CASE STUDY

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Experiential learning in clinical pathology using Design Thinking Skills (DTS) approach

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I. INTRODUCTION

Twenty first century learning requires analytical thinking and problem solving; hence, medical educators must design suitable model to prepare learners for challenges in future. Medical teaching and learning are moving towards this direction and use of technology in education is embedded in the process. The role of laboratory testing in patients care is recognised as a critical component of modern medical care (Smith et al., 2010). Ability of practicing physicians to appropriately order and interpret laboratory tests is declining and little attention was given to appropriate medical student education in pathology (Smith et al., 2010).

Clinical Pathology (CP) is a module recently introduced in our medical programme. In depth learning of pathology requires learners to identify appropriate tests and specimen containers, interpret patients' results with consideration of other factors that may influence them.

Design thinking skills (DTS) is a guided process of thinking where learners' work in a team and work through to identify problems (patient case), analyse through collaborative learning, provide justification for investigation, interpretation of results, and outline relevant effective management. Experiential learning emphasises the central role of the learners in the educational process by allowing the learner to draw own conclusions and ruminate on meaning of the learned material (Clem et al., 2014). Blending DTS and experiential learning creates a holistic approach to the learning of CP.

II. METHODS

A pilot study was executed amongst year 3 medical students in the Faculty of Medicine and Health Sciences, University Putra Malaysia, Serdang, Selangor, Malaysia. The study was approved by Ethics Committee for Research Involving Human Subjects, Universiti Putra Malaysia, (JKEUPM-2019-387). It was conducted over a span of two months outside students' formal teaching and learning. Inclusion criteria include students who in clinical years and never been expose to Clinical Pathology module. Students were divided into small groups of either 4 or 5 students, and all were equipped with the CP app (Appendix 1) in Android smartphone together with DTS task book. Each group had a clinical pathologist facilitating the four hybrid sessions (physical and online) due to the global pandemic. In brief, phases involved introduction to CP (empathy), case findings (define), laboratory workup (ideation), results interpretation (solution), case approach (prototype), critical analysis (reflection and post-mortem). [Details in Appendix 2]. These were then presented in the final phase of DTS in a simulated grand ward round. Learners went through pre and post-test in CP and were asked to evaluate their experiences using a modified 28 items questionnaire (Appendix 3) using Likert scale score; adapted from a validated experiential learning questionnaire (Clem et al., 2014).

III. RESULTS

Twenty students from Medicine and Surgery posting participated in this pilot study, conducted from 27th April 2021 to 26th June 2021. In general, students were very satisfied with the experiential learning project. Responses of experiential learning and score marks were tabulated in Table 1. The 28 items were divided into 4 subheadings; as for the type of environment used, 66% agreed to the hybrid approach used in running of the project. Seventy-five percent agreed on the active participation in different phases of DTS. Eighty-six percent agreed with the relevance of the content of CP in their teaching and learning towards being a medical professional. Over two third of respondents agreed on utility of the CP learning experience be adapted in their future learning. As per for students' performance (n=20) in pre and post-test OSCE in pathology, students scored significantly higher mark in all items evaluated as seen in Table 1.

Encouraging responses were recorded from some of the respondents as stated below:

"I enjoyed it very much. I received a lot of clarity on how important clinical pathology is after the session. Even after all these sessions, I even read again and again the clinical pathology notes that I have. I feel I can slowly relate my prior knowledge when it comes to clinical."

Respondent 1

"In my opinion, I think this research project has given me a lot of benefits such as I can know how to correctly fill in the form to order the lab investigation, understand how to choose the correct tube for each lab investigation. I like this project very much as it can help me in this medical field"

Respondent 2

"I am grateful for being part of this research since I learnt a lot from the sessions. I have learnt about the type of lab investigations and blood tube, the sequence of taking blood as well as the phlebotomy techniques from the sessions which may help me in my future medical career."

Respondent 3

Subheading I	Agree (%)	Neutral (%)	Disagree (%)
On the environment of Clinical Pathology used in the experiential learning	66	15	19
On the active participation and learning of Clinical Pathology	75	14	11
On the relevance of the content of Clinical Pathology module	86	3	11
On the utility of Clinical Pathology experience in future learning	68	3	29
Subheading II	Pre-test (/5)		Post-test (/5)
Correct selection of specimen container	0.6		3.5
Correct order of blood draw	2.5		4.0
Correct preanalytical variables identified	0.3		3.0
Relevant information in the laboratory form	2.3		4.0
Interpretation of laboratory tests	3.5		4.5

Table 1. Responses to the questionnaire, pre and post-test score for OSCE in Clinical Pathology

IV. DISCUSSION

The pilot study conducted has shown to be beneficial for the clinical students who participated in the research.

Using Kirkpatrick model (Kirkpatrick & Kirkpatrick, 2021), students in this pilot study achieved level 2 of the model outcome. As Clinical Pathology is a new subject in the amended curriculum, 'sensitising' the students to the importance of Clinical Pathology (CP) is achieved.

Small group teaching practised in this pilot study is in line with other schools who used small group teaching which resulted in close relationship between students & facilitator (Smith et al., 2010). The CP app provided self-directed learning on information about laboratory tests which able to improve students' performance (Smith et al., 2010). When students worked through their own clinical case, this create inquisitive learners as they were able to do clinical correlation with the laboratory findings of their patients.

Disagreement showed by some of the students' implied the need to improve implementation and running of the project. Students' learning preferences varies from visual, aural, reading, and kinaesthetic (VARK) and a suitable approach need to be designed to suit spectrum of students.

Post-test OSCE scores showed improvement in common pathology knowledge required from students. This general knowledge will assist them in other clinical postings in future. CP app provided earlier will be useful

as self-directed learning. However, there's still challenges in developing a standardised approach to assessing students' knowledge and skills in this area (Smith et al., 2010) which is an avenue for future research.

V. CONCLUSION

Students developed more confidence in CP which is useful for future learning experience in other disciplines and future career.

Notes on Contributors

ERT designed the research, developed the CP app storyboard, created the DTS task book, analysed the results, wrote the manuscript. HM developed the CP application, edited the manuscript. FAG, INS, SCT, SZZ, ZS revised the protocol, CP app story board, DTS task book, facilitated the project, edited the manuscript.

Acknowledgement

Funding

Declaration of Interest

All authors declared there is no conflict of interest, including financial, consultant, institutional and other relationships that might lead to bias or a conflict of interest.

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Appendix 1. Selected features available in Clinical Pathology app

The app has few features whereby it provided

a. an augmented reality phlebotomy process including arterial blood gas, heel and finger prick.

b. description on blood collection tubes and specimen containers used in laboratory

c. order of blood draw

d. notes on general conduct of histocytopathology specimen collection
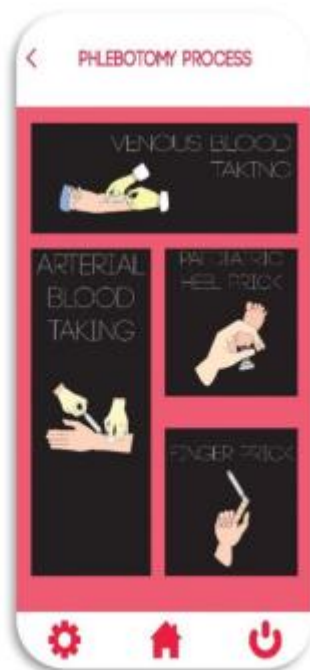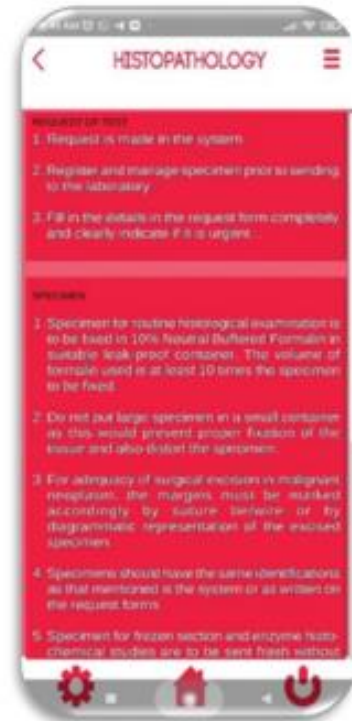
Appendix 2. Methodology of Design Thinking Skills (DTS)

Design thinking skills (DTS) is both a process and mindset whereby it is a systematic approach to solving a complex problem, as in the medical world, patient's presentation cuts across many spectrums. Through a systematic approach, guideline or algorithm can be created to help solve the complex problem.

DTS requires a few repetitive phases to achieve its outcomes. The phases are Empathy, Define, Ideation, Prototype and Evaluation, Reflection and Postmortem.

1. In the medical context, Empathy is a mindset of understanding others and in this context, it is understanding Clinical Pathology and its various sections as it is one of the core disciplines involved in solving patients' problems. It consists of modified Objective Structured Clinical Examination (OSCE) pre-test in pathology and a tour of the laboratory.

2. In the Define phase, learners chose and presented the clinical history, and relevant physical examination on patients' case they clerked in their posting to solve and learn from. In this phase, learners create a meaningful and actionable problem statement in Clinical Pathology based on the patient's presentation and perform systematic tasks in relation to Clinical Pathology to understand & provide solutions to patients' problem. During this session, learners discussed in detail the relevant phlebotomy process, blood collection/specimen container use, appropriate information to be filled in the different laboratory investigation form available.

3. In Ideation phase, based on the initial solutions discovered earlier, members of the team brainstorm and ideate on further strategies in Clinical Pathology by considering the various tests needed, implication on costs, resources, and possible variables, which may influence patients' findings and interpretation. In this session, learners presented and choose laboratory workup for their patients. Learners interpreted tests findings of their patients presented in the last session, identified possible variables (especially preanalytical) influencing patients' results and measures to overcome the variables. Learners also included ethics and professionalism for example confidentiality of certain test findings, and cost analysis aspect of certain laboratory tests that may cost burden to patients

4. From Ideation, a prototype is developed. In the medical context as in Clinical Pathology,prototype will be in the form of guideline or algorithm or other similar platforms on the systematic approach in dealing with a similar patient's presentation if encountered in the future. This algorithm/ model/ guideline developed will undergo an evaluation process through simulated Grand Ward Round or other similar platforms to validate its usefulness and applicability in similar future cases.

5. Final phase of DTS is Reflection and Post-mortem, whereby members of the team provide reflection and post-mortem on engagement in Clinical Pathology and future improvement needed to strengthen DTS in Clinical Pathology. Post-test OSCE is also conducted, and scores calculated for comparison.

In each session, team members would provide peer feedback and at the end of the process, all learners reflected upon their experience.

Appendix 3. 28 item statement

1. The setting where I learn helps me understand Clinical Pathology better.

2. I expect real-world problems to come up during this learning experience

3. The environment I learn in does not enhance the learning experience.

2. The learning experience requires me to interact with people other than students and teachers.

3. I expect to return to an environment like the one where this learning experience occurs.

4. I am stimulated by what I am learning.

5. The learning experience requires me to do more than just listen

6. The learning experience is presented to me in a challenging way.

7. I find this learning experience boring.

8. I feel like I am an active part of the learning experience.

9. The learning experience requires me to really think about the information.

10. I am emotionally invested in this experience.

11. I care about the information I am being taught

12. The learning experience makes sense to me.

13. This learning experience has nothing to do with me.

14. This learning experience is enjoyable to me.

15. I can identify with the learning experience.

16. This learning experience is applicable to me and my future career.

17. My educator encourages me to share my ideas and past experiences.

18. This learning experience falls in line with my interests.

19. I can think of tangible ways to put this learning experience into future practice.

20. This learning experience will help me do my job better.

21. This learning experience will not be useful to me in the future.

22. I will continue to use what I am being taught after this learning experience has ended.

23. I can see value in this learning experience.

24. I believe this learning experience has prepared me for other experiences.

25. I doubt I will ever use this learning experience again.

26. I can see myself using this learning experience in the future.

    Item 1-6 : Environment in experiential learning
    Item 7-15 : Active participation & learning
    Item 16-24: Relevance of content
    Item 25-31: Utility of experience in future