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Modeling with Medicinal Chemistry: Practical Innovative Technology-based Activity to Enhance Student's Learning Through Inter-Departmental Collaboration: PART I

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Modeling with Medicinal Chemistry: Practical Innovative Technology-based Activity to Enhance Student's Learning Through Inter-Departmental Collaboration: PART I

Abstract

Background: Concepts of formulary management and its applications in clinical practice is a challenge faced by many first professional year pharmacy students. This challenge may be attributed to a lack of foundational knowledge and practical skills at this level. Preparing students for lifelong learning mandates early exposure to practical application of concepts. This warrants the need for students to integrate knowledge, skills, abilities, and attitudes in clinical practice. As a result, a state-of-the-art one stop shopping structure of the day (SOD) activity was created for P1 pharmacy students to enable the authors to assess their skill sets.

Objective: The objective of the study was to assess the impact of this technique on students' ability to integrate science into practice.

Methods: An institutionally structured curriculum permits concurrent administration of standalone but related courses through inter-departmental collaboration. Connecting the dots in drug information, medicinal chemistry, pharmacology, and pharmacokinetics was identified as a creative means to accomplish this goal. A comprehensive literature search to identify existing models was conducted in PubMed, International Pharmaceutical Abstract (IPA), Embase, Cumulative Index in Allied Health Literature (CINAHL), and alternate resources from inception to 2013 without success. A Pre-class interactive technology-based "Structure of the Day" activity was created utilizing the Moodle course platform, Accelrys®, and SoftChalk® software. Students identified functional groups on new molecular entities, determined the relationships to pharmacological properties, pharmacokinetic profiles, and their applications to drug formulary management. Application activities via in-class discussions and debate were implemented to assess knowledge, attitude and ability to integrate the basic sciences into a skill-building activity.

Results: The expected outcome was captured through the sequential activities facilitated by an audience response system. The overall results of the study were promising and positive. The assessment on knowledge, ability, skills and attitude ranged from 72% to 95%.

Conclusion: The investigators plan to implement this technique in the curriculum.

Keywords

Structure of the Day, technology, students

Modeling with Medicinal Chemistry: Practical Innovative Technology-based Activity to Enhance Student's Learning Through Inter-Departmental Collaboration: PART I

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Abstract

Background: Concepts of formulary management and its applications in clinical practice is a challenge faced by many first professional year pharmacy students. This challenge may be attributed to a lack of foundational knowledge and practical skills at this level. Preparing students for lifelong learning mandates early exposure to practical application of concepts. This warrants the need for students to integrate knowledge, skills, abilities, and attitudes in clinical practice. As a result, a state-of-the-art one stop shopping structure of the day (SOD) activity was created for P1 pharmacy students to enable the authors to assess their skill sets.

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Conclusion: The investigators plan to implement this technique in the curriculum.

Background

The Accreditation Council for Pharmacy Education standards both in 2007, 2011(revision to 2007) and the new 2016 standards mandate drug or health information concepts in pharmacy education and curriculum.[1,2,3] Many new and established pharmacy programs allow for creativity and innovation regarding how drug information concepts are offered. Many offer standalone courses, some are in combination with research and evidence-based medicine courses, others are in combination with pharmacoeconomics and informatics courses, and yet some programs have incorporated the concepts longitudinally over the whole length of the professional program. Concepts of formulary management is one core area in drug information practice and as such it is taught didactically at various levels and in the practice experience portion of the professional program. Despite the familiarity of the topic, concepts of formulary management and its applications in clinical practice is a challenge faced by many first professional year pharmacy students. This challenge may be attributed to a lack of foundational knowledge and practical skills at this first year level. Law et al confirmed this challenge among their professional year 3 (P3) students and therefore incorporated evidence based medicine in a pharmacoeconomic (PE) course to ease the anxiety.[4] Didactic instruction of drug information concepts utilizing various pedagogical approaches is a very unique teaching strategy in our institution. The offering of a standalone drug information course provides the students a unique opportunity to prepare scientifically sound drug monographs. These monographs are based on new molecular entity drugs approved by the Food and Drug Administration (FDA). To help ease the P1 anxiety of this huge task of preparing a monograph, the authors recognized the need to design the activity differently than that previously required of the students. Comprehensive literature searches to identify existing models were conducted in PubMed, IPA, Embase, CINAHL, and alternate resources from inception to 2013 without success. The authors of this manuscript recognized that Law et al concluded in their study that adding a monograph assignment to the PE course promoted students' interest and added some value to the PE course.[4] Shrader et al found positive impact on students' satisfaction, attitudes, confidence and performance when communication and technology were incorporated into a capstone course.[5] However, none of these studies provided a specific model to help relieve the burden of knowledge and skills disconnect among P1 students and the ability to write a scientifically sound drug monographs. Preparing students for lifelong learning, which mandates early exposure to practical application of concepts, is paramount in graduate and professional programs. This notion therefore warrants the need for students to integrate knowledge, skills, abilities, and attitudes in clinical practice. Through creativity, innovation and pedagogical techniques in our institution, the authors of this manuscript designed an activity to ease the anxiety and enable the professional year 1 (P1) to write a sound drug monograph. The authors also recognized that connecting the dots in drug information, medicinal chemistry, pharmacology, and pharmacokinetics (courses that are concurrently scheduled and taught in the Spring semester) was identified as a creative means to accomplish this goal. A pre-class interactive technology-based "Structure of the Day (SOD)" activity was then created utilizing the Moodle® course management platform, Accelrys® Draw 4.1, and SoftChalk® software. This activity was vertically integrated into the Drug Information Informatics course and the Integrated Medicinal Chemistry and Pharmacology Course. The goal of this project was to take advantage of the concurrent administration of the two courses to enhance students' learning and understanding of new drugs and to enable them apply it to their assignments. The authors hypothesized that if the P1 students were exposed to the new drugs and understood their actions and functions in the Medicinal Chemistry and Pharmacology course, the foundational knowledge gap will be narrowed. And narrowing the gap will hopefully improve students' skills, ability, and attitude towards the assignment and their perception towards the Drug Information course. The objective of this educational research-scholarship of teaching was to assess the impact of this technique on students' ability to integrate science into clinical practice.

Methods

This was a longitudinal cross-sectional pilot study involving an activity and observation that took place in the spring of 2013, from January to the end of April, 2013. The class of 2016, consisting of 55 students was selected for this educational research. Exemption from Cedarville University Institutional Review Board was provided due to the nature of this educational research. On day one in the Drug Information Informatics course, assignment details, rubrics and expectations were discussed with the students. The class was grouped into 13 teams consisting of 4 students per team. Four (4) pathways were developed to accomplish the goal of this study. The pathways were described as "The Stepwise Approach" as outlined below: Student Driven Pathway,

Faculty Driven Pathway, Student-faculty Driven Pathway, and Student Integration and Application Pathway-Figure 1.

Student Driven Pathway:

The study was initiated with the Student Driven Pathway and the students were engaged in activities per the following description.

- Students retrieved new molecular entity (NME) approved drugs within the last year from the date of the assignment. This was done via the Food and Drug Administration (FDA) website.
- A Discussion Forum was created by the course coordinator using the Moodle Course Management Platform. This platform served as a communication medium for the students to share details about their NME drugs. Details shared included drug generic and brand names, approved indication, therapeutic class, approval date, and at least two links to large clinical trials that support the approved indication. Students were given one week to complete the forum discussion among themselves. After the first week, the list of the drugs chosen by the teams of students were compiled.

Faculty Driven Pathway:

The completion of the student-driven pathway paved the way to begin this second pathway.

- The compiled list of drugs was shared with the Medicinal Chemistry and Pharmacology course coordinator. The coordinator then incorporated the in-class discussion into the Medicinal Chemistry and Pharmacology course. The in-class discussion of a NME drug was mapped to the specific scheduled disease state topic areas in the Medicinal Chemistry and Pharmacology course. For example, if the NME drug was a cardiology drug, then the discussion took place when cardiology agents were discussed in the Medicinal Chemistry Pharmacology course. Utilizing a combined technology-based recipe consisting of Accelrys Draw 4.1 software, Moodle Course Management Platform, Audience Response System (Turning Points) and SoftChalk Lesson Builder software, the state-of-the-art SOD activity was created for the students.
- Accelrys Draw was used to redraw each NME drug allowing for flexibility of moving functional groups on the drug structure around to enhance students understanding of the compound. It also demonstrated to students how each component contributes to the various functions including adverse drug reactions and contraindications of the drug.
- The newly drawn compound (NME) was then incorporated into SoftChalk Lesson Builder software. Application activities via in-class polls, discussions, and debates were implemented to assess knowledge, attitude and ability to integrate the basic sciences into skill-building activities.
- Specific questions regarding functional groups leading to the identification of the mechanism of action, drug activity, drug-drug interactions, adverse effects and contraindications just to list a few were incorporated into the interactive lessons. Quizzes were also imbedded as part of this SOD activity in this lesson builder.
- A link to the SOD activity was posted on the Moodle Course Management Platform. Once it was posted, a mass email via a Moodle Announcement forum was sent to all registered students in the Medicinal Chemistry Pharmacology Course. The students were given instructions to self-navigate the activity, move functional groups around and quiz themselves using the questions provided. The same drawn compound was then transferred to a PowerPoint slide using Audience Response System (Turning Point). A day was selected during that specific week when the respective disease state topic area was covered for the SOD discussion.

Student-Faculty Driven Pathway:

This pathway required interaction between students and the faculty in a class-room setting.

- On the day, the SOD slide along with questions was pulled up on a projector in the classroom. The various teams were given about 10-15 minutes to discuss the questions. After that period, the students were given an opportunity to select their answers using the self-identifiable clickers. Using a jeopardy line of questioning style, the floor was opened for any individual or team that was prepared to answer or argue out their choices and the correct responses in a debate-like format. Afterwards, the professor would clear any possible debates and provide rationale for the correct responses.

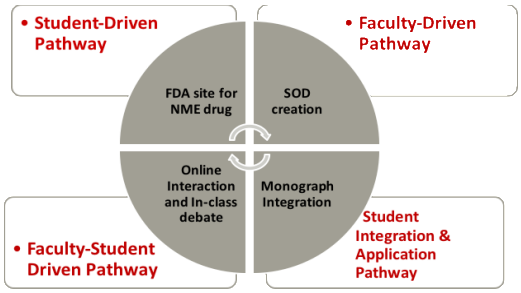
Student Integration and Application Pathway

In this pathway, the take home message for the team that the NME drug belonged to was to take the knowledge acquired from this interactive activity and apply it to the

preparation of their formulary drug monograph in the Drug Information Informatics Course.

Figure 1:

4 Way Pathway Approach:



Assessment and Data Collection

A non-validated 5-question survey was developed by the two course coordinators for Drug Information Informatics and Medicinal Chemistry Pharmacology. The questions measured the students' knowledge, attitude and ability to integrate the basic sciences principles into skill-building activities using the clinical science application activity for the formulary drug monograph. Fifty-five (55) students participated in the polls using the Audience Response System (TurningPoint). This poll was taken on the last day of class in Spring.

Biostatistics

A total of 55 students participated in the survey in a class room setting following a cross-sectional design. The data collected from the survey questions were ordinal data asking the participants to either agree, strongly agree, disagree, or strongly disagree. The authors converted the ordinal data into nominal data resulting in either agree or disagree. Graphical descriptive statistics was used to analyze the data for knowledge, ability, skills, and attitude.

Results

The results are depicted in Figures 2 through 7.

Knowledge

75% of the students agreed that the Structure of the Day (SOD) activity reinforced their knowledge of medicinal chemistry concepts in relation to the relevance in writing new drug monographs (Figure 2).

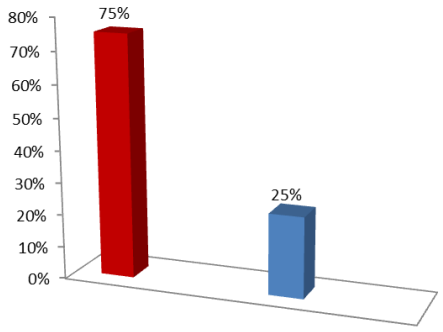


Figure 2

95% agreed that the TurningPoint® questions assessed comprehension of different concepts employed in the SOD exercises (Figure 3).

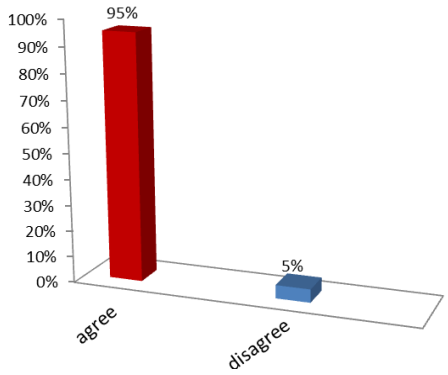


Figure 3

65% indicated that the activity enhanced their knowledge of integrating basic sciences into clinical practice (Figure 4).

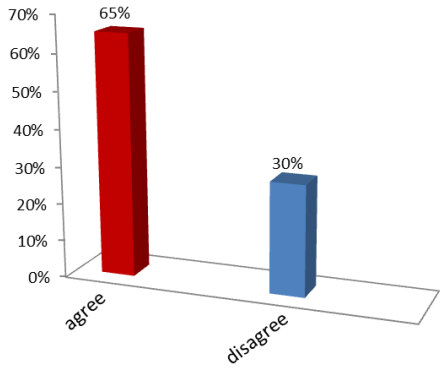


Figure 4

Ability and Skills

72% specified that the activity promoted their critical thinking ability about drug molecules and their functions in the body (Figure 5).

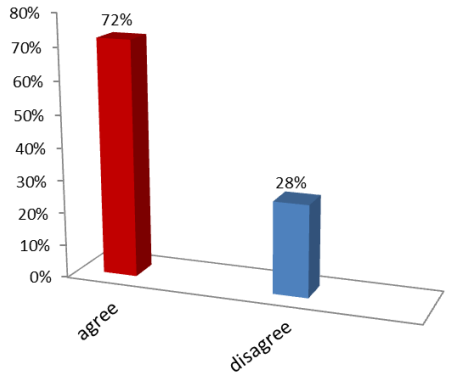


Figure 5

89% agreed that the SoftChalk® activity of SOD promoted mastery of the materials through hands-on practice (Figure 6).

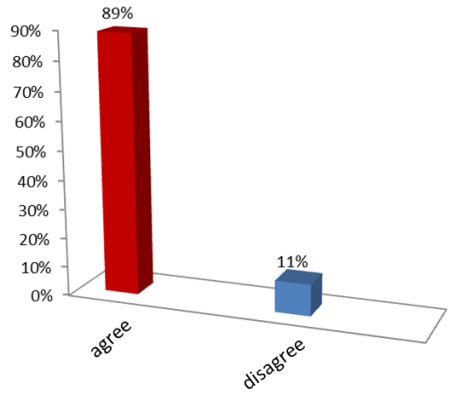


Figure 6

Attitude

50% said that the activity promoted their interests regarding the application of basic science concepts into writing scientifically sound drug monographs (Figure 7).

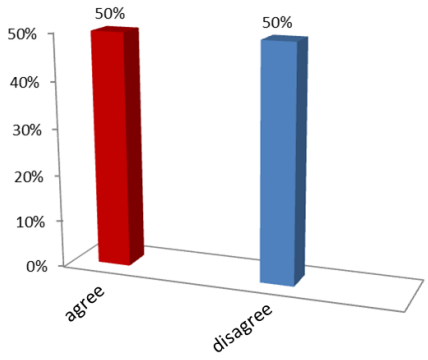


Figure 7

Conclusion

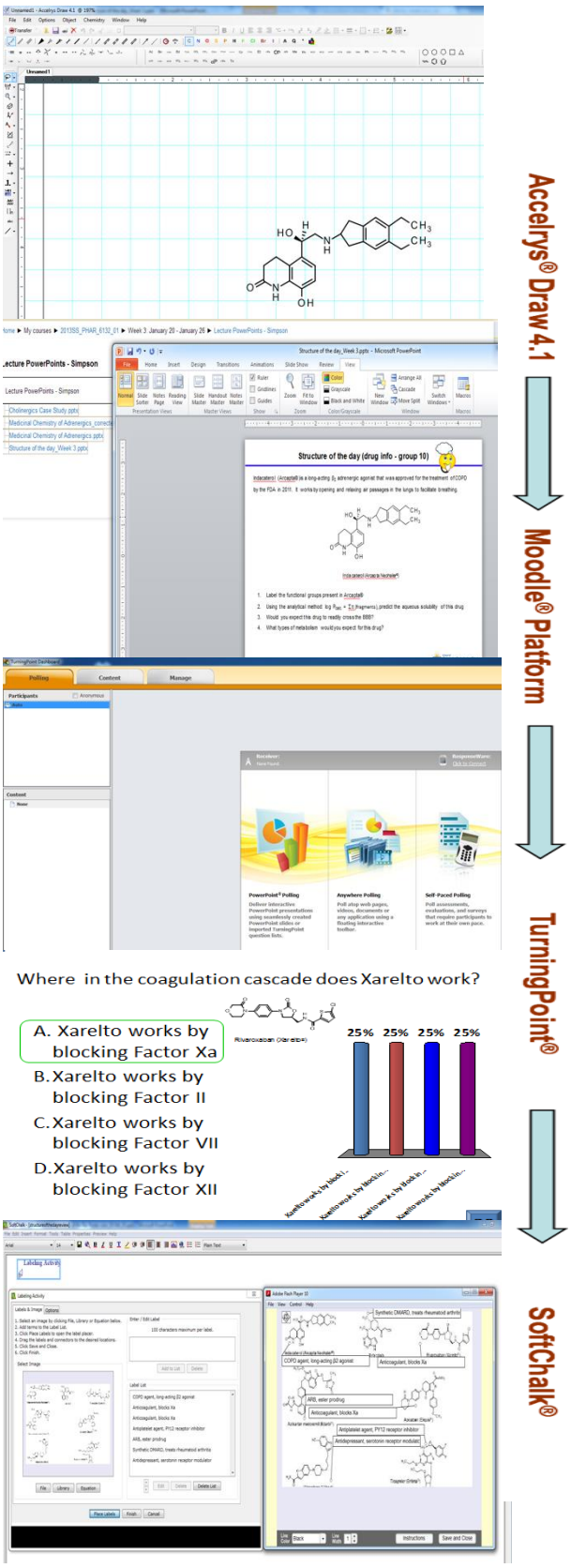
The SOD activity was well-received by the students and enhanced their understanding of medicinal chemistry concepts within a drug formulary management framework. Additionally, it gave the students a better appreciation of the basic sciences courses and their link to clinical practice promoting interdepartmental collaboration. The SOD activity was therefore selected to be incorporated in future pharmaceutical sciences course work. The investigators planned to implement this technique in the curriculum when and where appropriate to enhance knowledge and the ability of students to integrate sciences into practical aspects of the program. It was recommended to expand it to include pharmacokinetic profiles, pharmacogenomics profiles and their applications to drug formulary management.

Pharmacogenomics and pharmacy practice laboratory courses will also be included in this innovative approach within the curriculum.

Discussion

Formulary management is crucial in the professional journey of every clinical pharmacist. Every pharmacist must know how to prepare a drug monograph. As a result, the knowledge of close, open, abbreviated and comprehensive monograph is paramount in the professional development of pharmacy students.[6] To date, there is lack of literature focusing primarily on how to assist P1 students to understand the importance of a highly time-intensive activity such as a drug monograph at their level. This manuscript serves to share the experience with other professors of institutions of higher education. Limitations for this study included incomplete students' participation issue due to a delay in the Audience Response System. Also, only fifty percent of the NME drugs were piloted in the Medicinal Pharmacology Course which impacted the result of students' attitude towards the activity. Lastly, Optional Moodle® Platform exercises for students affected overall participation rate. Part II of this manuscript is under preparation and will be disseminated in the near future.

Figure 8: 4-Step Technology Recipe Approach



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References

1. Accreditation Council for Pharmacy Education 2007, Standard 13, guideline 13.1. Retrieved from https://www.acpe-accredit.org/pdf/s2007guidelines2.0_changesidentifiedinred.pdf. Accessed February 2, 2013.
2. Accreditation Council for Pharmacy Education 2007/2011, Standard 13, guideline 13.1. Retrieved from https://www.acpe-accredit.org/pdf/s2007guidelines2.0_changesidentifiedinred.pdf. Accessed February 2, 2013. Accreditation Council for Pharmacy Education Standards 2016, Standard 13, Appendix 1. Retrieved from https://www.acpe-accredit.org/pdf/s2016guidelines2.0_changesidentifiedinred.pdf. Accessed February 2, 2013.
3. Accreditation Council for Pharmacy Education Standards 2016, Standard 13, Appendix 1. Retrieved from https://www.acpe-accredit.org/pdf/s2016guidelines2.0_changesidentifiedinred.pdf. Accessed February 2, 2013
4. Law AV, Jackevicius CA, Bounthavong M. A monograph assignment as an integrative application of evidence-based medicine and pharmacoeconomic principles. Am J Pharm Educ 2011;10(75):1-5. (Article 1)
5. Shrader S, Kostoff M, Shin T. Using communication technology to enhance interprofessional education simulation. Am J Pharm Edu 2016;80(1):1-7.
6. Malone P, Fagan NL, Malesker MA, Nelson PJ. Drug Formulary Management. In: Malone P, Kier K, Stanovich JE, Molone MJ. Drug Information a guide for pharmacists.5th ed. New York, NY: McGraw Hill, 2014: chap 13.