



## INTERDISCIPLINARY TEACHING IN FLIPPED CLASSROOM STYLE; EFFECTIVENESS IN LEARNING OUTCOME ACHIEVEMENT

Dr. Vinuth D.P<sup>1</sup>, Dr. Poonam Agarwal<sup>2</sup>, Saleh F. Alqifari, PharmD<sup>3</sup>,  
Dr. D.S. Veerabhadra Swamy<sup>4</sup>, Dr. Uppu Praveen<sup>5\*</sup>

### Abstract

**Background:** Medical education in Saudi Arabia is largely based on a dedicated curriculum with minimal interdisciplinary teaching. With the increasing demands of clinical practice, the dentist is expected to have precise competencies to meet the challenges. Interdisciplinary learning is one of the prodigious teaching method to prepare future practitioners.

**Objective:** To identify the effectiveness of Interdisciplinary teaching via adapting Flipped classroom style by comparing the learning outcome results with the previous semester.

**Methods:** A Pre-experimental statistic group comparison study design was used for this study. A total of 28 students enrolled for this study, which were compared to previous batch (Control group of 30) the topics and the content of the course [Dental pharmacology II (PHL 411)] were same as the previous semester. The interdisciplinary team comprised of oral pathologist, clinical pharmacist, and oral diagnosis specialist.

**Results:** Knowledge (K) and Skill (S) domains of learning outcomes were assessed. In the present study percentage of student achievement for K1.1, K1.2 is 78 and 82%. Skill domain were designated as S2.1 and S2.2, the results are 84 and 88%. In comparison to previous semester results; K 1.1, K1.2, 72 and 78 %. S 2.1, S2.2 were 77 and 76%.

**Conclusion:** Blended Interdisciplinary learning course with Flipped classroom teaching strategy can contribute in attaining greater degree of knowledge and cognitive skills. Flipped classroom style teaching can change passive learning into active learning.

**Keywords:** Interdisciplinary teaching, flipped classroom, domains, dental curriculum

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<sup>1,2</sup>Director, BL Family Oro Dental Care, Maddur, Karnataka, India.

<sup>3</sup>Assistant Professor College of Pharmacy - Department of Pharmacy Practice, University of Tabuk, Tabuk, Saudi Arabia

<sup>4</sup>Assistant Professor, Department of Nursing, College of Applied Medical Sciences, University of Bisha, Bisha, Asir Province, Saudi Arabia

<sup>5\*</sup>Associate Professor Sharda School of Nursing Sciences and Research, Sharda University, Greater Noida, Uttar Pradesh, India

**\*Corresponding author:** Dr. Uppu Praveen

\*Associate Professor, Sharda School of Nursing Sciences and Research, Sharda University, Greater Noida, Uttar Pradesh, India.

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## Introduction:

From the beginning of the 20th century, considerable articles were published for reforming dental curriculum (Change et al. 2009; Haden et al. 2010)<sup>1,2</sup>. The Institute of Medicine (IOM) 1995 report stressed the necessity for modernizing dental school courses by eliminating duplication, and implementing integrated curriculum. As per IOM summit 2002: Healthcare personnel are not being sufficiently trained to deliver the highest standard of care, nor is their ongoing competence being sufficiently evaluated. For the twenty-first century the report recommended patient-centered care, working as interdisciplinary teams, evidence-based practice, focus on quality improvement; and utilize information technology<sup>1,3</sup>

The current global dental education curriculum is based on problem-based learning (PBL), competency-based learning (CBL), case-reinforced learning, and evidence-based practice, as well as intended learning outcomes (ILO) and outcome-based education (OBE). The American Dental Education Association Commission on Change and Innovation in Dental Education (ADEA CCI) started implementing curricular changes to achieve better learning outcomes based on research evidence (Elangovan et al. 2016)<sup>4</sup>. Despite efforts to modify the curriculum, the majority of graduate education is still given in a passive learning environment with a high intellectual workload. As a result, the stakeholders have limited time to comprehend the material covered in numerous back-to-back sessions (Elangovan et al. 2016)<sup>4</sup>. Academic dental faculty were attempting to close the gap between fundamental biomedical concepts and clinical training by incorporating community-based patient care and small group discussions of patients' care scenarios into the dental curriculum in recognition of the need for reform and an effort to achieve comprehensive learning outcomes<sup>2,5</sup>.

In American dental schools, integrated curricula or integrated interprofessional curricula have been developed and tested<sup>6</sup>. "Interdisciplinary education" is an educational process that gives students in the health professions "experience across professional disciplinary lines as they acquire knowledge and skills in subject areas required in their respective educational programmes"<sup>7</sup>.

The Commission on Dental Accreditation (CODA), which is the governing organization for dental education, oversees dental programmes in the United States. Standards and practices for accreditation and quality assurance in Saudi Arabia are decided upon by the National Commission for Academic Accreditation and Evaluation

(NCAAA)<sup>8</sup>. The NCAAA is an authority of all educational programmes and institutions of higher learning. This helps to assure quality and quality assurance across the board in academics, by specific emphasis on dentistry education. Additionally, the NCAAA mandates that universities seeking accreditation or reaccreditation form partnerships with other organizations in fields including training and research. NCAAA requirements, at the moment, does not offer guidance nor requires an integrated curriculum (NCAAA)<sup>9</sup>.

Medical education in the kingdom of Saudi Arabia is mostly based on specialized curriculum structures with little interdisciplinary training. Academicians and curriculum designers are advised to adopt cutting-edge teaching and learning innovations in order to enhance the outcomes of medical education. Interdisciplinary education seems to be a useful teaching strategy to get future practitioners ready for working in teams, especially with the growing requirement for team players in the healthcare system<sup>4</sup>. It promotes fresh perspectives and aids students in connecting disparate pieces of knowledge. Higher accomplishment in the interpersonal/values domain of learning, coupled with cognitive abilities like problem-solving and critical thinking, is a result of interdisciplinary education<sup>6,10</sup>.

College of Dentistry and Pharmacy at Buraydah private colleges is an NCAAA institute accredited college situated in the central province of KSA. Here in the graduate program, a course of Bachelor of Dental Surgery is offered, which is an ILO based curriculum. This study was designed with introducing a blended interdisciplinary pharmacotherapy topics with traditional didactic lectures in Dental pharmacology II (PHL 411) course. The interdisciplinary team comprised of oral pathologist, clinical pharmacist, and oral diagnosis specialist.

For interdisciplinary learning, Flipped classroom style was utilized where students were given the topics and suggested reading materials one week prior to the session time. The principal objective for opting flipped classroom is to shift the learning from teacher centric model to learner-centered approach and inculcating collaborative learning<sup>11</sup>.

The aim of this paper is to compare the present semester (code 402) percentage of student achievement criteria in PHL 411 course to previous semester (code 401). During the beginning of the each session, students gave feedback about the assigned topic, followed by a detailed discussion of simulated case scenarios, presentations and recent updates with clinical situations. To conclude each session, integration

and implementation of basic concepts to clinical situation, radical approach in treatment and follow-up of patients were stressed. These messages revolved around the most critical points of a given topic for future practitioners.

### Objective:

To identify the Effectiveness of Interdisciplinary teaching via adapting Flipped classroom style by comparing the learning outcome results with the previous semester.

### Materials & Methods:

#### Research design:

A Pre-experimental statistic group comparison study design was used for this study. Sample: A total of 28 students enrolled for this study, which were compared to previous batch (Control group of 30) the topics and the content of the course were same as the previous semester. Tools & techniques: The following instruments were used

for the collection of data: Tool 1-Demographic Proforma: Tool II: GPA Scores.

PHL 411 is a semester course with one credit hour studied in 6<sup>th</sup> year of the curriculum. Topics were segregated into traditional didactic lectures and interdisciplinary learning; which focused on contemporary pharmacotherapy related topics in dental practice. This later section of topic selection was based on the commonly encountered clinical cases at the college's teaching clinics for which a Pharmacotherapeutic intervention was needed in comprehensive management of oral medicine (MDS441) and comprehensive clinical dentistry (DEN491). Interdisciplinary learning topics included were; clinical implications and management of anticoagulation drug therapy in dental practice, Medical Management of orofacial pain in dental practice, Pharmacotherapy considerations for special populations (pregnancy, pediatrics, and geriatrics) in dental clinic etc. (Table 1)

**Table 1** –Interdisciplinary teaching through flipped classroom learning

Topics	Activity	Contact hours
Clinical implication and management of anticoagulation drug therapy in dental practice	Case presentation, case scenario and group discussion	1
Clinical implication and management of antiplatelet drug therapy in dental practice	Lecture cum Group discussion and Journal club	1
Medical Management of orofacial pain in dental practice	Assigned reading, group discussion and case study	1
Clinical practice and prescribing antibiotics in dental practice	Journal club and Group discussion	1
Clinical implications of nonsteroidal anti-inflammatory drugs (NSAIDs) drug therapy in dental practice	Group discussion and preparing drug book	1
Pharmacotherapy considerations for special populations (pregnancy, pediatrics, geriatrics) in dental clinic	Group discussion	1
Review of resources and interpretation of drug information	Group discussion and Journal club	1

Both formative and summative assessments were included according to the detailed course policy. The percentage of student achievement criteria were compared with the previous semester, the course topics and assessments methods were same in both the semester but didactic lectures was the only teaching strategy applied in previous semester.

### Results:

Knowledge (K) and skills(S) domains of ILO were assessed for the PHL 411 course. Direct assessment sheet reflected the student achievement criteria for each intended learning outcome (402) and it was compared to previous semester (401). Descriptive data of student achievement for each ILO were presented in Table 2.

**Table 2:** Comparison of the present semester (code 402) percentage of student achievement criteria in PHL 411 course to previous semester (code 401).

Semester	n	K1.1	K1.2	S2.1	S2.2
402(PRESENT)	28	78%	82%	84%	88%
401(PREVIOUS)	30	72%	78%	77%	76%

### Discussion:

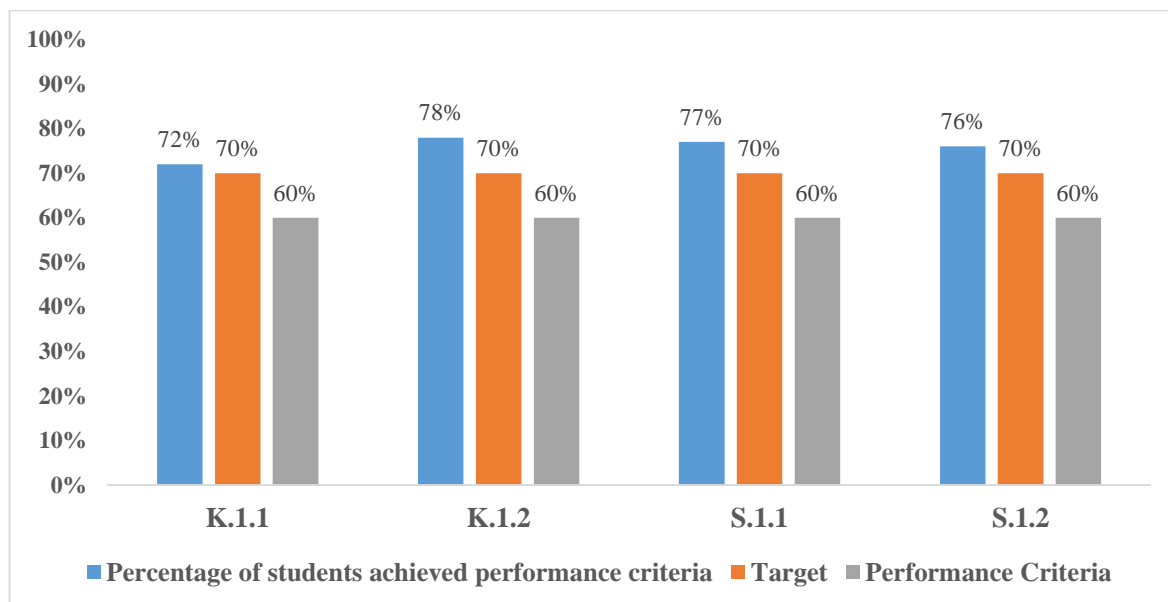
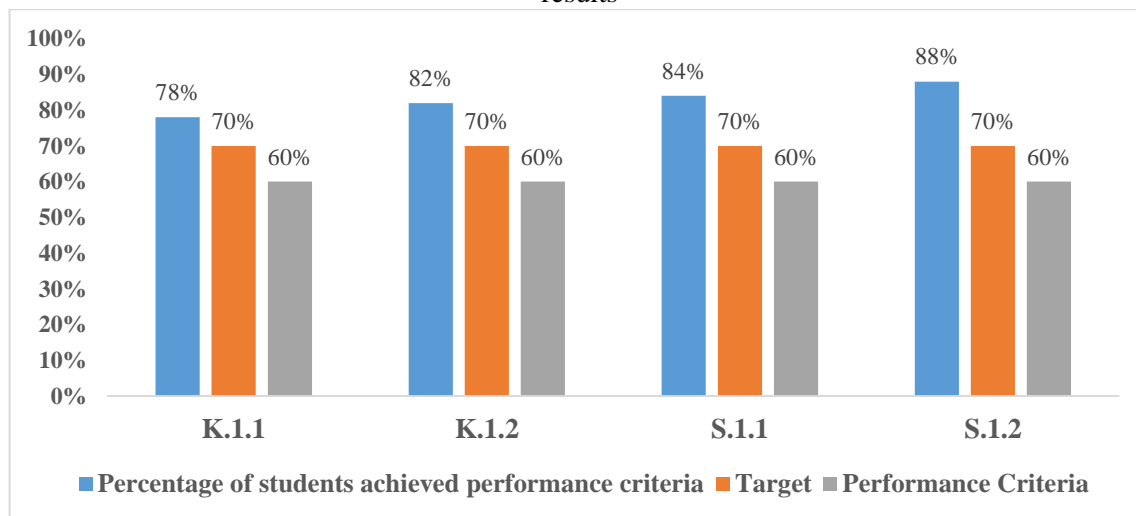
We are rendering ILO based curriculum with Knowledge (K), skills(S), values (V) domains, in this study we didn't measure the value domain because it was not included in CLO. The learning outcomes were designed according to the NCAAA framework at the department council level and

approved by the program council. Performance criteria was the minimum achievable grade to declare as passing, which is 60%. Target is the internal benchmark set according to year in which course is offered, for the PHL 411 the set target criteria is 70%. In the present study percentage of student achievement for K1.1, K1.2 is 78 and 82%.

Skill domain were designated as S2.1 and S2.2, the results are 84 and 88%. In comparison to previous

semester results; K 1.1, K1.2, 72 and 78 %. S 2.1, S2.2 were 77 and 76%. (Figure 1 and 2).

**Figure 1.** Graphs showing student achievement performance criteria for each ILO's 402 semester (current) results



**Figure 2.** Graphs showing student achievement performance criteria for each ILO's 401 semester (Previous) results

Our experience are in accordance with the studies of Yilmaz et al<sup>12</sup> and Yang et al<sup>13</sup> which inferred that better student performance were attained in implementing interdisciplinary learning strategies. The greater student achievement in the present study could be attributed to multiple factors such as designing interdisciplinary topics, flipped classroom teaching strategy and also co-teaching. Zhao R et al<sup>14</sup> emphasized on co-teaching, biochemistry and clinical sciences were co-delivered by Oral biologist, biochemistry faculty and the students learning experience were enhanced. The recent study by Mussalo et al<sup>15</sup> stressed biomedical sciences topics should be meaningfully integrated into the clinical phase of

dentistry. Blended way of learning i.e. Didactic lectures, interdisciplinary topics and flipped classroom teaching had synergistic effect in achieving enhanced student results. Kavarella A et al<sup>16</sup> studied student evaluation on blended learning course in oral radiology, students attitudes towards blended courses were positive, promotes active engagement and was helpful in summarizing the subject and clarifying difficult issues.

We tried to incorporate novel approach in teaching style for this particular course. The reasons to choose Flipped class room teaching for interdisciplinary topics were; stakeholders were in final year of the program and active participation which included pre-classroom preparations and

collaborative team work could be enthusiastically delivered, also the interdisciplinary team comprised from various specialties where sharing of the resources materials with the peer and stakeholders would be clear and effective. Flipped classroom teaching style is effectively adapted to dental curriculum from many years Vanka et al and Bohaty BS et al<sup>16,17</sup> concluded from their study, that the student learning outcomes (course grades) improved in pediatric dentistry course with the flipped classroom design. Bizhang et al<sup>18</sup> in Herdecke University Germany observed that, 94% of dental students preferred to study in flipped classroom style in caries diagnosis course of undergraduate curriculum. Also, active learning strategies such as flipped classroom learning style promotes higher order Bloom's taxonomy and cognitive thinking modalities<sup>11</sup>. From the current study experience, flipped classroom teaching will be effective if implemented in higher levels of the program, where stakeholders can contribute effectively to the learner centered loop and the rapport with the peer groups will be healthier to contribute in presentations and group discussions. These kind of newer approaches in teaching can shift the passive, teacher centered learning experience into active student centered.

### Conclusion:

Interdisciplinary courses enhance comprehension and application of learned concepts. The gaps in connecting the loops of knowledge, cognitive and psychomotor skills can be achieved by collaborative courses. Designing the dentistry curriculum with Multidisciplinary or interdisciplinary courses with blended teaching and learning strategies will shift the paradigm from passive to active learning. Flipped classroom style is a promising tool for learner centered approach. Based on numerous stakeholder's feedback, educators observed a struggle from students in bridging the cognitive and psychomotor skills in PBL assessments, clinical practice. Pharmacotherapeutic interventions were the sought after topic, hence this interdisciplinary teaching and learning strategy was designed. Other Teaching and assessment strategies and curriculum deficiencies were also identified, and were put into a plan for the future. Globally dentistry curriculum is undergoing a prompt transformation. Interdisciplinary learning and curriculum have given a positive impact in building the cognitive and psychomotor skills.

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