A Model for Overview of Student Learning: A Matrix of Educational Outcomes Versus Methodologies

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Abstract: A concise overview of an institution's aspirations for its students becomes increasingly elusive because dental education has evolving emphases on priorities like critical thinking and adapting to new technology. The purpose of this article is to offer a learner-oriented matrix that gives a focus for discussion and an overview of an institution's educational outcomes. On one axis of the matrix, common educational outcomes are listed: knowledge, technical skills, critical thinking, ethical and professional values, patient and practice management, and social responsibility awareness. On the other axis, methodologies are listed: definition, cultivation strategies, measures (summative/formative, objective/subjective), institutional coordination, and competency determination. By completing the matrix, an overview of the process by which students reach these outcomes emerges. Each institution would likely complete the matrix differently and, ideally, with active discussion. While the matrix can first be used to establish "Where are we now?" for an institution, it can also be a starting point for more extensive matrices and further discussion. Vertical and horizontal analyses of the matrix provide a unique lens for viewing the institution's learning environment.

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While the culture of dental education has improved dramatically over the last thirty years, identifying formats to focus discussion and debate on educational outcomes and their assessment has been elusive. While curriculum rosters are needed for scheduling, these rosters are oriented toward courses (inputs) more than outcomes and can reflect programs as static rather than dynamic. The advantages of identifying alternative formats (or matrices or taxonomies) include providing 1) a learner-oriented format to focus faculty discussions in individual schools on "With what do we want our students to emerge from the D.D.S./D.M.D. pro-gram?"; 2) a concise overview of outcomes versus methodologies for that institution; 3) a compass for setting direction and making decisions on learning programs and resources; and 4) focal point(s) for further discussion and debate on aspirations for student outcomes and measurement. The matrix format can thus provide an additional lens for viewing student learning on an institutional level. We are not aware of any comparable consolidated matrix previously offered for dental education.

A concise format or matrix on current educational outcomes for a given school can serve as a prerequisite for a focused discussion on educational

outcomes. The effort in our school to develop such a matrix was prompted by an interest in continuous improvement since our goal is to continually seek ways to improve even if current teaching and learning seem adequate. With the growing number and complexity of learning programs (and various kinds of programs), which are often added on a spontaneous basis, the relationships and interactions among these programs call for a depiction different from a one-dimensional course listing over time. The matrix approach offers the potential to provide a clearer overview of our school's increasingly complex learning programs and the relationships among different kinds of programs. The matrix approach also offers consistency in terminology. While our school has been actively involved in developing and measuring stated educational outcomes for more than twelve years, the matrix approach was developed by an ad hoc focus group within the last year.

The purposes of this article are therefore threefold: to describe a format/matrix with outcomes classifications on one axis versus methodologies for implementation on the other axis; to present a completed matrix for our school to demonstrate its applicability; and to show how the matrix can provide a framework for ongoing discussions on "To what do we aspire with our students for the D.D.S./D.M.D. program?" The matrix we present has been completed for our school, but may well evolve over time. By the same token, while we see this model as potentially applicable at any dental school, its details will vary from school to school.

The Matrix Approach

While the matrix approach can be used to articulate future initiatives for student learning, another value is to pull together faculty members to discuss, debate, compromise, and perhaps even agree to disagree. Matrices can foster collective reflection and review by faculty members. A prerequisite for the matrix model to succeed is the interest and, more importantly, time for key faculty members to participate in an overview. Its future usefulness is likely to depend on how well it continues to facilitate collective, iterative review by the faculty.

This article is limited to the "Where are we now?" perspective for one school: the College of Dentistry at the University of Iowa. This project was classified as exempt from federal regulations by the University of Iowa's Institutional Review Board.

Components of the Matrix

A group of faculty members representing a spectrum of disciplines across the four-year curriculum was involved in the project. The educational outcomes and methodologies were developed by the first author with input from the coauthors. Matrix entries were then made from a combination of group input and individual interviews with coauthors. The intent was to assess potential use of the matrix and to describe the current learning environment at our dental school.

The horizontal axis of the matrix includes commonly referred to educational outcomes: knowledge, technical skills, critical thinking abilities, ethical and professional values, patient/practice management, and social responsibility awareness (see Figure 1). The horizontal axis is congruent with the accreditation standards.[1] The vertical axis has methodologies to operationalize the outcomes: definition of each outcome, main strategies to cultivate each outcome, articulated measures (including the perspectives of objective/subjective and formative/summative approaches), level of institutional coordination needed, and strategies/tactics to determine progress to competence.[2,3]

Opportunities and Limitations

The matrix approach allows transition from an overview to specifics on outcomes or methodologies and back to an overview without losing orientation. For busy faculty members focused on their courses, the larger view offers both an overview and the opportunity to see how their courses fit into the overall outcomes. While an outcomes approach artificially segments the broader subject of how students learn (and can learn better), starting with a blank slate makes a focused discussion difficult. The argument can also be made that this segmentation is overly simplistic to capture the complexities of student learning. Any matrix will be incomplete, just as improving our learning programs will be incomplete. This matrix has only two dimensions. This model and this article are limited to educational outcomes and methodologies. The goal is limited due to the complexities of adding more perspectives.

Future matrices can include additional dimensions such as sequencing and timing. A major advantage is that the focus is on the learner. Other advantages of this matrix are that it is concise and uses terminology familiar to faculty members and in educational circles. Faculty members at other

institutions may need to introduce changes to make the matrix a better fit for their needs. Outcomes listed correlate with natural activity areas in many schools; for example, knowledge is provided with lectures, technical instruction is conducted with simulations and clinics, critical thinking skills are cultivated with PBL, etc. More extensive entries can be made separately as demonstrated in the next section.

Application of the Matrix

The matrix is intended to be descriptive and not proscriptive since the horizontal and vertical axes are applicable with minor modifications to any school. The entries for each cell will be specific to the school. Completion of the matrix can be a combination of bottom-up and top-down as with strategic planning. Different approaches can be used to fill in the matrix. For a bottom-up approach, the question can be: "What are we now doing in each of these cells?" For a top-down approach, the question can be: "Here is one response to where our school is in describing how we achieve our educational aspirations for our students. How can these entries be clarified?" More elaborate entries can be made separately as demonstrated in the next section. The sample matrix was completed using a combination of bottom-up and top-down approaches.

Sample Entries for Our School

To this point, this article has focused on generally accepted terminology and methodology. In this section, we describe our school's progress toward identified educational outcomes. For this article, the dynamic of crafting each entry is as important as the result since specific entries will vary at each school. Each educational outcome is now listed with elaboration for sample entries by one school.

1. Knowledge

Definition: A core of facts and concepts for identified basic science and clinical disciplines.

Cultivation format: Lectures are the main format for delivering information. Each course has autonomy to determine the knowledge core/base for that discipline. Attempts are made to reference information to the best science and, where lacking,

to best practices.[4] Several lectures challenge students to discern the importance of the information given, but this is not systematic or related to performance measurement. The charge to basic science is to provide the learner with knowledge. Other outcomes are not a formal aspiration. However, clinical sciences are expected to achieve other outcomes as well as knowledge.

Performance measures: Objective tests predominate, mostly with summative evaluations.[2,3]

Institutional coordination is minimal beyond assembling performance reports from courses and departments. The Curriculum Committee identifies overlap and gaps in knowledge.

Progress toward competence and entry-level competence are determined from the assembly of department and course reports.

2. Technical Procedural Knowledge

Definition: For identified disciplines, a core of technical procedures to include knowledge of steps, staging, and execution.

Cultivation format: Most technical instruction is provided in the simulation clinic or in the patient clinic. Each course has autonomy to determine the core/base of technical procedures. For remediation, some departments use the approach of remediation to the technical outcome rather than repeat the process.[5]

Measures: Criterion-referenced and research-based clinical measures are widely used.[6] Objective measures are used to ensure the student's knowledge of criteria for each procedure. A standardized subjective measure is used to measure the student's fulfillment of each criterion. A formative approach is used for chairside interactions and mannequin-side instruction. A summative approach is used to measure performance with designated test procedures. Self-assessment is widely used to establish this practice after graduation. Self-assessment is not used to determine progress to competence.[7]

Institutional coordination is minimal beyond assembling performance reports from departments. The Curriculum Committee identifies overlap and gaps. Systematic institutional practices include precise instruction, extensive repetition, and an incubation time spanning the four years.

Progress toward competence and entry-level competence are determined from the assembly of department/course reports.

METHODOLOGIES / EDUCATIONAL OUTCOMES

			Analytical Learning Oriented to Patient Care				Practice Management and Interpersonal Skills	Social Awareness and Responsibility
	Knowledge	**Technical Procedural Knowledge**	**Foundations for Critical Thinking**	**Patient Process Management**	**Clinical Review**	**Ethics/Profes-sional Values**	**Practice Man-agement and Interpersonal Skills**	**Social Awareness and Responsibility**
Definition	Core of facts and concepts in designated disciplines	Core of proce-dures Know steps, staging execut-ing	The art of analyzing think-ing with a view to improving it	Integration and applic of knowledge, Tx plan, staging proce-dures Self-assessment	Review of judg-ment in clinic: patient well-being	Primacy on patient well-being	Practice prin-ciples and applications Communication skills to partner in oral health	Study of and care delivery for underserved populations
Cultivation Format	Lectures, seminars, lab, assignments	Simulations, clinic Direct instruc-tion Self-assessment	Principles of critical thinking lecture; lit-erature review; evidence-based dentistry; PBL in small groups	Small groups: master steps and planning; applic of each step to each patient	Chairside with individual fac-ulty interaction	1) Principles of ethics 2) Peer exchange Recordings of patient interac-tions	Lecture Practice exer-cise	Didactic Clinical
Measure Summative/ Formative Objective/ Subjective	Summative, objective	Criterion-referenced science-based D-1: summative > formative; D-2: reverse Calibrated examiners Self-evaluation	Small groups: formative/ objective + subjective Learning reports: sum-mative and formative objective/ subjective	Objective to know steps Subjective on application of steps to the patient	Summative Systematic and subjective	1) Test summa-tive objective 2) Complete exercise forma-tive, objective/ subjective	Summative: lecture and practice exer-cise Formative for communication review	Didactic completion Summative: objective clinic rotation Summative/ formative Objective/ subjective Standards of care
Institutional Coordination	Dept autonomy; institutional com-munication		Extensive over the four years and among disciplines		Widespread application, not highly coordi-nated	Separate track plus family dent depts mixed	Single coordi-nator for each	One coordina-tor
Competency Determination	Collection of dept and course dir reports		Progressive and coordinated		Supportive and not primary	Course/exercise completion	Reports from resp coordina-tors	Rotation completion

Figure 1. Educational outcomes: definition, cultivation, measurement

Note: In this matrix, educational outcomes are listed on the horizontal axis, with methodologies listed on the vertical axis. Entries in cells were created in faculty discussions. Entries are ab-breviated in the matrix with elaborations in the text. Abbreviations are practical to keep the matrix relatively concise. Discussion can thus be focused at any point on the matrix, then drawn back to a wide view, and then refocused on another point without losing orientation.

3. Analytical Learning Oriented to Patient Care

Definitions: The matrix exercise highlighted the need for our school to consolidate a workable set of definitions on critical thinking. The following reflect definitions now in use:

- Critical thinking: the art of analyzing and evaluating thinking with a view to improving it.[8]
- A method of thinking in which the thinker improves the quality of his or her thinking by taking charge of the structures inherent in thinking and imposing intellectual standards upon them.
- Self-directed, self-disciplined, self-monitored, and self-corrective thinking.
- The school's widely applied approximation of critical thinking includes use of the scientific method to develop the process of patient assessment, treatment planning, and guidance. The program is described in a previous article.[9] Evidence-based dentistry plus best practices are widely used but not in a systematic fashion.

Cultivation format: The school has three central and overlapping themes with corresponding activity areas. The first two activity areas are intended to guide student learning and measure performance. The third theme/activity area is clinical review, which reinforces and reviews the main domains of patient care.

The first step of the cultivation format is to build a foundation around principles for critical thinking and then extrapolate (approximate) these principles to the clinic. First, the foundation is started during the first semester with concepts of critical thinking, use of the scientific literature, and evidence-based dentistry. Students then engage in problem-based learning (PBL).[10] Second, for transition to the clinic, all departments engage students in small groups in patient assessment, treatment planning, and guidance with several departments applying the following protocol[9]: 1) a set of steps used by all departments delineating the patient assessment and treatment planning process and 2) systematic application of the steps to a patient/case.[11] In addition to department sessions, third-year students are engaged in a monthly multidisciplinary treatment planning session. Third, several departments conduct clinical review as a reminder of analytical lessons such as treatment planning, evidence-based dentistry, self-evaluation, etc. The daily outline and assessment instrument lists treatment plan review, integration of evidence-based dentistry, self-evaluation, time utilization, and professionalism/ethical behavior. The intent is to reinforce and measure inclusion of analytical lessons at chairside.

The school does not have a protocol for systematic review of the scientific literature for each case or for each patient. Inclusion of literature review is part of all PBL cases and in several other formats in the school, but the practice is not systematic. Faculty members have a growing awareness of the inevitable dynamics of Novice to Expert.[3,12] Inclusion of Novice-to-Expert principles seems essential in designing programs on patient assessment and planning. The school is in the early stages of systematically considering the Novice-to-Expert principles in designing programs in critical thinking.

Performance measurement has three overlapping thematic areas to match the three central activity areas. First, to assess students' mastery of the principles of critical thinking, they are measured by intertwining objective and subjective approaches in a highly formative and interactive small-group setting. In small groups, students are expected to apply principles of critical thinking to literature and to cases. Learning reports have summative measures with scores for performance categories and formative written feedback.[10] Second, for transition to the clinic, performance measurement of the student's ability in patient assessment and treatment planning centers around his or her ability to manage the process.[9] For each case/patient, the student's knowledge of the process is measured objectively. The student's application of the steps to each case/patient is measured in a standardized subjective way across departments and across the four years. Essentially all performance measurement is done in a formative way. Until the fourth year, all departments orient assessments to "progress toward competence" based on the year of the student. In the fourth year, the charge is to determine entry-level competence.[9] Third, widespread inclusion of judgment assessment is applied in the clinical setting with listings along with other clinical performance criteria. With the constraints of the clinical dynamic, the performance measure is not intended to be in-depth. This approach maintains an awareness of judgment integrated into clinical performance and does so at a practical level. Criteria include review of the treatment plan, use of relevant scientific literature, time management, self-evaluation, independence, professionalism, and ethical behavior. Measurement is subjective and systematic with faculty calibrated

on simulated cases. A potential activity for review is the student's ability to stage and execute a procedure. Objective structured clinical examinations (OSCEs) are used for summative measurement in some courses but are not used to guide students to proficiency in critical thinking.[13]

Institutional coordination is extensive, particularly compared to the outcomes of the Knowledge and Technical areas. At each point, progress toward competence is coordinated through the Academic and Professional Performance Committee. This differs from Knowledge and Technical, in which definitive determinations of mastery are made at the point of demonstration.

Entry-level competence is determined during the fourth year, conditioned on reported progress toward competence at each preceding level.

Regarding lifelong learning, the process of defining, cultivating, and measurement of critical thinking principles and applications is the essential precursor. We see this process as inseparable from lifelong learning and as the school's basis for building lifelong learning habits and principles.

4. Ethics/Professional Values

Definition: Primacy on patient well-being. Application of core ethical principles and professional values in daily practice.

Cultivation format/activities: Principles of ethics and professional values are presented in lectures. Students present personal ethical and professional values to their peers in case-based seminars. Ethical principles are formally integrated into the PBL cases and in some case presentation seminars.[14,15] Listing of ethical performance as a criterion is widespread in clinical performance measurement, but definitions of criteria are basic and not systematically assessed. In the fourth year, students write a dilemma paper based on extramural experiences in a case they have experienced. While not a separate exercise for students, an institutional assumption is that a significant part of cultivating ethical and professional values is through faculty and staff role modeling.

Measures: Lecture courses on principles of ethics (in the first and third years) have summative measures with objective tests. Mini-assignments have formative measures with both objective and subjective written and verbal feedback.[14,15] Application of knowledge and ability to manage a thought process in clinical situations/cases is measured in a way similar to that in PBL.[10] As part of the community

based-clinical experiences during the fourth year, each student analyzes an ethical dilemma that he or she experienced while completing a rotation. This analysis occurs through a guided reflection paper. Students are expected to discuss within the paper the ethical principles related to the case.

Institutional coordination: The program in ethics is a de facto track with integration into PBL and some case seminars. There is widespread awareness through listing of criteria like "ethical performance" in several clinics, but with limited depth in criterion definition and little or no institutional coordination. The widespread awareness has led to institutional disciplinary actions in a few cases.

Competence determination is made through assembly of performance measures in the courses just listed.

5. Practice Management and Interpersonal Skills

Definitions: Development of communication skills to educate and persuade patients to partner for improved oral health. Mastery of dental practice principles with practice model exercises

Cultivation format: Communication skills are cultivated through observation, lecture, and then application with peers and patients. Small groups are used to conduct recorded interviews and case presentations with peers, standardized patients, and patients. Content for interviews and case presentations is learned in individual departments. Business principles are learned in lecture with exercises in the fourth year based on student delivery of patient care in the clinic.

Performance measurement: Communication skills are measured objectively for steps in the communications process and systematically measured subjectively and in a formative way for recorded interactions. Practice principles are measured objectively for both the lecture component and the patient-based practice management exercises in the fourth year.

Institutional coordination is with a single coordinator for communication skills and another for practice management.

Competence determination is accomplished through reports by the coordinators. The matrix exercise highlighted the eclectic nature of the programs, cultivation formats, and measures in the educational outcome. Future efforts can now focus on gaining consistencies for this educational outcome.

6. Social Awareness and Responsibility

Definition: The study of the dental and oral care provided for individuals in underserved populations.

Cultivation format: A didactic (knowledge-based) component offers principles of social responsibility awareness through the courses "Issues in Dentistry" and "Principles of Public Health." The clinical component with community-based clinical experiences allows students to gain experience in the delivery of care to identified underserved populations. Students spend ten weeks outside the traditional curriculum. Although the program has specific goals and objectives, it is different from the outcomes of knowledge and technical skills in that this outcome does not identify a specific list of facts to memorize or procedures for students to complete. Lectures deliver information, and clinics offer experience.

Measures: For the didactic/lecture courses, objective tests are given with summative evaluations. Patient care delivery within the community-based experiences is measured at the level of accepted standards of care. Additionally, guided reflection (via written papers and seminars) is used to assess students' progress toward understanding the community-based clinical experience's goals and objectives.

Institutional coordination: There is one overall coordinator for these programs with input from coordinators from sites, the department, and collegiate administration.

Competence determination is accomplished with assembly of measures for course and clinical rotation completion.

Uses of the Matrix

The matrix approach offers a view of student learning completely different from tracking a curriculum from year one through year four or from viewing a course catalogue. The matrix approach fulfills the purposes of developing a concise statement/overview on "Where are we now?" regarding institutional aspirations for students; capturing the main activity areas leading to attainment of the outcomes; and providing a focus for a learner-oriented discussion. Through the different lens of the matrix approach, a concise overview of student learning on an institutional level is developed, and busy faculty members focused on a single course have the opportunity to gain a larger view on how their efforts fit into the institution's overall efforts on student learning. Another unique benefit of the matrix approach is to facilitate cyclical discussions alternating from a big-picture perspective to specific segments and back to the overview without losing the reference point of the discussion. The matrix allows a "take it apart and put it back together" approach. Future usefulness will depend on interest in taking an institutional view of learning and time for key faculty members to participate.

Besides fulfilling the basic purposes, the matrix approach offers opportunities for systematically scanning the matrix from the horizontal axis and then the vertical axis. The following are examples of segmented discussion followed by the opportunity for convergence back to the overall matrix. While scanning the matrix vertically and horizontally can lead to conclusions that seem obvious to some, it does sharpen the larger strengths and deficiencies for the busy, course-oriented faculty member. With the matrix approach, we can focus on one outcome and set aside others for a more concentrated and less distracted discussion.

Horizontal Axis

Analysis of each line on the horizontal axis allows a methodological and even a cultural analysis for each outcome or groups of outcomes.

Definitions: Horizontal analyses of outcome definitions reveal fundamental differences that will impact measurement. For example, knowledge is defined partly as a "core of facts," while critical thinking is defined partly as "the art of analyzing a thought process." Knowledge is a tangible, quantifiable entity, while critical thinking is not. Quantifying an "art" would inherently include some component of subjective measurement. Measuring (quantifying) critical thinking is thus on another level of complexity from knowledge, even after definitions are established. Compromise and accommodation will come to bear in measuring critical thinking. The challenges of measuring critical thinking thus go back to the definition.

Cultivation formats: A horizontal scan across the outcomes highlights the array of formats needed to achieve outcomes. As Brandsford et al. note, "Research has indicated that transfer across contexts is especially difficult when a subject is taught only in a single context rather than in multiple contexts."[3] Thus, the matrix makes apparent an array of contexts, all of which are included in assessing competence and are likely to enhance learning.

Measurement approaches: The matrix approach allows a ready overview and comparison of the wide array of measurement approaches for individual outcomes. For example, within a few cells, we gain an overview of our approach to cultivation and measurement of analytical thinking. Within the umbrella of critical thinking, our school has a variety of measurement approaches. Our approach to competency assessment in critical thinking and patient process management is based first on a foundation to include 1) mastery of principles of critical thinking in the first year, 2) mastery of searching the scientific literature, and 3) mastery of principles of evidence-based dentistry.[10] This foundation is followed by an approximation of critical thinking principles with an integration of evidence-based dentistry and best practices, thus giving structure to the process of patient assessment and treatment planning. This transition from foundation to clinical implementation is based on an institutionally agreed-upon set of steps in patient assessment and treatment planning objectively measured across the four years and systematic assessment of each step for each patient or case.[9] Another example of horizontal analyses is with formative and summative performance measurement, which reflects a cultural preference as well as selection of educational methods.[2,3] It is an institution's choice on how to balance formative and summative evaluation. The matrix provides a view of the institution's current balance. Formative evaluation reflects interaction with students to combine teaching, learning, and performance measurement.

Also on the horizontal axis, the balance of objective and subjective approaches is apparent regarding the institution's preference for performance measurement. While the liberal arts have combined the use of objective and subjective measurements for several decades,[16] schemes and protocols for systematically structuring and intertwining objective and subjective measures have received limited attention in dentistry at least on an institutional level.[9]

Institutional coordination is reflected by following the matrix horizontally across each outcome. For example, institutional coordination is minimal in assessing competence for knowledge and technical procedural knowledge and is extensive in assessing competence in critical thinking for patient care. The balance of faculty (or course) autonomy and institutional coordination is different for each outcome.

Progress toward competence for critical thinking is more extensively managed institutionally than the outcomes for knowledge and technical procedural knowledge. With ongoing discussion using the matrix approach, our school now focuses on coordinating principles of critical thinking with the variety of thought processes in patient care. One example of a deficiency is the need for more intense inclusion of scientific literature in the protocol for patient assessment and treatment planning.

Competence determination: Following horizontally across each outcome reveals the relative weight on each outcome in assessing competence. The school then sanctions entry-level competence for the student based on the collection of performance measures for stated educational outcomes. For example, knowledge and technical procedural knowledge are weighted more than critical thinking.

Vertical Analyses

Having analyzed the matrix from the horizontal axis, a next step can be to analyze columns against one another. Comparing entire columns against each other allows a comparison of fundamental differences for the outcomes. The outcomes for knowledge and technical procedural knowledge are straightforward to delineate and logistically imposing to implement. Large numbers of courses develop factual and technical materials with extensive instruction and assessment. The matrix approach helps to accentuate just how different critical thinking is from other outcomes. Critical thinking is difficult to delineate and less ponderous to implement logistically. From this matrix exercise, it became apparent that our school did not have a cohesive set of definitions on critical thinking, judgment, evidence-based dentistry, patient process management, etc. The matrix also allowed our school to see within a few cells our approach to cultivating and measuring critical thinking abilities. Individual courses in critical thinking are as rigorous as any, but there are fewer of them. The small-group format used to cultivate critical thinking in patient assessment and treatment planning reinforces a team approach in planning patient care.[9] This is distinctly different from the lecture formats used to master knowledge and the individual instruction in preclinical and clinical format used to master technical skills. The small-group format used to cultivate critical thinking in patient assessment and treatment planning replicates the ideal collegial interaction in determining alternatives for the patient. The small-group format is also a building block for a learning community within the school.[3] The experiential learning track is the spine running through the curriculum.

By comparing entire columns, the matrix approach allows discussants to understand interfaces of outcomes. For example, we aspire to a core of knowledge as well as an ability to discern the importance of knowledge that is gathered. These fall into two separate categories: knowledge and critical thinking. While this separation is artificial, the format allows for a focus on each outcome followed by a focus on the larger picture.

Also on the vertical axis, the matrix approach makes apparent the gaps, strengths, and weaknesses. For example, for our school, it is apparent that formal measurement for the outcome on interpersonal skills is not completely integrated with other outcomes and is not as large a factor in determining competence. We also realized that separating ethics and social responsibility might inadvertently communicate a lesser priority. The matrix is limited in resolving this kind of complexity.

Conclusions

The matrix approach can facilitate individual and group discussion on aspirations for students by offering a single view of educational outcomes posed against the methodologies—a different lens. At the same time, the matrix allows maintaining a focus on the learner with a ready reference point to keep the discussion on track. Busy faculty members focused on teaching a single course can see the larger picture. The matrix will be artificial in that patient care is not delivered by categories of learning nor in disciplines. A matrix will always be incomplete because the process of elaborating educational outcomes is inherently incomplete. The establishment of "Where are we now?" sets the stage for more extensive discussions on institutional aspirations for students. Scanning the matrix horizontally and vertically provides an added opportunity for analysis with the matrix approach. Strengths, weaknesses, gaps, and variability are visible on one viewing.

Acknowledgments

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