development support and presentations addressing specific measurement or therapy-evaluation problems. The objective is to allow institutions to determine the pace and extent of their own transition rather than prescribe a single route that every program must follow.

This creates a progression from relatively modest engagement to more substantial curricular change: awareness → informed inquiry → faculty preparation → student questioning → curricular integration → transition.

At each stage, the measurement framework itself remains open to criticism. Faculty should challenge it. Students should question it. Universities should examine whether it satisfies the scientific standards it claims legacy HTA has failed to meet. A transition to normal science cannot legitimately be based upon replacing one body of received doctrine with another.

The nine-unit program is therefore best understood as transition infrastructure rather than simply instructional content. It brings together the scientific argument, the measurement framework, faculty preparation and continuing support required to begin moving from recognition of the problem toward practical curricular change.

A fee is charged for access to the program to support its administration, maintenance, updating and continuing participant support. This should not obscure its larger purpose. The objective is to make engagement with a fundamentally different approach to quantitative therapy evaluation manageable for faculty and institutions that may be encountering representational measurement for the first time.

Nor does participation require immediate abandonment of legacy HTA. Universities may continue to teach conventional methods because students need to understand the framework that remains embedded in current HTA and reimbursement systems. The nine-unit material can initially be introduced alongside that framework. The crucial change is that students encounter measurement first, so that they possess the scientific knowledge necessary to evaluate everything that follows.

The program is consequently offered as a template for faculty preparation and for the progressive development of post-legacy graduate HTA education. Universities can use it to supplement existing teaching, reconsider the scientific organization of established programs, or provide the foundation for a new graduate course organized explicitly around representational measurement.

The transition need not begin with institutional commitment, curricular reconstruction or agreement with the conclusions advanced here. It can begin much more simply. Introduce the measurement principles. Ask the questions. Examine the answers. Give students the knowledge required to decide for themselves.

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