

Gap Design as a New Tool for Learning and Assessment

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Abstract

The attempt was to stimulate positive provocation in learners to think and create alternative approaches to deal with real-life problems. The study involved learners of the end second-semester of the Master in Hospital Administration program. The research problem was to analyze the gaps in that program's curriculum and the competencies of faculty as per the contemporary requirements. Based on an extensive investigation on student-centered learning and the framework method of qualitative analysis a code matrix for gap design was done. It was found that our gap design method qualified as an effective and innovative teaching-learning tool. It stimulated multi-disciplinary insights, joyful learning, and intellectual exchanges. The process involved a curated flipped classroom design with 40 students in 9 groups. Each group was assigned a faculty mentor and a unique industry problem based on field survey and validation. The final assessment of group projects provided the basis of gap analysis in learning and teaching. A prototype gap design tool called 'assessmend' was conceptualized and deployed over the internet for feedback and practice on continuous improvement on learner engagement and curriculum update using the tool got implemented.

Keywords: Pedagogy, Higher Education, Framework Method, Problem-Based Learning, Capstone Project, Flip Learning, Gap Design

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Introduction

The Problem

The end-semester assessment tasks and the rubric of the evaluation were not something that learners were self-motivated to look forward to. Rather, they took it as part of compliance for receiving their grades and for moving on to the next semester. On the other side, teachers continued with their previous practices of evaluation. In our study case with the Master of Hospital Administration program in our University, it was found that the teaching-learning curriculum has been very slow in responding to the changing industry demands and the emerging skills, and smart healthcare technologies. As a result of which both learners and teachers are unable to update themselves to the new realities. Given that situation, the research questions were, how to bring more purpose and joy in the teaching, learning, and assessment? and thereby, not only provisioning more student-centered fluidity in syllabi but also applying the high order thinking skills for problem-solving.

Study on the Need for Student-Centered Models

A crucial task was to provide innovative education for students who would enter the labor market in the future. Higher education has to raise its competitiveness and promote the development of society in the long term (Crosling et.al, 2015). The need was for flexible, effective, active, and student-centered teaching (Nouri, 2016). Else, it was increasingly difficult for students to fully engage in educational practices, which led to a superficial understanding of disciplinary knowledge (Guo, 2020; Briggs, 1979; Gagne & Driscoll, 1988). Besides, universities, and research universities, in particular, were more focused on the cultivation of students' research skills rather than professional skills or transferable skills. It resulted in the widening of the gap between what students learn at the university and what they need in the workplace (Holmes, 2012). To change that situation, project-based learning was an attractive proposition (Chen & Yang, 2019) to address the need for real problem-solving and knowledge construction in authentic professional contexts. Besides, fostering students' innovation by supporting their autonomy during learning tasks (Martín et.al., 2017). There were differences between project and problem based learning in terms of the different types of tasks and role of the instructor that would be required. For example, the former, dealt with the application of knowledge, the latter, with the construction of knowledge (Braßler, 2016; Helle, 2006).

Study on Inquiry-Based Learning

In light of our problem, various learning theories and methods of teaching that showed positive results were studied. The inquiry was described as a teaching method that combined student-centered, hands-on activities with discovery (Uno, 1990). Furthermore, it was found that students' attitudes changed after using the inquiry learning model (Suwondo & Wulandari, 2013). Importantly, the educator acted as a facilitator of the learning activity, promoting student discussion and providing guidance rather than directing the activity (Herron, 2009; Uno, 1990; Wood, 2009). Based on the principles of the scientific method, in inquiry-based learning students observed a phenomenon, synthesized research questions, tested their questions in a repeatable manner, and finally analyzed and communicated their findings (Uno, 1990;

Weaver et.al., 2008). And, many different roles of a teacher were the means to achieve the desired learning outcomes (Strauch, 2014). The emphasis on knowledge-in-use showed an increased awareness by educators, learning scientists, policymakers, and the public of the facilities required by global citizens in the 21st-Century (Miller, 2019). Various literature studied around that concept (NRC, 2012; NRC, 2007; Kulgemeyer, 2014; PISA, 2014; OECD, 2016, Blanchette, 2010, Peterson, 2009, Chen, 2011, Sharan, 2010, Illeris, 2000) revealed how students were able to work with authentic problems, data synthesis, evaluation and development of solutions under curated learning environments. It was found that inquiry-based promoted deeper learning. Such design-based research methods (Barab & Squire, 2004) were able to test the curricular system materials (Sandoval, 2014). The learners were interested to pick complex problems (Schneider et al., 2016) and it was found that they were motivated to sustain their investigations throughout their period of study and emanated new insights (Krajcik & Czerniak, 2018). A high level of student satisfaction and a significant improvement in student learning outcomes were found under the project and problem-based activities, where learning was directed by the student with the educator providing a supportive role (Smallhorn et.al, 2015). The level of input from the educator depended on the level of inquiry. Building friendships with peers facilitated a sense of belonging which improved engagement and contributed to better learning outcomes and increased retention (Larmar & Ingamells, 2010; Lowe & Cook, 2003) while responding to real-world questions or challenges through an extended inquiry process.

Study on Affecting Factors

One of the affecting factors for low learning outcomes was found to be the learning models (Andrini, 2016) that were responsible for student's lack of motivation for inquiries. Such models affected the emotional and intellectual abilities of students in acquiring knowledge and impaired the purpose of education to choose and determine methods of teaching or to provide a conducive learning environment. The 21st-century learners require to survive and compete in the global community, therefore, education should not adversely affect critical thinking, effective communication, technology-readiness, fluidity, open learning environment, and innovation (Suto, 2013). Rather, learners have to be allowed to hone their skills and knowledge as per their choices (Trna, et.al., 2012). On the flip side, the use of inquiry learning methods affected the monopoly of teachers (Sund & Trowbridge, 1973).

Study on Flipped Learning

The flipped classroom was defined as a “pedagogical approach, in which, direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter” (The Flipped Learning Network, 2014). Flipped Learning allowed for a variety of learning modes; educators often physically rearranged their learning spaces to accommodate a lesson or unit, to support either group work or independent study. They created flexible spaces in which students chose when and where they learn. Flipped Learning model deliberately shifted instruction to a learner-centered approach, where in-class time was dedicated to exploring topics in greater depth and creating rich learning opportunities (Bergmann

& Sams, 2012; Dunn, 2014). Moreover, the model allowed students to learn at their own pace, it encouraged students to actively engage with lecture material, and teachers got expanded opportunities to interact (Gilboy, 2015; Betihavas, 2015). Its flexible and blended student-centered learning strategies mitigated the limitations of the transmittal model of education (Betihavas et. al, 2015) and addressed several challenges of traditional ways of teaching with active learning strategies employing higher levels of Bloom's taxonomy (Krathwohl, 2002). For instance, (McLaughlin, 2013; Davies, 2013) compared three different instructional strategies in an information systems spreadsheet course, and showed that students attending the flipped classroom course also were more satisfied with the learning environment compared to the other treatment groups. Several studies reported that students enjoyed learning at their own pace and preferred flipped classrooms over traditional approaches (Larson & Yamamoto, 2013; McLaughlin, 2014; Gilboy, 2015). As a result, students were found to be actively involved in exploring new learning beyond the curriculum.

Methodology

Step 1

The environment for problem-based learning using a flipped classroom model was designed. 40 students of Master of Hospital Administration of end second-semester of 2018-20 batch were put in 9 groups, where each group had a mix of high, medium, and low-grade achievers. Each such group was assigned problem areas and was guided and tasked to obtain problems from industries relevant to their assigned problem areas. Each group had one faculty mentor for proper elucidation and validation of the problem. This step got completed in 45 days. The mentors facilitated their respective groups to acquire knowledge, skills, and data relevant to solving the problems.

Step 2

3-day flip classroom activity was conducted. For that, a big hall was specially arranged for group-activity with provisioning of all requisite infrastructure support along with food and refreshments for all the 3 days of problem-solving activity. The faculty mentors and other faculty members were only allowed to visit during the stipulated zero-hours to interact with groups. The groups were mandated to work on all possible alternative approaches towards solving their problems within the 3 days, similar to a hackathon event.

Step 3

Evaluation and feedback of group-wise presentations were held. The evaluation board comprised groups' faculty mentors and representatives from healthcare institutions from where the problems were sourced. Based on an agreed rubric the final scores were assigned to the groups that indicated the extent of - critical thinking, out-of-box ideas, innovation, the feasibility of solution approach, reasoning, and the quality of presentation. Finally, as per the given template, the groups submitted their reports

with needful omission and commission along with their feedback that helped us to measure the outcome.

Step 4

The above activities were documented as a video for later analysis of group-learning behavior and its customized replication and use by our other departments. A short educational video was also made available on YouTube (iSoOeCWEaGA) in that regard.

Step 5

Gap design in learning and teaching was done using the ‘theme-category-code-description-label’ framework method for qualitative analysis (Gale et.al., 2013). The body of knowledge in and around the semester courses was framed under a category-code-description structure. All the codes were labeled corresponding to the applicable Bloom’s taxonomy levels (Anderson et.al., 2001) that included the curriculum and outside the curriculum codes, which were used for solving the problem, referred to in our framework as the theme. (see Appendices). Finally, the mapping of the codes was done under each of the themes as tabulated under (Table 1). It was required to understand the efficacy of teaching-learning for solving the real problems.

RESULTS

The results showed the use of codes for solving the problems, T1-9 (Table 1), and the relative use of code-clusters (Figure 1). Moreover, the scores obtained for each group were beyond our expectations.

Table 1: Code-Label Mapping with Theme

Theme (T1-T9)	Code-Label Mapping	Score %age
Medical Equipment Marketing (X-Ray Machine)	SP02, SP06, HP01, HP05, HP12, HP15, MM02, MM04, MM05, MM07, MM10, RM01, RM02, RM03, RM04, RM05, RM06, RM07, RM08, RM10, IS01, IS08	71.3
Health Care Education	SP01, SP02, SP03, SP04, HP14, HP15, HP21, HP22, OT01, S09, IS10, QM02, QM05, RM01, RM02, RM03, RM04, RM05, RM06, RM07, RM08, RM10	88.7
Financial Allocation & Utilization in a Government Hospital	SP03, SP04, HP02, HP04, HP07, HP08, HP11, HP14, HP16, HP17, HP19, OT02, RM01, RM02, RM03, RM04, RM05, RM06, RM07, RM08, RM10, IS03, IS04	87.5
Bio-Medical Waste-Handling and Disposal in a Private Hospital	SP02, SP03, SP04, SP16, SP17, SP18, SP19, SP20, SP21, SP22, SP23, MM03, QM02, QM06, HP14, P15, HP18, HP19, HP21, RM01, RM02, RM03, RM04, RM05, RM06, RM07, RM08, RM10, IS04	87.1
Procurement Management of Medicine in a Super-speciality Government Hospital	SP01, SP02, SP03, SP05, SP06, SP08, SP09, SP12, SP13, SP14, MM03, MM04, MM05, MM06, MM07, MM09, MM10, HP06, HP07, HP08, HP12, HP18, HP21, HP23, RM01, RM02, RM03, RM04, RM05, RM06, RM07, RM08, RM10, IS04	87.3

A Project Report on Bio-Medical Waste Related Challenges at a Government Hospital	SP02, SP03, SP04, SP16, SP17, SP18, SP19, SP20, SP21, SP22, SP23, MM03, QM02, QM06, HP14, HP15, HP18, HP19, HP21, RM01, RM02, RM03 RM04, RM05, RM06, RM07, RM08, RM10, IS04	87.2
Ward Management of a Community Health Centre	SP01, SP02, SP03, SP04, SP09, SP13, SP14, SP20, MM02, MM04, MM09, QM01, HP03, HP04, HP06 HP07, HP08, HP13, HP15, HP18, HP19, HP21, HP23, OT02, OT03, OT04, OT05, OT06, RM01, RM02, RM03, RM04, RM05, RM06, RM07, RM08, RM10, IS09, IS10	85.3
Ambulance Service - An Attempt for Betterment	SP01, SP02, SP09, SP13, SP14, MM03, QM03, QM06, HP01, HP02, HP18, HP21, IS04, IS09, IS10, RM01, RM02, RM03, RM04, RM05, RM06, RM07, RM08, RM10	89.2
Child Marriage and Early Pregnancy- A barrier to Maternal Health	SP01, SP02, SP03, SP04, SP09, QM01, HP04, HP15, HP18, HP21, OT01, OT03, OT04, OT05, OT06, OT08, OT09, RM01, RM02, RM03, RM04, RM05, RM06, RM07, RM08, RM10, IS09, IS10	88.6

The codes marked in color (Table 1) highlighted that students had employed concepts beyond their taught lessons. As a result of which the motivation for our healthcare management teachers was for additional learning of new codes CI01-15 (see Appendices) to direct their teaching around real problems.

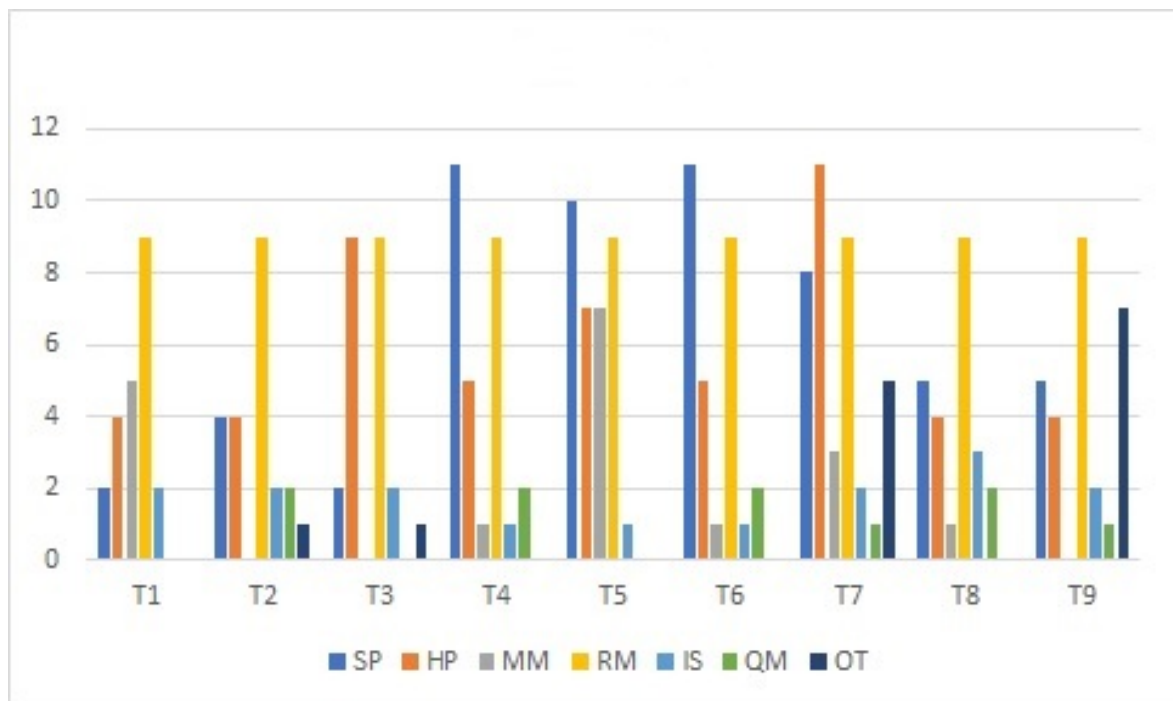


Figure 1: Theme-Wise Use of Learning

The above figure depicted the extent of use of the second semester's taught courses – SP (Hospital Support Services), HP (Hospital Planning), MM (Materials Management), RM (Research Methodology & Quantitative Methods), IS (Health Management Information System), QM (Quality Management) and also the involvement of OT (Others) concepts beyond those (see Appendices). The following tables (Table 2 and Table 3) were the self-assessed results on faculty competency gaps

on OT codes and their 6 chosen competencies, from CI01-15, for improved teaching and continuous curriculum update

Table 2: Mentor-Assessed Competency-Gap on a Scale of 3 on OT Codes

Faculty Mentor	OT01	OT02	OT03	OT04	OT05	OT06	OT07	OT08	OT09	Net Score
1	2:3	1:3	3:3	3:3	3:3	3:3	2:3	2:3	2:3	2.33
2	2:3	1:3	3:3	3:3	3:3	3:3	2:3	3:3	3:3	2.56
3	3:3	2:3	2:3	2:3	2:3	2:3	2:3	2:3	2:3	2.11
4	3:3	1:3	3:3	3:3	2:3	3:3	3:3	1:3	3:3	2.44
5	2:3	1:3	2:3	1:3	2:3	2:3	2:3	2:3	2:3	1.78

Table 3: Mentor-Assessed Competency-Gap on a Scale of 3 on CI Codes

Faculty Mentor	6 Required Competencies Chosen from CI01-15 codes						Net Score
1	CI01	CI02	CI03	CI06	CI08	CI15	1.25
	1:3	2:3	1:3	1.5:3	1:3	1:3	
2	CI01	CI04	CI05	CI06	CI07	CI15	1.41
	1:3	2:3	2.5:3	1:3	1:3	1:3	
3	CI05	CI08	CI09	CI10	CI12	CI15	1.16
	1:3	1:3	1:3	2:3	1:3	1:3	
4	CI01	CI05	CI11	CI12	CI14	CI15	1.66
	1:3	2.5:3	1:3	2:3	2:3	1.5:3	
5	CI04	CI08	CI12	CI13	CI14	CI15	1.16
	2:3	1:3	1:3	1.5:3	1:3	0.5:3	

Conclusions and Discussion

Our research was able to validate the findings of the literature studied and was able to answer the research questions. We inferred that our gap design model would contribute to the widening and deepening of learning in higher education. The learners will be able to joyfully relate with not only the taught knowledge and skills but also be able to explore new knowledge and skills while in the proposed model's process of designing solutions for real-life problems related to their program of study. It will lead to useful insights to continuously update, especially the professional program's curriculum in line with the contemporary requirements, and thereby pave the way for multi-disciplinary learning. The only limitation of the said model will be that it will erode a lot of time from the end-semester routine classes to devote to fieldwork and might hamper the completion of taught lessons on time. However, with the inclusion of digital space, faculty members can take their classes online and learners can even go through their missed lessons in an asynchronous mode. That way, no learner will be left out.

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Appendices

The Code Glossary

Appendix A

Label	Code	Bloom's Level
A.	CURRICULAR COVERAGE	
SP01	Health Care Process	L2-L5
SP02	Services in a Hospital	L2-L4
SP03	Components of Hospital	L2-L4
SP04	Classification of Hospitals	L1-L5
SP05	Clinical Laboratory	L1-L2
SP06	Diagnostic Radiology	L1-L2
SP07	Hospital Laundry	L2
SP08	Central Sterilization and Supply Department	L2
SP09	Safety & Security	L2
SP10	Blood Transfusion Centre and Blood Bank	L1-L2
SP11	Nursing Service Administration	L2
SP12	Medical Records Department	L2-L3
SP13	Outpatient Services	L2
SP14	Day Care Services	L2
SP15	Food Services Department	L2
SP16	Bio-Medical Waste Management	L2-L4
SP17	Medical Waste	L2
SP18	Waste Treatment Process Categories	L2
SP19	Hazard associated with poor Hospital Waste Management	L2-L3
SP20	Survey of BMW	L2-L4
SP21	Types of costs involved in BMW	L2-L3
SP22	Waste Team Training	L2-L3
SP23	BMW(Management & Handling)	L2-L5
MM01	Material Forecasting	L2-L3
MM02	Material Requirement Planning and budgeting and controlling	L2-L3
MM03	Logistics	L2
MM04	Purchase Cycle	L2
MM05	Inventory	L2
MM06	EOQ Model	L4
MM07	Vendor Management	L2-L4
MM08	Law of Contracts	L2
MM09	Storage and Stores Accounting	L1-L2
MM10	Inspection & Quality Control	L4
QM01	Quality Manual	L2-L3
QM02	Medical Audits	L2-L4
QM03	Quality Assessment	L2-L3
QM04	Quality Assurance	L2-L4
QM05	Techniques and tools in Quality Management	L2-L3
QM06	Assurance Procedures- Demming's Principle, Juran's Trilogy, Kaizen, Philip Crosby,s Principles, Quality Circle-	L2-L3
HP01	Demand Estimation- Hospital Equipment Planning	L2-L3
HP02	Utilization Index	L2-L3
HP03	Listing of common medical equipment used in hospital	L3-L5
HP04	Selection Guidelines cost and quality control planning	L2-L4

HP05	Tendering	L2
HP06	Procurement	L2
HP07	Method of payment	L2
HP08	Letter of credit	L2
HP09	Import documentation	L2
HP10	Buyback Policies	L2
HP11	Profit Projection	L2-L4
HP12	Codification and classification of equipment	L2-L4
HP13	Occupancy and bed ratios	L3-L5
HP14	Hospital Construction	L2
HP15	Regionalization	L2
HP16	Size of the site selection	L2
HP17	Preparing project report	L2-L3
HP18	Medical ethics	L2-L4
HP19	Hospital accreditation	L2-L5
HP20	Accreditation standards for extended care facilities	L2-L4
HP21	Infection Control	L2
HP22	Mortuary Services	L2
HP23	Manpower Planning	L2-L4
IS01	E-commerce/E-business	L2
IS02	Decision Support system	L2
IS03	Basics of Commercial Software like SAP, Oracle Apps	L2
IS04	Database Management System	L2-L3
IS05	Data Warehousing and Data Mining	L2
IS06	Multidimensional Modeling	L2
IS07	Online Analytical Process	L2
IS08	Online Transaction Processing	L2
IS09	Health Information Management	L2-L4
IS10	Health System Research	L2-L4
RM01	Methodology	L2-L4
RM02	Research Problems	L2-L4
RM03	Literature Review	L2-L4
RM04	Research Design	L4-L6
RM05	Sampling Fundamentals	L2-L4
RM06	Measurement and Scaling Techniques	L2-L4
RM07	Methods of Data Collection	L2-L4
RM08	Processing and Analysis of Data	L2-L3
RM09	Testing tools/criteria	L3-L5
RM10	Concept of Statistics	L2-L5

Appendix B

B.	OUTSIDE CURRICULAR COVERAGE – GAP 1 (Curricular Learning)	
OT01	HealthCare Education System	L2-L4
OT02	Financial System	L2-L4
OT03	Community Health Centre(CHC)	L2-L4
OT04	CHC Staffing Issues	L2-L4
OT05	CHC Problems	L2-L4
OT06	CHC Patient Issues	L2-L4
OT07	Ambulance Service	L2-L4
OT08	Child Marriage	L2
OT09	Early Pregnancy	L2

Appendix C

C	OUTSIDE TAUGHT COMPETENCIES – GAP 2 (Curricular Teaching)	
CI01	Big Data Analytics	L1-L2
CI02	Media Management	L1-L2
CI03	Behavioral Psychology	L1-L2
CI04	Public Health	L1-L3
CI05	Quality Standards	L4-L6
CI06	Digital Communication	L3-L6
CI07	Consumer Psychology	L3-L5
CI08	Health Care Automation	L2-L4
CI09	Hospital Architecture Software	L2-L4
CI10	Problem-Based Inquiry	L4-L6
CI11	Referral Services	L2-L4
CI12	AI, Expert Systems, Telemedicine and associated for Digital Healthcare	L1-L4
CI13	Healthcare Insurance and Security	L2-L3
CI14	Advanced Research Methods	L3-L5
CI15	Sustainable Development and Goals (Focus on SDG 3)	L1-L5

Appendix D: INDEX

Label	Subject Area Category	Bloom's Level No.	Learning Level
SP	Hospital Support Services	1	Remembering
MM	Materials Management	2	Understanding
QM	Quality Management	3	Applying
HP	Hospital Planning	4	Analyzing
IS	Healthcare Management Information System	5	Evaluating
RM	Research Methodology & Quantitative Methods	6	Creating
OT	Others (Gap in taught lessons)		
CI	Competency (Gap in teachers)		

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