

MAIMON RESEARCH LLC
**ARTIFICIAL INTELLIGENCE LARGE LANGUAGE
MODEL INTERROGATION**



**REPRESENTATIONAL MEASUREMENT FAILURE IN
HEALTH TECHNOLOGY ASSESSMENT**

**UNITED STATES: WHAT HAPPENS IF NOTHING
CHANGES? QUESTIONS FOR THE FUTURE OF
PharmD EDUCATION AND HTA**

*A discussion prompted by international AI large language model interrogations
of HTA knowledge bases for US pharmacy Colleges and Schools*

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INTRODUCTION

"The issue may no longer be whether measurement inversion exists, but whether Colleges and Schools of Pharmacy should prepare students for its consequences."

Over the past six months, Maimon Research has undertaken 71 AI large language model interrogations of HTA knowledge bases associated with Colleges and Schools of Pharmacy in the United States. The findings have been remarkably consistent. Responses to a canonical diagnostic framework repeatedly suggest weak recognition of representational measurement principles together with strong endorsement of assumptions supporting utilities, QALYs, simulation frameworks, and cost-effectiveness claims <https://maimonresearch.com/us-pharmacy-college-assessments/>.

These findings have been communicated through individual College and School assessments, faculty correspondence, and transition proposals. While discussion has begun, responses have generally been cautious and measured. This is perhaps unsurprising. Questions concerning the scientific foundations of PharmD-linked HTA and HEOR education rarely generate immediate institutional reaction, particularly where current frameworks remain deeply embedded within teaching programs, publication practices, reimbursement systems, experiential training, and professional expectations.

Yet muted response should not be confused with absence of significance. Scientific questions often require time before their broader implications become apparent. If interrogation findings continue attracting attention, the issue may no longer concern isolated methodological debates. It may increasingly concern how PharmD graduates are prepared for careers involving formulary assessment, managed care, payer evaluation, outcomes research, and healthcare decision-making.

The purpose of this paper is therefore not to revisit technical arguments regarding representational measurement. Rather, it is to explore broader questions that may arise if awareness of measurement inversion continues expanding. What happens if nothing changes? Could current concerns prove temporary? What are the implications for PharmD curricula, graduate preparation, educational responsibility, and institutional preparedness? And perhaps most importantly: if transition eventually becomes necessary, should Colleges and Schools begin preparing now?

QUESTION 1: "IF CURRENT HTA METHODS HAVE BEEN ACCEPTED FOR FORTY YEARS, WHY SHOULD PHARM D EDUCATION CHANGE NOW?"

This is perhaps the most common reaction to criticisms of current HTA practice. The underlying assumption is straightforward: if methodologies have been used internationally for four decades, supported by governments, universities, journals, reimbursement agencies, and thousands of publications, then surely, they must possess scientific legitimacy. Institutional persistence becomes confused with scientific validity.

The difficulty is that scientific history provides many examples where widespread acceptance and methodological validity diverged. Entire disciplines can stabilize around conventions and assumptions that later prove difficult or impossible to defend. Longevity demonstrates institutional

success; it does not establish scientific truth. Scientific disciplines evolve not because practices are old, but because they continue satisfying the standards required for credible claims.

The central issue for Colleges and Schools of Pharmacy is therefore not whether current HTA approaches have generated useful information. Clearly, they have. The question is whether PharmD programs should continue preparing graduates to inherit existing methodological structures without explicit consideration of their scientific foundations.

The concern raised by 71 interrogations is remarkably consistent: representational measurement appears largely absent while assumptions necessary to support utilities, QALYs, preference scores, and simulation frameworks remain strongly reinforced. The issue is therefore no longer simply whether current approaches have operated successfully for forty years. The question becomes whether future PharmD graduates should understand the assumptions upon which these structures rest and the implications if those assumptions increasingly come under scrutiny.

The implication is not sudden curriculum disruption. Existing programs will continue. The issue is preparedness. Colleges and Schools may increasingly need to ask whether early consideration of transition pathways is preferable to later reactive adjustment.

QUESTION 2: “WHAT HAPPENS IF COLLEGES AND SCHOOLS OF PHARMACY SIMPLY CONTINUE WITH BUSINESS AS USUAL?”

At first sight, the answer may appear obvious: perhaps very little happens. Colleges and Schools of Pharmacy continue teaching established material, supervising students, developing experiential programs, contributing to HEOR and HTA research, and preparing graduates for careers in managed care, formulary assessment, pharmaceutical industry positions, and outcomes research. Faculty continue teaching familiar analytical frameworks, students continue learning established methodologies, and graduates enter professional environments where cost-effectiveness models, utilities, and QALY-based evaluations remain routine components of healthcare decision-making.

Indeed, in the short term this may be entirely correct. Educational institutions are rarely highly responsive to methodological criticism, particularly when existing practices remain supported by journals, reimbursement agencies, accreditation structures, professional organizations, and accepted teaching conventions. Existing frameworks possess substantial institutional inertia. Entire curricula, research programs, and professional expectations become organized around accepted assumptions.

The issue, however, concerns the longer term rather than immediate disruption.

The recent AI large language model interrogations across 71 Colleges and Schools of Pharmacy suggest a recurrent and remarkably consistent pattern. Across pharmacy programs, HTA-related teaching, and associated educational environments, the same issue repeatedly emerges: weak recognition of representational measurement requirements together with strong endorsement of frameworks dependent upon arithmetic manipulation of constructs whose measurement properties remain unresolved.

If these findings continue attracting attention, the consequences may become cumulative rather than immediate. Questions begin to emerge regarding the scientific foundations of methodologies routinely presented to PharmD students. Why are utilities treated as though they support multiplication? Why are latent constructs approached through ordinal summation rather than invariant measurement? Why are QALYs assumed to possess measurement properties required for arithmetic manipulation? Why does measurement appear to follow arithmetic rather than precede it?

Schools may initially regard these concerns as peripheral. The difficulty is that unresolved scientific criticism rarely disappears automatically. It accumulates. Graduate students begin asking questions. Faculty become curious. Adjacent disciplines begin noticing anomalies. Eventually, what initially appeared to be a technical issue begins influencing perceptions of educational credibility and graduate preparation.

The risk is therefore not sudden institutional disruption. PharmD programs will continue. Graduates will continue entering practice environments. Accreditation structures will continue. The larger concern is more gradual: the possibility that educational frameworks become increasingly associated with reproduction of inherited assumptions rather than scientific evaluation of those assumptions.

The issue therefore is not whether Colleges and Schools of Pharmacy preserve existing structures. They undoubtedly will. The larger question concerns whether pharmacy education wishes merely to reproduce current HTA frameworks or participate in shaping how future generations understand the scientific foundations upon which quantitative claims should rest.

QUESTION 3: “COULD THIS SIMPLY PROVE TO BE ANOTHER PASSING METHODOLOGICAL DEBATE?”

This is a reasonable question. Health technology assessment and health economics have experienced no shortage of methodological disputes over the past four decades. Debates concerning discounting rates, willingness-to-pay thresholds, probabilistic sensitivity analysis, Bayesian versus frequentist approaches, indirect treatment comparisons, utility instruments, and model structures have all generated extensive discussion. Most eventually settled into revised conventions without fundamentally changing either HTA practice or the educational structures supporting it.

Viewed in this context, criticisms of representational measurement may initially appear to be simply another technical disagreement. Academic disciplines regularly generate controversies that attract temporary attention before fading from view. Colleges and Schools of Pharmacy might therefore reasonably conclude that present concerns regarding utilities, QALYs, dimensional homogeneity, and latent construct measurement will ultimately prove no different.

There is, however, an important distinction.

Most previous HTA debates occurred within an accepted methodological framework. Arguments focused upon how best to perform cost-effectiveness analysis, improve model assumptions, or

refine statistical techniques. The current discussion differs because it raises questions concerning the conditions required before quantitative claims can be made at all.

The issue is not whether a simulation model should use one parameter estimate rather than another. The issue is whether the constructs entering the model possess admissible measurement properties in the first place.

The recent AI large language model interrogations of 71 Colleges and Schools of Pharmacy provide additional reason for caution. Across diverse educational environments, remarkably similar findings have emerged. PharmD-linked HTA and HEOR frameworks repeatedly demonstrate weak recognition of representational measurement principles together with strong endorsement of assumptions supporting utility-based cost-effectiveness analysis. The consistency itself becomes noteworthy.

A recurrent pattern across institutions suggests something broader than isolated methodological disagreement. Questions concerning dimensional homogeneity, arithmetic admissibility, latent trait measurement, Rasch measurement, and falsifiability are appearing repeatedly rather than sporadically. That repetition may indicate that the issue concerns the educational foundations supporting HTA rather than one particular analytical technique.

This does not guarantee major change. Educational systems can continue operating despite unresolved theoretical difficulties for long periods. Yet persistent foundational criticism differs from ordinary methodological adjustment. Once questions begin involving the scientific status of measures themselves, the discussion becomes more difficult to dismiss as merely technical.

The issue therefore may not be whether this debate disappears next year or the year after. The more important question may be whether Colleges and Schools of Pharmacy should assume that it will disappear.

If representational measurement becomes part of PharmD-linked HTA and HEOR education, the implications extend far beyond another methodological adjustment. Representational measurement is not one framework among many. It alone establishes the necessary conditions for lawful quantitative claims.

Under representational measurement standards there are only two admissible forms of quantitative assessment for therapy impact claims: (i) linear ratio measures for manifest attributes and (ii) Rasch logit ratio measures for latent attributes. There are no additional categories.

This distinction is important because it shifts discussion away from refinement of existing conventions toward the prior question: what measurement properties are required before arithmetic operations can occur? Utilities, preference scores, and cost-per-QALY structures are no longer accepted simply because they are established conventions. They become subject to explicit examination regarding admissible measurement properties and arithmetic operations.

Once measurement itself becomes part of the curriculum, the discussion changes fundamentally. The issue is no longer whether representational measurement disappears from view. Rather, future PharmD graduates may increasingly ask why these requirements were absent in the first place.

In this sense, the discussion differs from previous methodological debates. The issue is not technical refinement. It concerns the scientific foundations upon which HTA and HEOR claims either stand or fail.

Scientific history offers many examples where apparently minor foundational criticisms eventually proved far more significant than initially imagined. Institutions responsible for preparing future pharmacists may therefore wish to consider not merely whether the issue survives, but whether graduates should be equipped to understand and evaluate it if it does.

QUESTION 4: “IF CONCERNS REGARDING UTILITIES AND QALYs EXPAND INTERNATIONALLY, WHAT ARE THE IMPLICATIONS FOR PharmD EDUCATION?”

This question may ultimately prove more important than arguments over reimbursement systems, simulation models, or cost-effectiveness thresholds. Methodologies can evolve gradually and agencies can revise guidance documents, but educational programs determine how future generations understand the structure of evidence itself. Colleges and Schools of Pharmacy reproduce assumptions, analytical habits, and methodological frameworks. If foundational assumptions are not examined during training, they frequently become accepted as natural and self-evident.

Current PharmD-linked HTA and HEOR educational structures are largely organized around a familiar sequence. Students are introduced to economic evaluation, utility assessment, QALYs, cost-effectiveness analysis, decision modeling, probabilistic sensitivity analysis, and simulation techniques. These methods are often presented as established analytical tools supporting evidence-based healthcare decision-making. Considerable attention is devoted to statistical sophistication, model construction, and analytical application.

The issue raised by recent interrogations is not that these methods are taught. Rather, it concerns what may be absent from the curriculum.

Across interrogations involving 71 Colleges and Schools of Pharmacy, one pattern repeatedly appears: weak recognition of representational measurement requirements. Concepts such as dimensional homogeneity, admissible transformations, latent versus manifest attributes, falsifiability, and Rasch measurement frequently occupy little or no visible role within PharmD-linked HTA and HEOR educational structures. Measurement often appears as an assumed background condition rather than a prerequisite for quantitative claims.

If concerns regarding utilities, QALYs, and simulation frameworks continue expanding, future students may ask increasingly uncomfortable questions.

Why was multiplication undertaken before establishing ratio properties?

Why were preference scores treated as though they possessed interval or ratio characteristics?

Why were latent constructs represented through ordinal summation rather than invariant measurement structures?

Why was representational measurement largely absent from educational programs preparing graduates for outcomes research and formulary assessment?

These are not trivial questions because they concern the scientific legitimacy of the methods students are being trained to apply professionally.

The issue is not that existing curricula suddenly become invalid. Educational systems evolve continuously. New techniques, analytical frameworks, and professional competencies appear regularly. The concern is whether PharmD education may have inadvertently normalized assumptions regarding measurement that were never explicitly examined.

If this proves correct, curriculum revision becomes more than an administrative exercise. It becomes a question of scientific responsibility. Students entering managed care, pharmaceutical industry roles, payer environments, formulary assessment, and outcomes research increasingly require explicit understanding of measurement principles before proceeding to arithmetic manipulation and simulation frameworks.

The implication is not immediate abandonment of existing courses. Rather, Colleges and Schools of Pharmacy may increasingly need to ask whether future graduates should merely learn current conventions or also understand the foundational assumptions upon which those conventions depend.

Ultimately, the future direction of HTA may be influenced less by agencies and journals than by what PharmD students are taught in classrooms today.

QUESTION 5: “COULD COLLEGES AND SCHOOLS OF PHARMACY SIMPLY WAIT UNTIL EXTERNAL ORGANIZATIONS DECIDE WHETHER CHANGE IS NECESSARY?”

This is an understandable position. Colleges and Schools of Pharmacy operate within broader institutional environments shaped by accreditation bodies, reimbursement agencies, journals, professional organizations, managed care systems, employers, and healthcare policy frameworks. If organizations involved in HTA and HEOR continue endorsing existing approaches, there may appear little reason for PharmD programs to move independently. Why assume methodological risk if larger institutions have not yet signaled the need for change?

From an administrative perspective, waiting may seem entirely rational. Existing HTA and HEOR frameworks remain deeply embedded within healthcare decision-making systems. Journals continue publishing cost-effectiveness studies; reimbursement organizations continue relying upon utility-based frameworks; graduates continue entering professional environments where QALYs and simulation models remain commonplace; and educational programs continue teaching

accepted approaches. Existing structures possess substantial institutional stability. In the short term, maintaining alignment with prevailing practice may appear both safe and practical.

The difficulty is that waiting also transfers intellectual leadership elsewhere.

The recent AI large language model interrogations suggest that a recurrent pattern of measurement inversion extends across agencies, academic environments, journals, pharmacy schools, and healthcare systems internationally. If concerns regarding representational measurement continue attracting attention, future discussions may increasingly focus not upon technical refinements alone, but upon the foundational legitimacy of quantitative claims themselves.

Historically, scientific and educational change rarely begins through centralized directives. New ideas often emerge at the margins of established systems before gradually influencing broader practice. Universities and Colleges of Pharmacy have traditionally played an important role in that process. Their purpose is not merely to reproduce existing assumptions but to examine whether those assumptions remain scientifically defensible.

Waiting for external organizations to determine future directions may therefore create an unintended consequence. Institutions that delay engagement risk becoming passive recipients of change rather than participants in shaping it. If methodological transition eventually becomes necessary, Colleges and Schools that engaged early may influence curriculum development, graduate competencies, educational standards, and future professional expectations. Those remaining observers may later find themselves adapting to frameworks developed elsewhere.

The issue is not whether Colleges and Schools of Pharmacy should immediately abandon existing educational structures. Existing systems will continue operating for many years. The question is whether institutions should begin examining alternatives before external developments force reactive adjustment.

In practical terms, there is little disadvantage in early examination of representational measurement, Rasch latent trait measurement, evaluable claims, dimensional homogeneity, and the distinction between manifest and latent attributes. Exploration does not imply commitment. It simply preserves intellectual flexibility.

The future of PharmD-linked HTA and HEOR education may ultimately depend not on who waited longest, but on who recognized early that foundational questions were beginning to change.

Colleges and Schools of Pharmacy therefore face a choice: wait for others to define the next stage of educational development, or participate in shaping it themselves.

QUESTION 6: “WHAT IS THE ACTUAL RISK OF DOING NOTHING?”

The immediate response may be: perhaps there is very little risk at all. Colleges and Schools of Pharmacy continue graduating students, faculty continue publishing papers, experiential programs continue operating, journals continue accepting submissions, and PharmD-linked HTA and HEOR education proceeds much as before. Existing educational structures appear stable and

professionally embedded. From this perspective, concerns regarding representational measurement may seem largely theoretical and disconnected from day-to-day educational activity.

Indeed, the risk is not sudden institutional disruption. No College of Pharmacy will lose accreditation tomorrow because of questions surrounding dimensional homogeneity or Rasch measurement. Educational programs will continue; outcomes research will continue; cost-effectiveness studies will continue to be taught; graduates will continue entering managed care, payer environments, industry positions, and formulary assessment roles. Existing educational structures possess substantial inertia and can persist for long periods despite unresolved methodological questions.

The more important issue concerns gradual rather than immediate consequences.

Over recent months, 71 AI large language model interrogations of Colleges and Schools of Pharmacy have demonstrated a remarkably consistent pattern. Across PharmD-linked educational environments there appears weak recognition of representational measurement together with strong endorsement of assumptions supporting utilities, QALYs, simulation frameworks, and cost-effectiveness claims. Repetition across institutions suggests that the issue is not isolated. The pattern itself increasingly becomes evidence.

If these findings continue attracting attention, questions may gradually shift from methodological details toward educational foundations.

Why are arithmetic operations undertaken before establishing admissible measurement properties?

Why are latent constructs represented through preference scores and ordinal aggregation?

Why does representational measurement appear largely absent from educational preparation?

Why does measurement appear secondary to modeling?

Initially these questions may seem peripheral. Yet educational credibility rarely changes abruptly. More commonly, assumptions become increasingly difficult to defend as unresolved anomalies accumulate. Concerns that once appeared technical gradually begin influencing perceptions regarding curriculum quality, graduate preparation, and scientific legitimacy.

The risk therefore is not operational disruption. The risk is that Colleges and Schools of Pharmacy increasingly find themselves reproducing inherited assumptions whose scientific foundations become progressively more difficult to justify.

Perhaps the greatest risk is one of preparedness. Existing educational structures may continue functioning successfully for years. But if methodological transition eventually becomes necessary, institutions delaying engagement may later find themselves responding reactively rather than leading constructively.

The issue is not whether change is inevitable. The issue is whether prudent educational institutions should prepare for the possibility. Scientific disciplines rarely remain unchanged indefinitely. The question is whether PharmD education anticipates future developments or waits until fewer options remain.

CONCLUSION: PREPAREDNESS, LEADERSHIP AND THE NEXT STAGE OF PHARMD EDUCATION

The purpose of these questions has not been to argue that Colleges and Schools of Pharmacy should dismantle existing curricula or immediately abandon current HTA and HEOR frameworks. Existing educational structures are deeply embedded within healthcare systems and will continue influencing professional practice for many years. Nor does the presence of measurement inversion imply that all current educational activity lacks value. Descriptive research, epidemiology, health services analysis, and policy evaluation continue to provide important contributions.

The issue raised by recent AI large language model interrogations is narrower but potentially more significant. Across 71 interrogations of Colleges and Schools of Pharmacy, a remarkably consistent pattern has emerged: weak recognition of representational measurement principles together with strong endorsement of assumptions supporting utilities, QALYs, simulation models, and cost-effectiveness claims. If these findings continue attracting attention, questions concerning the scientific foundations of PharmD-linked HTA and HEOR education may become increasingly difficult to ignore.

The practical issue therefore becomes one of preparedness. What should Colleges and Schools of Pharmacy do if assumptions underlying current HTA frameworks increasingly come under scrutiny? Waiting for consensus may appear sensible, but scientific transitions rarely begin through universal agreement. Educational change more commonly emerges through gradual exploration, local experimentation, and early institutional leadership.

Colleges and Schools of Pharmacy occupy a distinctive position. Their role extends beyond reproducing existing conventions. They also provide environments in which assumptions may be examined, challenged, and revised. Initial change need not be revolutionary. Students may simply require explicit introduction to representational measurement, dimensional homogeneity, latent versus manifest attributes, Rasch measurement, and evaluable claims alongside existing HTA structures.

Most importantly, students may increasingly require understanding that lawful quantitative assessment ultimately rests upon only two admissible forms of measurement:

- **Linear ratio measures for manifest attributes**
- **Rasch logit ratio measures for latent attributes**

The contrast with cost-per-QALY frameworks and preference-based arithmetic structures is substantial. It places HTA and the assessment of therapy impact claims within the framework of normal science, where measurement precedes arithmetic, claims are empirically evaluable and

falsifiable, and objective knowledge evolves through scientific challenge rather than through the continued reproduction of unsupported assumptions.

The issue therefore is not immediate replacement of existing approaches. It is scientific preparedness. Historically, institutions engaging early during periods of transition often help shape future developments. Others adapt later.

Whether PharmD education approaches such a transition remains uncertain. But if representational measurement increasingly enters wider discussion, Colleges and Schools of Pharmacy may eventually face a choice: **lead, follow, or defend inherited assumptions.**

The issue may therefore no longer be whether measurement inversion exists. The more important question may be whether PharmD education is prepared for the possibility that the next stage of HTA development has already begun.

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