Knowledge, Abilities, Responsibilities: The Design of a Three-Dimensional Curriculum Framework for Modern Pharmacy Education

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Abstract

Our post-modern world is extraordinarily complex: if our graduates are to be able to thrive in this world they must be empowered to evince professional competence, steward the practical and theoretical knowledge fundamental to their work, and choose the right actions in complex contexts. This manuscript describes an approach to designing a curriculum framework intended to facilitate the achievement of these aims based on three methodologies: 1) an analytic process that identifies the tasks and underlying knowledge, skills, and attitudes required in the performance of professional duties; 2) a clinical learning methodology that creates intentional connections between theoretical and practical knowledge, and; 3) a curricular assessment process that assesses the integration of cognitive, social, and affective abilities into professional work and learning activities, and drives the design of learning activities. The resultant "three-dimensional" (3D) curriculum integrates complex abilities with the development of professional competence on the road to expertise.

Introduction

St Louis College of Pharmacy (STLCOP) strives to prepare its graduates for lives of personal fulfillment and professional significance and responsibility. Given the increasing complexity and accelerating change of the 21st century faculty identified three broad and intersecting areas of long-term proficiency for our graduates:

Practical Competence (Collin & Evans, 2007) in undertaking a defined set of responsibilities or duties unique to the profession. Ultimately, the goal is expertise but this cannot practically be developed in four years. Research across many occupations and professions show that it takes about ten years of deliberate practice to achieve this aim;

Stewardship of theoretical knowledge through ongoing learning, careful, objective evaluation and integration of the knowledge and skills gained, and applying them to answer questions and solve problems;

Right Action – The skilled application of a set of intellectual abilities that enable the professional to make decisions and choose actions that cumulatively engender trust and confidence in the professional and the profession (Joint Commission of Pharmacy Practitioners, 2007; Carr, 2007).

An evaluation of the existing curriculum at St. Louis College of Pharmacy was undertaken by obtaining critique from key stakeholders in the form of a "SWOT" (Strengths, Weaknesses, Opportunities, Threats) analysis relative to these aims; this revealed shortcomings that were sufficiently serious to motivate us to embark upon a curricular redesign process. In doing so, we asked ourselves "What would a curriculum look like if we could truly start from scratch?" This was a rare opportunity to create a curricular product that was both effective and efficient, unmarred by the historical and political baggage characteristic of most extant curricula.

Designers—engineers, architects, and so on—deliver products that fit some specified requirement. They begin with the end in mind. Quality instructional design follows the same "backward" process (Davis, 2007a; Davis, 2007b; Richey, Klein & Tracey, 2011; Smith & Ragan, 2005; Kruse & Keil, 2000; Dick & Carey, 1996). This begins with an analysis of the intended long-term behaviors which are translated into measurable educational outcomes. Then, a variety of designs are explored and one is selected or synthesized as the prototype for the new curriculum. The design is completed by an iterative development and assessment process that modifies the design until it achieves its specifications. This manuscript describes the first two steps of STLCOP's curriculum redesign resulting in our "3D curriculum framework" that integrates professional competencies, knowledge, and intellectual abilities.

Each of the three broad areas of performance required a unique curriculum design strategy. A review of the literature yielded a variety of approaches in each domain, had to select among these. In the end, the components

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of "Practical Competence" were established using the DACUM (DevelopingACurriculUM) methodology (Norton, 1985). "Knowledge stewardship" was aligned with a "clinical learning methodology" designed by STLCOP faculty. This methodology will form the basis of the teaching of all therapeutics, therefore providing students ample opportunity to develop it as a habitual and systematic approach to learning: a prerequisite of knowledge stewardship. "Right action" was aligned with the American Association of Colleges and Universities' (AAC&U) LEAP Outcomes (LEAP stands for "Liberal Education and America's Promise" National Leadership Council for LEAP, 2007), which can be assessed and evaluated in authentic work samples across the curriculum using the VALUE rubrics (AAC&U, accessed 2.23.15). The rationale for selecting these approaches and their assessment are described in detail in the following sections.

Methods

Using DACUM to Identify the Components of Practical Competence

There are several approaches to identifying the personal and professional competencies needed by expert workers to perform their jobs including occupational analysis, information search, and critical incident analysis. We chose a combination of occupational analysis and information search because this combination has been shown to yield superior outcomes (Willett & Hermann, 1989).

DACUM is a popular approach to occupational analysis. Since its inception, it has been used extensively to develop curricula in a wide variety of settings, including high school, community college, industry, vocational / technical schools, and universities. Its wide adoption has resulted from the fact that it has proved to be efficient and cost-effective. The two fundamental assumptions of the DACUM methodology are: 1) An occupation can be effectively described by the responsibilities (an identifiable segment of work consisting of several related tasks – McCormick, 1979) and associated tasks (smallest part of a job having a meaningful unitary purpose or goal, Altman & Gagne, 1966) undertaken by expert workers; 2) Expert (high-performing incumbent professional) workers are often better at identifying and describing their responsibilities and tasks than anyone else.

Many years of experience with the DACUM methodology have revealed that most occupations can be described by 6-12 responsibilities and each responsibility can be analyzed into a set of interrelated tasks. A task is an observable unit of work with observable steps. A typical occupation can be delineated by 50-150 tasks – about 6-25 per responsibility.

Occupational analysis is not universally embraced by the academy because of the following criticisms: a) it discourages creativity on the part of faculty; b) competency is insufficient (Talbot, 2004); it places excessive control on students thus discouraging autonomy; d) competence decisions are seen as black-and-white rather than decisions that involve levels of increasing excellence and expertise; and e) inordinate amounts of documentation are required (Rees, 2004). We agree with some of these criticisms, which led us to develop the 3D curriculum wherein the results of DACUM were simply circumscribed to its required core.

The original version of DACUM relies only on the input of incumbent professionals in the development of the job profile. Faculty can participate in the process, but only as facilitators or observers. We chose to *include* faculty as full participants for the following reasons:

1. This facilitated more universal buy-in and overcame the criticism associated with loss of creative freedom.
2. Pharmacy is still in transition, and some of the job responsibilities, for example managing a practice of patients, ensuring economic viability of the practice, and political advocacy, among others, are rarely assumed, if at all, even by some of our best clinicians. Curriculum development in these areas would have to be based on best evidence and evidence-based hypotheses.
3. Information search—seeking content-validated literature on an occupation that describes competencies associated with an occupation—can validate the DACUM process as well as fill in gaps.

In the end, we adopted a modified version of DACUM that employed a team of faculty, alumni, employers, and "high-performing incumbent professional (HPIP)" pharmacists, supplemented by information search. HPIP are practitioners whom others wish to imitate. They are practicing at the highest level of their knowledge and skill and are seen as leaders in managing and advancing their practices. We included faculty because it would facilitate understanding and buy-in. We also reasoned that they might be better than the HPIPs at identifying the component knowledge and skills, as these often become tacit as expertise is developed. Moreover, in a professional curriculum, student autonomy must be somewhat limited by the social service required by a profession. Table 1 outlines the DACUM methodology.

The charge for the DACUM team was to use the steps in Table 1 to construct a profile of responsibilities and tasks for the entry-level pharmacist in *all* practice settings for

Table 1 DACUM Methodology

Step	Description
1. Occupation Title	A useful title succinctly differentiates this occupation from other occupations.
1. Occupation Description	This is a single paragraph that delimits the scope of the occupation and describes how it fits into the world of work.
2. Definition of Responsibilities	Responsibilities are general areas of competence that successful workers in the occupation must demonstrate or perform on an ongoing basis. Each occupation can usually be described by a set of 6-12 responsibilities.
3. Definition of Tasks	A task is a work activity that has a definite beginning and ending, is observable, consists of two or more definite steps, and leads to a product, service, or decision. Each responsibility is comprised of 6-25 tasks.
4. Prioritization	Prioritization determines which responsibilities and tasks take priority in the curriculum due to their scope, importance, and requirement for competence.
5. Validation	The profile of responsibilities and tasks generated by the DACUM process is compared with workplace observation, literature search, and the review of comparable curricula in other institutions.
6. Task Analysis	The knowledge skills and attitudes required to perform each of the tasks are identified along with a level of competence appropriate to an entry-level practitioner.

the year 2020. Participants began by adopting a broad "job description" previously identified by the Joint Commission for Pharmacy Practice: "*Pharmacists will be the health care professionals responsible for providing patient care that ensures optimal medication therapy outcomes*." The occupational analysis process eventually yielded 8 responsibilities:

1. **Patient Care Provider** — The pharmacist provides patient-centered care as the medication expert by collecting and interpreting evidence, prioritizing, formulating assessments and recommendations, implementing, monitoring and adjusting care plans, and documenting these activities.
2. **Population Care Provider** — The pharmacist can describe how population-based care and health and wellness programs influence patient-centered care and can participate in the development of practice guidelines and evidence-based best practices.
3. **Practice Manager** — The pharmacist manages patient healthcare needs using human, financial, technological, and physical resources to optimize the safety and efficacy of medication use systems.
4. **Self-Developer** — The pharmacist develops and undertakes an ongoing self-learning and self-development plan.
5. **Interprofessional or Organizational Team Member** — The pharmacist actively and effectively participates and engages as a member of organizational and interprofessional teams.
6. **Information Master —** The pharmacist demonstrates competence as an information processor by collecting, retrieving, organizing, generating and validating data from a variety of sources.
7. **Advocate for the Profession and Community Member —** The pharmacist assures that the patients' communities are best served and aligned with the profession's capabilities.
8. **Participant in Research —** The pharmacist is able to contribute to the generation of new knowledge and to the application and integration of existing knowledge.

The next step was to identify the list of tasks that, together, define the responsibility. For example, if the area of responsibility is to "pursue professional development," the tasks might include reading professional literature, creating a personal development plan, participating in continuing education programs, and so on.

The criteria used by the work group to define the tasks included the following:

- Procedurally clear with specific, observable steps, best taught with a methodology
- Contemporary—but future oriented
- Deemed essential by HPIPs
- Complex—integrating concepts, procedures, contexts, tools, and ways of being
- Can be performed over a short period of time

- Can be performed independent of other work
- Can be observed, measured. and assessed
- Result in a product, service, or decision

Tasks are identified using a storyboarding process. Responsibilities are listed in order of importance along the left side of a large open wall using index cards, "stickies," or some other moveable element. The DACUM team is arranged in front of a wall and members are encouraged to propose tasks, and stick these on the wall. The group argues, rearranges, develops considerable insight into the work, and in a few hours ends up with an organized list of tasks with considerable content validity. This "DACUM" table is shared with a larger group of stakeholders for further validation and improvement. Some tasks associated with the responsibility of "Patient Care" include collecting pertinent data, assessing patient-specific medical problems, evaluating current therapy, selecting/ recommending therapy, monitoring patient medical problems and therapies, communicating, educating, and administering medications. The full list of tasks elucidated by the DACUM process is available upon request.

To further enhance content validity, the curriculum and curricular assessment committee at STLCOP then used a literature search to identify documents with which to reconcile the DACUM table. The resultant DACUM document was disseminated to, and accepted by, faculty in 2012 as one of the curricular determinants.

In the curriculum design stage, the faculty chose to use the DACUM responsibilities to define curricular tracks that progressed in complexity from year one to year four of the curriculum. Comparing this to the program design methodology, this process would be equivalent to choosing curricular "themes."

Local Adoption of a Clinical Learning Methodology

Since the 1911 Flexner report and the subsequent transformation of medical education, health professional education has become strongly tied to science and its underlying, largely instrumental philosophy. The medical and pharmacy curricula now consist of several intensive years of science. The scientific paradigm of professional education has been rightfully lauded for its beneficial outcomes in knowledge and breath-taking technological advancement. However it also has two profound deficits. First, the vast majority of curricula are content-oriented. This is reinforced by accreditation standards that specify content, almost exclusively at an informational level – Level 1 in Bloom's taxonomy (Bobrowski, 2007). Second, this content is usually taught in disciplinary silos, with little or no linkage to the practical world of the professional. This separation of the theoretical from the practical has led to a deep gulf between graduates' knowing and being able to apply what they know. The result is that most pharmacy graduates are truly knowledgeable (Waterfield, 2010) individuals who are not predisposed to steward, apply and advance knowledge through lifelong learning, to engage in practice-based problem solving, or to advance scholarship.

Attempts at bridging the divide between the theoretical and the practical have been made by various groups. Chase and colleagues used a "Discovery Mapping" process that led student groups to link content from across the curriculum to a particular disease state (Chase & Franson, 2001). Its limitation was that each student group only studied one disease state, and in a post hoc fashion. The process does not mirror what one would do in a practice situation, and it is unlikely that it would be taken into practice as a learning tool. The COMPASS curriculum at McMaster medical school is another attempt at forming a stronger bridge between theory and practice. The problem-based tutorial format of the original curriculum bred strong caregivers who had trouble passing the board exams. They were unable to transfer knowledge learned in the context of one problem to another. In the new approach a range of cases are used to illustrate critical scientific concepts such as "oxygen supply and exchange," "homeostasis," and "defense (Neville & Norman, 2007)," as well as their clinical correlates. The strength of this approach is that it gives students multiple opportunities to practice knowledge transfer and integrative learning. This approach mirrors the selection of "themes" in the instructional design approach advocated in Process Education, however it is limited to one professional responsibility of the physician: clinical problem-solving. It is also limited by the fact that it does not mirror the clinical environment and thus loses the power of contextual cues for knowledge retrieval and application. Engaging students in research is another promising approach to developing knowledge application and transfer (Wuller, 2010). However this too is not concretely linked to the experience of the practitioner.

Finally, an interdisciplinary approach to reconciling theory with practice in curriculum design was developed through a series of seminars hosted by the Carnegie Foundation in 2002 (Sullivan, 2005; Sullivan, Rosin & Shulman, 2008). A series of courses that achieved a successful synthesis of science, liberal arts, and practice were constructed through a recursive dialogue between practitioners and theoreticians. Through the process, the seminar participants discovered that courses designed for reflective action required four things of the learner: a) assumption of a particular professional identity; 2) finding a place within a professional community; 3) taking responsibility to act prudently on behalf of others, and; 4) integrating the skills

and attitudes necessary to steward the knowledge in their defined areas of expertise.

At STLCOP, we chose to use this discursive, interdisciplinary approach to curriculum design. Five benefits of this approach were readily apparent:

1. It provided a context for knowledge transfer (Haskell, 2001). A deeply integrated curriculum will enable graduate practitioners to use theory in new problems they encounter in day-to-day practice because this is the way they learned to approach problems in school.
2. It was systematic. The *regular* synthesis of practice, explanatory science, and value-based judgment renders habitual the skills required for the development and maintenance of expertise.
3. The discursive approach to curriculum design can help student pharmacists, academic practitioners, and researchers begin to view themselves as a community with a shared mission, values, work, community, identity, knowledge, and learning (Duncan-Hewitt & Austin, 2005).
4. This approach embeds an explicit, ethical dimension into every course. As a result of the input of the liberal arts into scientific and practical thinking, course activities force students to reflect on the human implications along with the scientific "means" and the practical "ends."
5. Such a curriculum is more easily modified as knowledge and practice evolve and change. An integrated curriculum revolves around practical situations or problems, and it is fairly easy to modify problems as knowledge grows and changes. Today, the increasing knowledge-base can be accommodated through accessible electronic media. It is far easier to add or change paragraphs and links in a "wiki" than it is to change lectures and PowerPoint® presentations. If the learners need the content, they can find it; if they don't, it simply won't be accessed.

As STLCOP faculty discussed various possible approaches to integration, they came to adopt a circular thinking process based on Wiggins and McTighe's (2005) "essential questions."

Wiggins and McTighe assert that all faculty are faced with the problem that we can't "cover it all," so they must design and prioritize instruction so that students can develop deep understanding of:

- the most important ideas
- the most transferable ideas
- overarching themes and processes
- paradoxes, assumptions, and perspectives

The faculty generated a set of essential questions by developing a systematic methodology for learning new knowledge in the realm of "patient care." Armed with an unfamiliar disease state or drug, the faculty came to consensus on an ordered set of questions that could be used to drive self-learning.

This ordered set of essential questions form the basis of the "clinical learning methodology" listed in Table 2.

In the new curriculum, activities will be designed so that students repeatedly cycle through the essential questions as they move from one topic to the next. With enough repetition, the methodology will become ingrained so that graduates will be likely to take it into practice.

Applying VALUE Rubrics to Monitor "Right Actions"

Our post-modern world is exceedingly complex: highly informational, increasingly bifurcated between the haves and have-nots, globalized, delocalized, deregulated, insecure, polluted, and rapidly changing. If our graduates are to be able to thrive in this world by thinking for themselves, making well-informed decisions, and continuing to learn and grow, they must be "liberally educated," not just as undergraduates, but through their professional programs and beyond. *AAC&U defines liberal education as "An approach to college learning that seeks to empower individuals and prepare them to deal with complexity, diversity, and change"* (AAC&U, 2011).

STLCOP has long been an advocate of ability-based education, but in 2009, we decided to align our assessment of ability outcomes with the LEAP essential learning outcomes by selecting learning activities designed to develop these abilities and by adopting the VALUE rubrics as our means of evaluating the success of our teaching interventions (Gleason, et al., 2013).

The VALUE rubrics were developed to promote national dialogue on assessment of liberal education outcomes among colleges and universities. VALUE places emphasis on authentic assessment of student work and shared understanding of student learning outcomes rather than reliance on standardized tests administered to samples of students outside of their required courses. The rubrics articulate fundamental criteria for each learning outcome, with performance descriptors that demonstrate progressively more sophisticated levels of attainment, from a benchmark level to a capstone level.

Table 2 Learning Methodology for Using "Patient Care" Essential Questions

Step 1. Establish Fundamentals of Relevant Anatomy, Histology, Physiology, and Pathophysiology	
What is happening here?	What is the relevant anatomy, histology, physiology, and pathophysiology Why?
Step 2. Determine General Therapeutic Options/Mechanisms	
How can we intervene?	What are the molecular targets for prevention and treatment of the disease? Why? How does the mechanism of action result in the prevention of disease and disease progression, and in the treatment of disease and its complications? Given a drug mechanism, what is the projected impact of the drug on this condition (e.g. primary, secondary, tertiary prevention, treat symptoms, prevent development or progression of complications, etc.)?
How does the chemistry of molecules affect the course and outcome of pharmaceutical interventions?	How do you choose among drugs in a class? How does one account for intra-class variation? What does the body do to this drug?
What else can happen? What can go wrong?	How does the drug give rise to adverse or unwanted reactions and drug interactions (side effects, toxicology)?
Can we do more than one thing?	How might the different classes of drugs work together to treat/prevent disease?
Step 3. Apply Fundamentals to Learn, Assess, and Improve Standard Pharmacotherapeutic Practices	
What are considered to be best practices?	What is the best practice guideline today, and why? Is this really the best practice? What are the unanswered questions? How would new evidence, new drugs, drug changes, etc. impact the guidelines?
What would we do in providing patient-specific care?	What data would we collect? How do you select and recommend the best drug therapy? How and when do you extrapolate from or decide not to use an algorithm? What are non-drug therapies (alternative therapies, life-style, surgery, counseling, etc.) and what are their relative roles/evidence? How would you best monitor and adjust this therapy for this patient/situation/context? How do you educate the patient and/or his family and caregivers to empower him to better manage his health and disease? How do you take into consideration the broader socio-economic context in designing your care plan? As a pharmacist, what are your limitations in this situation and what can you do about it?

The decision to adopt the VALUE rubrics rather than others that can be found in the literature, or "home-grown" ones was a difficult one. For example, Process Education uses a rubric design process that produces extremely strong rubrics (Leise & El-Sayed, 2009). The VALUE rubrics were ultimately chosen because:

1. They were designed to align with the LEAP outcomes;
2. They were developed through the collaboration of experts in each of the abilities from over 100 institutions of higher education, giving them considerable face and content validity (Chambliss & Schutt, 2009);
3. They would allow us to benchmark the performance of our curriculum against that of others;
4. The VALUE rubric calibration process establishes good reliability (Finley, 2011);

Of the 16 LEAP outcomes, STLCOP chose to adopt 13: critical thinking, problem-solving, creative thinking,

written communication, oral communication, reading, foundations and skills for lifelong learning, integrative learning, intercultural knowledge and competence, teamwork, ethical reasoning, civic engagement, and information literacy. These were to be integrated into the didactic and experiential learning activities throughout the curriculum as well as the co-curriculum, serve as foundational outcomes in the course design process, to be evaluated in each course, and assessed across the curriculum for the purpose of continuous curricular improvement.

The methodology used to assess students' abilities across the curriculum is illustrated in Table 3.

Ensuring Achievement of Intended Outcomes

A new curriculum design can only truly be evaluated retrospectively. Therefore assessment, improvement, and amendment were built into the curriculum implementation process. However, the design process itself yielded benefits. Both the proposed curriculum assessment process and the immediate benefits of the design will be discussed in this section.

Professional Competencies

Immediate Benefits of the Design Process — The DACUM process provided a forum for faculty to dialogue across disciplinary boundaries and come to a strong mutual understanding of the goal of the curriculum. It also provided a means to prioritize: not everything can be taught, and professional competency became a central criterion for making decisions about what must be emphasized and what could be eliminated.

Assessment and Evaluation of the Curriculum — Competencies will be assessed and evaluated in several ways. First, competencies will be taught and tested in a skills lab that will parallel other courses throughout the first three years of the curriculum. An Objective Structured Clinical Assessment (OSCE) will be used to determine whether students are ready to progress to the fourth year of the program. Finally, competencies in *all* the areas of responsibility—not just patient care —will be assessed and evaluated during the advanced practice rotations. Once again, should any deficits be identified, remediation and curriculum modification will occur concurrently.

Knowledge Acquisition and Stewardship

Immediate Benefits of the Design Process — The dialogical process that produced the essential questions was difficult at first. Participants had to learn and come to appreciate each others' values and languages. However the faculty involved remarked that it was extremely powerful in the end. Practitioners observed that they were much more able to integrate the thinking of the basic sciences in their clinical decision-making. Some remarked that they wished that they could take some of these foundation courses all over again, armed with this new appreciation. Conversely, basic sciences faculty came to regard the essential questions as robust means of establishing the relevance of the sciences to practically-minded students.

Table 3 VALUE Rubric Methodology

Step	Description
1	**Sample Collection:** Collect work samples assumed to demonstrate the ability in question from courses across all years of the curriculum.
2	**Sub-Sample for Calibration:** Select several samples to serve in the calibration process.
3	**Calibration:** A team of faculty uses the rubric to assess the level of performance demonstrated in the sub-sample of work products. The ensuing discussion develops agreement about the interpretation of the rubrics and may lead to some rubric modifications. Calibration is complete when all faculty members assess subsequent performance to within one unit of the rubric scale.
4	**Assessment:** The work samples are distributed among the faculty for assessment. Two faculty members assess each sample, again seeking consensus as in Step 4.
5	**Analysis:** The results are compiled and analyzed. Questions to be answered include: 1) How much variability exists? 2) How much, if any, development of ability has occurred? 3) Which samples were easier or harder to assess, and why?
6	**Discussion:** Faculty gather to discuss the analysis in Step 5. Results can include: 1) evidence of ability development that can be used in program evaluation; 2) changes to learning activities to better evince the abilities; 3) enhanced understanding of what the abilities actually entail; and 4) redesign of portions of the curriculum.

Assessment and Evaluation of the Curriculum — Knowledge will be assessed by a number of traditional and more novel means including multiple choice examinations within each course, evaluation of students' ability to apply knowledge in problem-solving scenarios, and progress tests (Blake, et al., 1996): comprehensive tests of students' developing knowledge. Should any deficits be identified, remediation and curriculum modification will occur concurrently.

Right Action through the LEAP Abilities

Immediate Benefits of the Design Process — STLCOP has long been considered a leader in integrating "ability outcomes" such as critical think, problem-solving and so on across the curriculum. Adoption of the VALUE rubric strategy enabled us to assess the performance of our existing curriculum in achieving these outcomes. Because the assessment process is time-consuming, we chose to undertake this assessment over several years, assessing two outcomes per year. We began with critical thinking and problem-solving. Sadly, although we could report a statistically significant improvement in abilities, the effect size was disappointingly small. Students in the first professional year typically performed at the second of five possible levels in the rubric. Students in the last year of didactic study remained at this level. This result provided strong evidence for the need for curriculum redesign, including the development of better learning activities and assessments.

Assessment and Evaluation of the Curriculum — Learning activities across the curriculum will be designed to incorporate the 13 chosen LEAP abilities so that students have the opportunity to practice them and have their performance assessed over 4 years. Following the methodology described by Gleason et al. (2013), the abilities will be evaluated in individual courses as well as across the curriculum. This is an area where we expect to be making the greatest number of changes in the final iterative stage of curricular design, as faculty slowly reach consensus on what the abilities really entail and how to teach and assess them.

CONCLUSION

With the intent to prepare its graduates for lives of significance and responsibility, St. Louis College of Pharmacy developed a "3D" curriculum to educate students to demonstrate competence in all areas of professional responsibility, steward the knowledge that is foundational to the profession, and take appropriate actions in all contexts. The process, based in educational design theory, was laborious due to the need to develop mutual understanding and consensus among faculty. However we believe that the result is both robust and exciting, as it transparently links our educational intentions to the curricular content. Moreover, with assessment built into the implementation process, we will be able rapidly to make modifications as needed.

The next phase will involve the explicit design of each course. The interdisciplinary dialogue that is built into our course design process will provide the context in which priorities are set. We can't teach everything, so we will need to decide collectively what our graduates *must* know and be able to do versus what is optional. Because our graduates will enter practice with incomplete knowledge and only developing expertise, it will be critical that they have the ability to self-assess their learning needs, to undertake continual learning, and to constantly challenge themselves with problems that keep them on the "uncomfortable edge" of their competence. It is for this reason that STLCOP will be putting special emphasis on teaching, assessing, and continually improving students' performance in using the essential questions to drive self-learning and demonstrate competence in the LEAP outcomes in the future.

Generalizability of the Design Approach

DACUM has been validated across many occupations. Its major criticism has been excessive emphasis on routine aspects of work, especially in the context of "professions." We believe that incorporating the input of representatives from the underlying sciences helped to overcome this criticism. The clinical learning methodology is peculiar to the profession of pharmacy. However the approach used to develop this methodology is generalizable across professions and disciplines. Similar to the process used to develop all methodologies, the fundamental question asked of participants is, "What approach would a practicing professional use to expand his or her knowledge to solve a novel problem in this domain of work?" When this question is addressed collaboratively, the result has acceptable content validity. Finally, the abilities evaluated by the VALUE rubrics – critical thinking, problem-solving, communication and so on – have often been identified by employers as being more important than disciplinary knowledge. All professional curricula should be designed to inculcate them.

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