

Hybrid Team- Based Learning in Cardiorespiratory Physiotherapy in Higher Education.

SD Perumal

Cardiff University, Wales, United Kingdom.

Corresponding author: Shakila Devi Perumal, Lecturer in Cardio-Respiratory Physiotherapy, Cardiff University,

Highlights

- 1. This study adds evidence to a modified version of Team -Based learning strategy - Hybrid-Team Based learning(H-TBL).**
- 2. H-TBL design supports to build students ‘4Cs’ - Critical thinking, Communication, Collaboration and Creativity skills**
- 3. H-TBL design supports significant student’s cognitive engagement, accountability and self-efficacy.**
- 4. Design and sequence of delivery H-TBL are aligned to Blooms Taxonomy and Kolb’s experiential learning style.**
- 5. However, corroborates previous evidence that student’s cognitive engagement does reflect significant student’s satisfaction.**

Abstract:

Background: *Today’s modern and future cardio-respiratory physiotherapist are, and will be, presented with ubiquitous and uncertain complex problems in professional life. Yet, to date, teaching approaches lacks robust scientific evidence of optimal learning to stimulate student’s active cognitive engagement of higher order skills beyond knowledge and skills transfer and are only focused on graduation. For past two decades, pedagogy recommends use of active learning strategies to enhance authentic student engagement, self-efficacy and satisfaction. In recent years, team-based learning (TBL) is emerging as a popular student-centred active collaborative learning strategy that promotes individual and team learning in medical and allied health education.*

Objective: *This paper reports on the design and impact of a novel “Hybrid Team-Based learning” (H-TBL) on students’ engagement and perceptions of their learning experience in a Year 2 undergraduate physiotherapy Cohorts.*

Study Design: *A retrospective study.*

Methods: *In 2019, a keynote lecture on Chronic Obstructive Pulmonary Disease (COPD) was taught using novel “hybrid team-based learning” (H-TBL) comprising phases 1-4, delivered in two sessions (COPD1 and 2) to our year two (n=136) undergraduate physiotherapy students.*

Results: *Of 136 students, 82% engaged in Phase 1, 80% attended the Phase 2 and 3 of COPD 2 session and 74% engaged in phase 4. 72% provided their perception on their learning experience.*

Conclusion: *Majority of our students valued the learning experience in H-TBL design. This study confers that H-TBL supports students’ active engagement and self- efficacy. Future randomized studies are mandated to explore the validity and specificity of H-TBL in physiotherapy curriculum.*

Keywords: *Active Teaching, Team-Based Learning, Physiotherapy Education, Collaborative Learning.*

Date of Submission: 26-10-2020

Date of Acceptance: 06-11-2020

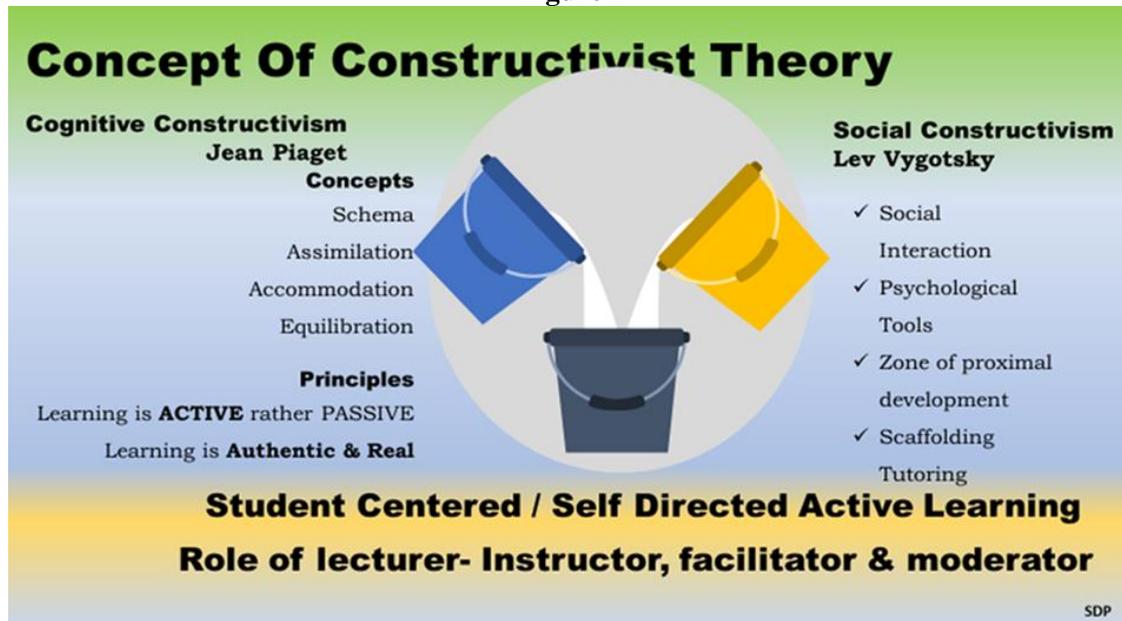
I. Introduction:

In 21st century, the cardio-respiratory curriculum has renewed demands on exit competencies for knowledge and skills of physiotherapy graduates to tackle unprecedented challenges of the growing healthcare industry (Troosters et al., 2019). Hence, it is crucial to reform the cardio-respiratory education process in higher education “that integrates generic skills and shapes students for professional responsibilities that transcend traditional boundaries of discipline-specific roles.” Over past two decades, series of influential reports and articles have highlighted traditional lectures fail to stimulate student engagement, accountability and self-efficacy (Bransford et al., 2000, Loftin and West, 2017, Weimer 2002). Recently, knowledge, evidence and learning for development report (2019) on the ‘Framework for 21st Century Learning’ summons education system to embeds the lens of ‘4Cs’ - Critical thinking, Communication, Collaboration and Creativity in any teaching curriculum to prepare students for the demands in professional workforce.

Ancient theories of learning by Jean Piaget (1926) and Lev Vygotsky (1978) as illustrated in Figure 1 have recommended “active learning” strategies to enhance student engagement, accountability and self- efficacy (Freeman et al., 2014). In fact, Bloom’s Taxonomy is the core to the development of active learning strategies in the world of education (Bloom et al., 1994). In order to strengthen Bloom’s higher order cognitive skills, such as application, analysis, synthesis and evaluation, an active learning strategy such as “visual learning, cooperative learning, debates, drama, discussions, role-playing and peer learning/teaching” should be embedded in the education curriculum delivery (Bonwell & Eison,

1991). This would stimulate students self-directed learning and train attributes of scientific mindset such as curiosity, lifelong inquiry and learning (Madhuri et al., 2012).

Figure 1



In the last few years, emerging evidence support team-based learning (TBL), a special flipped instructional design focused on student centred collaborative learning that incorporates specific sequence of individual work, group work and immediate feedback to promote student’s engagement and satisfaction (Sisk, 2011). A plethora of evidence affirms TBL enhances higher order skills, self-efficacy, teamwork, and academic performance (Branson et al., 2016; Clark et al., 2008; Fatmi et al., 201; Haidet et al., 2014; Reimschisel et al., 2017). Many courses have implemented a modified version of TBL with adherence to protocol of readiness assurance test (RAT) and application exercises to promote student interactivity and community of practice (Burgess et al., 2014; Haidet et al., 2014; Wenger 2010). In resonance, two studies in nursing education, one randomised trial (Kim et al., 2016) demonstrated use of TBL in respiratory management course improved student’s problem-solving ability, knowledge and clinical performance significantly compared to traditional lectures and the other observational study (Branney and Priego-Hernández, 2018) conferred use of TBL in pathophysiology teaching for nursing students improved their accountability and satisfaction to the course. Despite its proven benefits, to author’s knowledge there is little evidence of TBL use in physiotherapy education (Amorim et al., 2019; Lein et al. 2017; Livingston et al., 2014). This paper reports the design, implementation, and impact of a novel “Hybrid Team-Based Learning” (H-TBL) strategy on student engagement, accountability and self-efficacy. Furthermore, this study also aimed to explore impact on student’s cognitive engagement in H-TBL.

II. Methods:

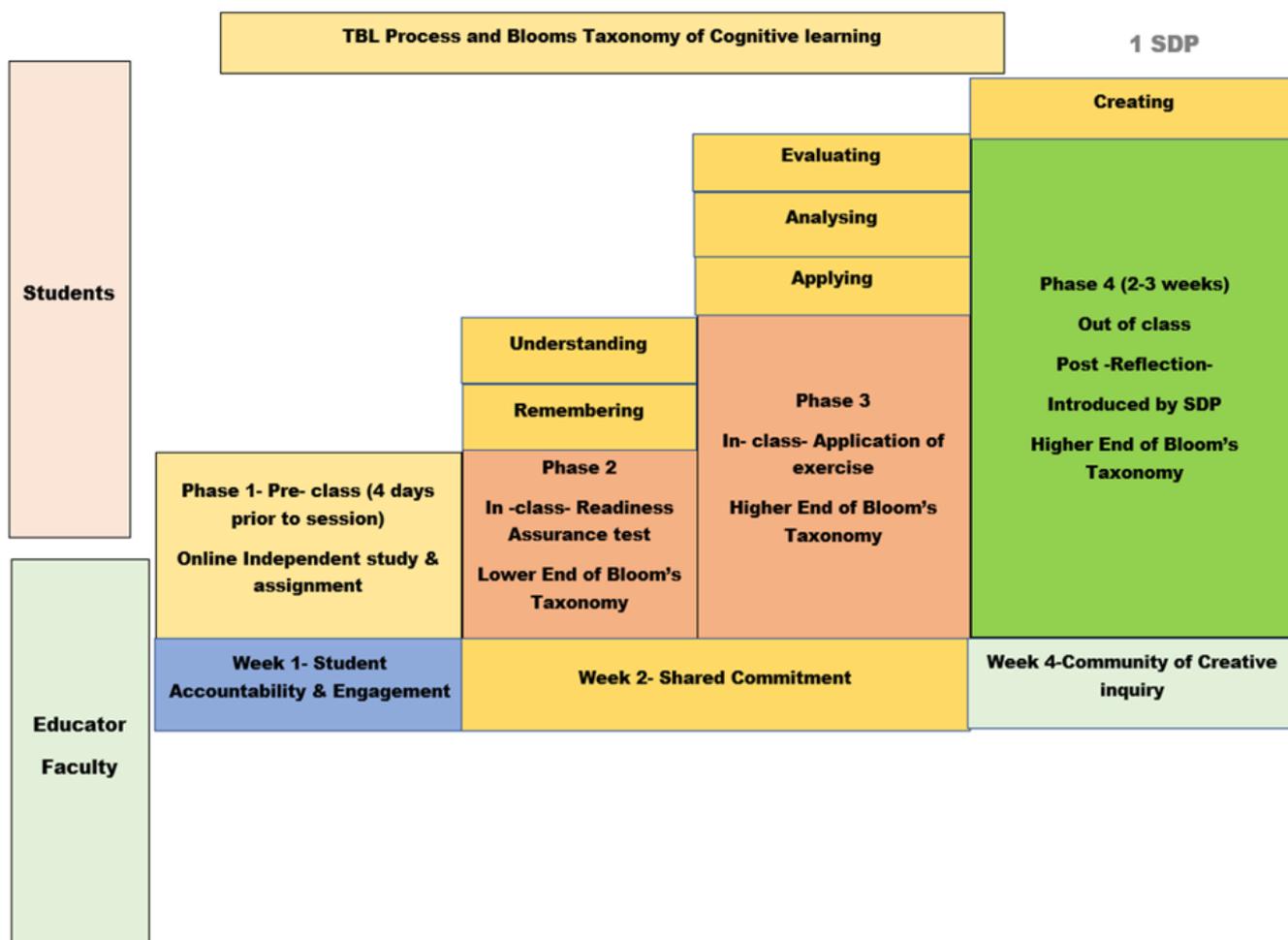
The presented retrospective data are from the academic year 2019 for a cohort of 136 students in Year 2 (level 5) of an undergraduate physiotherapy program at one of UK higher education institution. A novel Hybrid- Team-Based learning (H-TBL) strategy was implemented for one respiratory lecture topic – “Chronic Obstructive Respiratory Disease (COPD)” in a Cardio-Respiratory block (November-December), a part of a 30-credit module. All other topics in cardio-respiratory block was delivered as traditional lectures. The H-TBL comprised of COPD 1 and 2 delivered in four phases compared to usual TBL (3- phases), organising the levels of task expertise aligned to the Bloom’s cognitive higher order skills domains (**Figure 2**). The design of H-TBL (**Figure 3**) has strong relation to experiential learning style model developed by David Kolb in 1984 (McLeod, 2013)

The **COPD1 session** involves **Phase 1** of H-TBL that demands students individual pre-class work. A web-based course was designed with 3 mandatory elements 1. An online lecture comprised of 34 slides that includes orientation of the course content mapping session's learning objectives, links to online reading material and videos (length 5-7 mins), online application exercise and technological requirements, team-based learning expectations for the COPD- session 1 and 2, 2. A case challenge concept was introduced that involves a clinical case scenario and Individual Readiness Assurance Test – iRAT with 5 questions of diverse format (MCQ’s, True/False, fill in the gaps and match the answer) with formative immediate feedback , 3. A short journal review article. To ensure equality and diversity, the duration of student individual work was set between 40- 60 mins. The web-based content was introduced to the students in the virtual learning management systems four days prior to the lecture and instructed as pre-requisite to attend the on-campus COPD 2 session.

The **COPD 2 session** was delivered for an hour in a large lecture theatre and comprised of Phases 2 and 3. The session began with an introduction to learning objectives, plus an outline of the in-classroom TBL session and rules of engagement emphasizing professionalism and teamwork. The students required to take closed book Team Readiness Assurance Test – tRAT for 10 questions designed in mixed format (multiple-choice questions with four choices and True/False) administered via Kahoot, a learning game platform. In each team comprised a minimum 3 to maximum 4 students and sharing of the devices was permitted. The lecturer provided a mini-lecture presentation following tRAT for 10-15 mins as highlights of major vital points or to clarify any points of confusion risen from the readiness assurance test with an opportunity of verbal appeal in the classroom. Verbal appeals on any "burning questions" were acknowledged, and the lecturer clarified any concepts that students did not understand relating to the test and the pre-class task (reading material). The verbal appeal qualifies as "burning questions" if either a) ambiguous question or b) discrepancy between a correct answer and reading content in COPD1 session (web-based). If it is an ambiguous question, the students should identify the

source of ambiguity that would improve clarity and resolve the issue. The timeline for verbal appeals allocated was 2 mins following each question in MCQ's.

Figure 2: H-TBL design alignment with Bloom’s Cognitive domains



Phase 3 comprised application exercise that involves peer discussion (20 mins) and presentation to whole class (3 mins per team) on a given theme related to a journal article different from COPD 1 session. The framework for application exercise adheres to the “4S” principle: A diligent task design around a “Significant” problem, the COPD with a focus on the “Same” question on disease management with “Specific” choice relevant to journal article and students were reporting “Simultaneously” their answers and views to the whole classroom for immediate feedback (Michaelson and Sweet, 2008). For phase 3 activity, the students were reshuffled in teams (5-7 students) and peers elected their team representatives (one or two students). Representatives were instructed to facilitate team discussion and scribe the points in a sticky note. At the end of discussion, each team presented a reflective account to varying degrees of depth and rationale of their team’s decision on given theme.

The lecturer facilitated the intra team debate. After each reporting, the lecturer clarified and added critical supporting points. A mini test was exercised through “Mentimeter” to confirm and promote understanding of the session's context and contents. Before the close of the session, students’ feedback on the COPD 2 session was captured through “Mentimeter”.

Phase 4 involves out of class activity post completion of COPD 2 session. This phase was introduced to infer students’ reflection on COPD disease and management. Students were challenged with a formative creative assignment on a common theme, "Exacerbation," to promote critical reflection on their application exercise (phase 3) on recommendations for evidence-based management of COPD. Students autonomy was developed with a choice of either a blog of the maximum word limit of fifty or a PowerPoint with a maximum of five slides or one-page infographics. Students were set on a target of 10 days to complete and submit the task on the university learning management system (Turnitin). Lecturer instructed students that the creative assignment is not summative assignment or neither add credits towards the module. The students work was assessed by lecturer using "Rubrics on student’s reflection" (**Table 1**) as a guide.

Figure 3

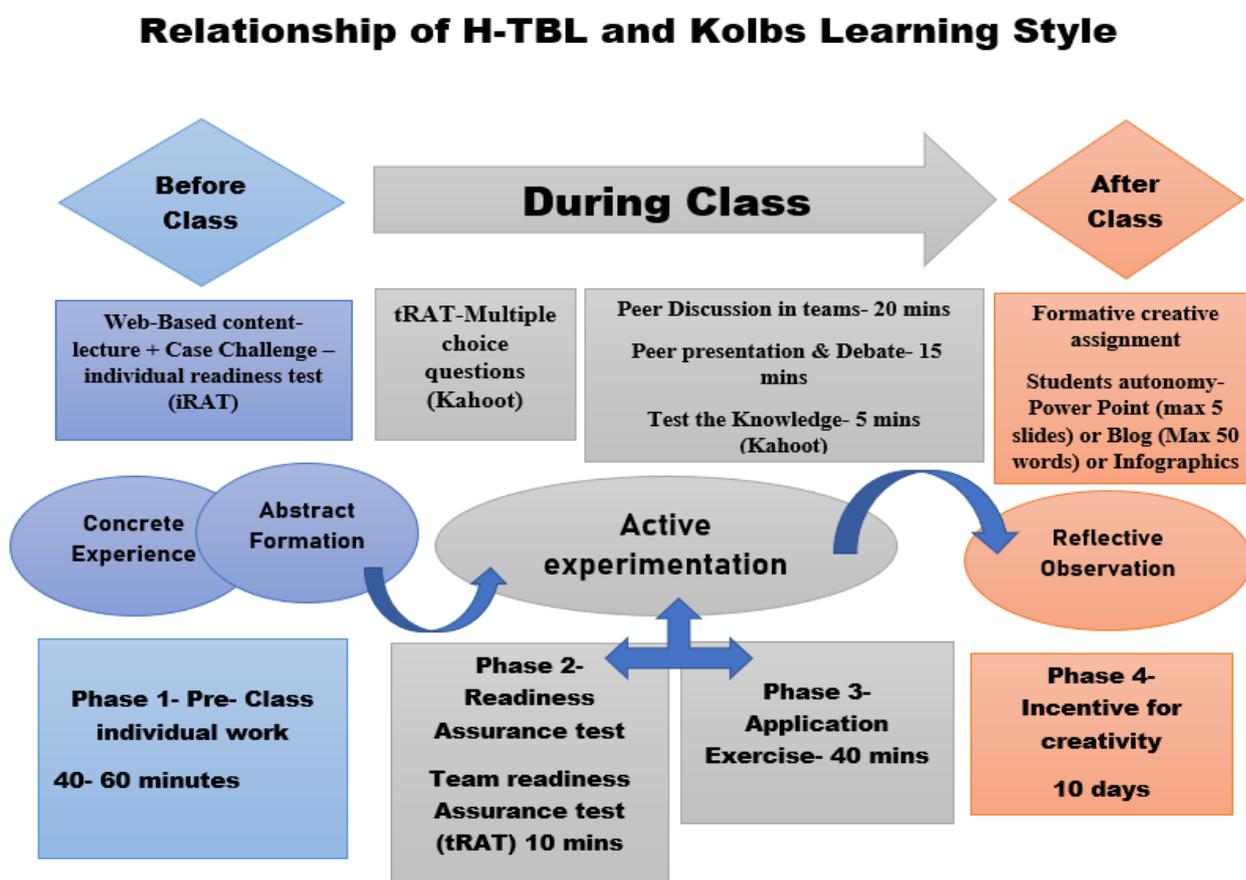


Table 1

Rubric for Students reflection

	Above Expectations	Meets Expectations	Near Expectations	Below Expectations
	4	3	2	1
Reflective Thinking	The reflection explains the student's own thinking and learning processes, as well as directions for future learning.	The reflection explains the student's thinking about his/her own learning processes.	The reflection attempts to demonstrate thinking about learning but is vague and/or unclear about the personal learning process.	The reflection does not address the student's thinking and/or learning.
Analysis	The reflection demonstrates an in-depth analysis of the learning experience, the value of the derived learning to self or others, appreciation of the subject related to discipline.	The reflection demonstrates an analysis of the learning experience, the value of the derived learning to self or others.	The reflections attempt a shallow analysis and value of the learning to the student or others is vague and/or unclear.	The reflection does not move beyond a description of the learning experience.
Making Connections	The reflection articulates multiple connections between this learning experience and content from other courses, past learning, life experiences and/or future goals.	The reflection articulates connections between this learning experience and content from other courses, past learning experiences, and/or future goals.	The reflection attempts to articulate connections between this learning experience and content from other courses, past learning experiences, or personal goals, but the connection is vague and/or unclear.	The reflection does not articulate any connection to other learning or experiences.

<https://www.scribd.com/document/333036195/portfolio-rubric-for-reflection-print-copy>

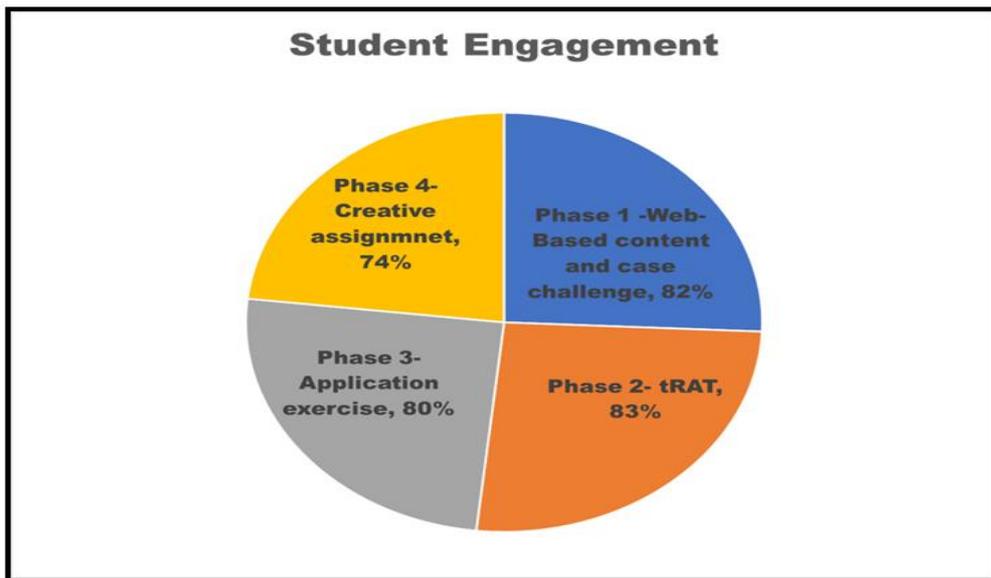
III. Results:

The overall outcome of H-TBL was measured based on three main domains, as discussed below:

3.1. Student's engagement

The student's engagement (**Figure 4**) was measured using the data from the completion of individual pre-course work (Web Based, COPD1 session), attendance to COPD 2 session and submission of formative creative assignment. In total, 109/136 (80%) students attended the COPD 2 session. 90/109 (82%) students confirmed (verbal) engaged in COPD 1 session and 75/90 (83%) engaged in tRAT (phase 2) of COPD 2 session. 67/90 (74%) students submitted formal creative task that includes: Blog (n= 4), PowerPoint (n= 58) and infographic (n=5).

Figure 4- Student Engagement



The students’ cognitive engagement measured based on their response in tRAT (Phase 2) and performance in formative creative assignment (Phase 4). The percentage of student’s right responses to MCQs in tRAT of phase 2 is shown in **Table 2**. And it was captured via Kahoot, an interactive educational gaming platform. The creative assignment was assessed using on a rubric for student's reflection as a benchmark tool (**Table 1**). Based on the rubric, 5/67 (7%) students were graded excellent, 56/67(83%) students graded good and 6/67 (9%) students graded near expectation.

Table 2

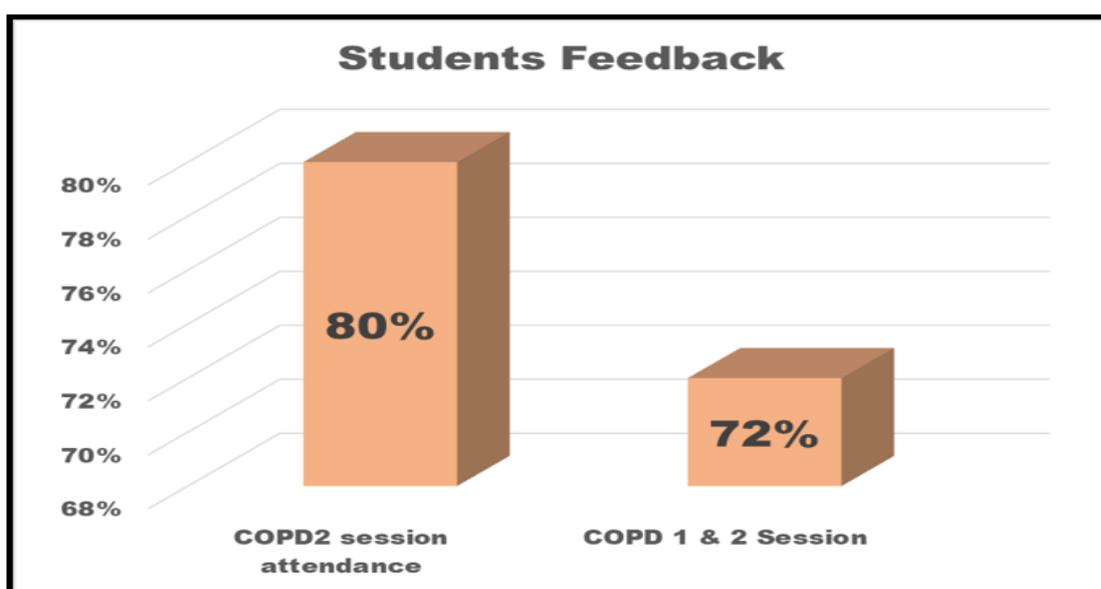
Team Readiness awareness test (tRAT)

No	Questions	Total response	Right response	Percentage
1	What is COPD?	37 teams	19/37	51%
2	What is main cause of COPD?	37 teams	37/37	100%
3	COPD comprises of?	37 teams	34/37	91%
4	What are cardinal symptoms of COPD	37 teams	35/37	95%
5	Why is exercise tolerance limited in COPD?	37 teams	20/37	54%
6	What does COPD management comprise of?	37 teams	36/37	97%
7	Which additional investigation gives more information on oxygen needs in COPD patients? 4 choices	37 teams	25/37	68%
8	COPD patients who experience frequent exacerbations are more likely to also experience	37 teams	32/37	86%
9	Exacerbation frequency is the best measure for predicting exacerbation risk – True or false?	37 teams	18/37	47%
10	What is the key patient related outcome measures?	37 teams	30/37	81%

3.2. Student's Perceptions

Student's perceptions were measured based on their feedback (**Figure 5**) captured through interactive polling platform "Mentimeter," and was used to understand their perception of H-TBL experience. In total, 54/ 75 (72%) students provided feedback on the session. Examples of students' feedback include "Vibey, Interactive, Energetic, Engaging, Informative, Creative, Good, Friendly, Fun, Unique and Love Group Work." In contrast, a small group of students recorded "Wanted to have a lecture, Better as a tutorial, No structure and Confusing."

Figure 5- Student Feedback



IV. Discussion:

The hybrid team-based learning (H-TBL) strategy reported in this study is considered to be novel model based on two unique features. First, introduction of web-based learning materials with formative guidance for case challenge using a problem-solving model in phase 1 and setting it as prerequisite to attend the COPD 2 session (inside classroom). Second, introduction of incentivizing phase 4 (outside classroom) to test student's creativity and cognitive engagement. This H-TBL session is first of its kind implemented in one lecture session of cardio-respiratory module in our three-year undergraduate physiotherapy program. Particular attention given in this section is to value H-TBL, as the author identifies benefits, challenges, and limitations.

4.1. Benefits

Our collaborative commitment to H-TBL early in the design process between educator, learning technologist, academic leadership, and facilities management was aligned to the vision of creating a

student-centred learning experience. Clear communication on the intended learning outcomes of the sessions (COPD 1&2), rules of engagement and expectations, use of appropriate tools (e.g.Kahoot, Mentimeter and Xerte) was in concurrence with best practice strategies for implementing online learning (Poll and Weller, 2014) to stimulate our students active virtual COPD 1 session (n=82%, Web course), physical (n= 80%,) in classroom COPD 2 session and cognitive engagement(n=83% , tRAT-phase 2; n=74%, formative task- phase 4). Our data on student's engagement corroborate with evidence on TBL (Sisk, 2011).

Introduction of web-based course content with formative feedback (COPD 1 session), before the classroom session (COPD 2 session), attracted student engagement and accountability on the content, was a springboard to success of accomplishing the learning objectives. Team readiness test (tRAT, n=82%) combined with immediate feedback from lecturer ensured student understanding from the pre-class work facilitating a meaningful use of class time for assessing and applying knowledge to process information at highest cognitive complexity (Parmelee and Hudes, 2012). Further, in phase 3, an explicit instruction on rules of engagement for peer discussion and presentation had placed a social constraint on students interpersonal and team engagement skills of being respectful, active listeners, inclusive, and accountable in groups. Besides, presenting a real-world practice challenge and inviting different perspective though daunting for students, it was apparent clear communication of expected team behaviour supported student's interactivity, critical thinking, professionalism, interpersonal communication, and collaborative teamwork. in non-threatening ambience.

Many authors Kelly et al. (2005) Clarke and Wells (2008), Haidet et al. (2012) confer student's profound engagement with subject translates into better performance (cited in Rotgans et al., 2017). An impressive performance data was observed both in tRAT and formative creative task activities demonstrates their self- efficacy in knowledge acquisition (Loftin and West, 2017). Notably, the completion of a creative assignment challenge in phase 4 revealed students' talents of creativity, proclivity, innovation, and ownership for knowledge acquisition. Thus, it gives confidence that H-TBL has potential to promote a culture of self-regulated learners and community of inquiry as illustrated by Garrison et al. (2000).

Furthermore, the author also believes the introduction of incentive system in phase 4 for the creative assignment had opened the channels of enthusiasm and a collegiate competition among students. Overwhelming response to creative work submission supports phase 4 of H-TBL had sparked student's heightened cognitive engagement, self-efficacy in the subject content at hand. Given the evidence, it can be believed H-TBL design and delivery had the potential to produce 21st century self-sufficient cardio-respiratory physiotherapists in the growing healthcare industry. Upon reflection on the

student's engagement, performance and feedback data, there is potential for transferability of H-TBL across other cardio-respiratory, musculoskeletal, and neurology modules in our physiotherapy program. These data are rich sources of information that could inform a consistent quality improvement in curriculum development and program evaluation. However, there were both human and logistical challenges encountered pre and post H-TBL design, development and delivery in our institution.

4.2. Challenges:

The primary challenge was in converting a face to face lecturer into a web-based interactive lecture was highly challenging. This demands lecturer's workload, skills and patience to design, develop and deliver the subject content in sequence with use of appropriate tools to promote authentic student's active learning experience (Khan et al., 2017). A pinnacle of challenge at implementation stage which experienced a widespread resistance among other lectures in physiotherapy teaching teams to acknowledge H-TBL. This behaviour of resistance from our lecturers to new teaching strategies correlates with pre-existing evidence that though universities are willing to adopt effective teaching-learning methods, often teaching practices in healthcare courses lacks training in practice performance or task design due to resistance from some students or lecturers or cultural perceptions of institution (Topbas, 2013; Karaman & Sari, 2020). Some perceived barriers by lecturers for active teaching are insufficient time, limited resources, a lack of departmental support, concerns about content coverage, concerns about evaluations of their education, and student's resistance to engage with their peers (Deslauriers et al., 2019).

Another perceived barrier was student's attitudes and behaviours for classroom engagement. From a teaching perspective, it was observed some students reported poorly prepared for COPD 2 session that reflects a variant in usage patterns of online content for individual pre-class work. The author attributes this to barriers of logistics support (scheduling) which could be one of the factors reflecting implicit bias on students' engagement. In addition, during phase 3 (application exercise) it was notable that some students' unwilling to challenge colleagues, lack confidence to voice their ideas or opinions to the class and educator, and anxious during presentation though it was not part of the module summative assessment. A plausible reason might be as the task design was matched to real-life scenarios, it might have challenged some student's coping skills to demands on accountability, working in teams, being creative, and time management skills (Atwa et al., 2019; Ghorbani et al., 2014; Livingston et al., 2014).

Extending the previous findings (Mennenga, 2013; Reimschisel et al., 2017; Swanson et al., 2019) though the majority of our students were satisfied and embraced the novelty learning opportunities in H-TBL design, whilst some students expressed dissatisfaction and preferred a

conventional lecture. In our renewed higher education system, student satisfaction is gaining as a prominent metric to quantify teaching quality (Langan and Harris, 2019). This might elicit an inquiry in our evidenced results on student engagement and performance. However, it's been documented, increased student's satisfaction does not have any direct relationship with their engagement and performance. In accordance with experiential learning theories, some students entwined their response of transition from novice to expert learning experience as "discomfort" and "vulnerable to emotions" that challenges their resilience and grit to become an expert in a given subject (Experiential Learning, 2020).

Last, but not the least, team formation was a great challenge and teams were assigned randomly during the COPD 2 session. The author believes this had given the team a potential mix for diverse intelligence quotient, personality and learning behaviours, promoting depth of accountability to self and peer's professionalism, an expected standard of conduct required by accreditation bodies of physiotherapy practice.

4.3. Limitations

The author perceives that this study has several limitations. First, this study design is retrospective and lacks a control group. Second, this study results cannot be generalized as it only reports the effects of TBL for one lecture in the cardio-respiratory module of a 3-year undergraduate physiotherapy program. Third, this study only reports on overall student engagement and does not explore students' cognitive engagement in different TBL phases or differences between elite and low performers. Fourth, the rate of student's class attendance cannot be commented as there was no previous data for the same session. Fifth, there was no validated instrument (e.g. questionnaire or focus group interviews) to capture students' perceptions to culminate qualitative data. Sixth, this study does not explore long term impacts on students learning and academic performance. Seventh, the lecturer is blinded to data on students learning disabilities that could have had a ceiling effect in the depth of student's engagement in peer discussion, presentation and completion of formative creative assignment.

V. Conclusion:

This study is first of its kind to introduce H-TBL in our cardio-respiratory module of undergraduate physiotherapy programme. Despite the challenges and limitations mentioned above, this study supports that H-TBL can foster self-regulated active learners, with 21st century '4Cs' Skills (Critical thinking, Communication, Collaboration and Creativity) for scientific mindsets. Adopting TBL, with appropriate instructional content, design and incentive strategies, can increase student cognitive engagement both inside and outside the classroom. This H-TBL design offers a framework for lecturers to construct active learning ambience mapped to sound pedagogical principles to close theory -practice gap. However, prospective randomized studies are warranted to confirm the validity

and specificity of H-TBL compared to conventional lectures on academic performance, self-efficacy, content mastery, attitudes of students and educators.

Future directions and recommendations:

Beyond application in one lecture on the cardio-respiratory module, there are several implications for employing H- TBL into learning. First, the importance of widening student's engagement cannot be underestimated. For this, it would be valuable to consider revising the module planning and potentially introducing the learning strategies for every lecture in the student handbook that could relinquish the control and management of student ownership to active learning. Second, to control time commitments, creating a living physiotherapy curriculum with learning contracts could appeal to diverse individual learning styles and students' academic bents. Third, supporting and developing a culture of openness to H-TBL approach between students and educators would unveil the ambiguity of its efficacy in the light of student benefits. Fourth, a monthly update on subject-specific active pedagogical practices would enhance co-operation and confidence among educators in active teaching-learning design, implementation methods, and benchmarking practices at the local, national and international arena. Fifth, lecturers' initiatives to co-create TBL rubrics for both formative and summative assessment with students would increase student's passion for active engagement in relevant subject and courses.

Acknowledgement

The author would like to acknowledge the support from both Ms. Rebekah Potton, learning technologist, School of Healthcare Sciences, Cardiff University, United Kingdom and Mr. Owen Crawford, learning technology officer, Centre for Education support and innovation, Cardiff University, United Kingdom for assistance on formatting and administrative support for developing the web-based content for COPD Session 1 of H-TBL (Phase 1). The author sincerely like to record her gratitude to Dr. Mark Davies, Senior Lecturer in Advance Practice, University of South Wales, United Kingdom and Dr. Michael Rowe, Associate Professor and the Departmental Chairperson of Physiotherapy at UWC for critical peer review to add more clarity to this paper. Prior to critical peer review, this article has been submitted to pre-print.org on 18th August 2020 and accepted on 20th August 2020 for pre-print version- <https://www.preprints.org/manuscript/202008.0463/v>. The author confirms this is a renewed version.

Compliance with Ethical Standards

Funding

No funding received and article produced in author's personal time.

Conflict of interest

The author reports no conflict of interest. The author is solely responsible for the content and writing of the article.

Ethical Approval: N/A- Anonymised retrospective study reporting on teaching practices.

Informed Consent: N/A

References:

- [1]. Amorim, J.S., Poltronieri, B.C., Ribeiro, A.M., & Ferla, A.A. (2019). Team-based learning in Physical therapy undergraduate course: experiment report. *Fisioterapia em Movimento*, 32. <http://dx.doi.org/10.1590/1980-5918.032.ao46>
- [2]. Atwa, S., Gauci-Mansour, V. J., Thomson, R. J., & Hegazi, I. (2019). Team-based and case-based learning: a hybrid pedagogy model enhancing students' academic performance and experiences at first-year tertiary level. *The Australian Educational Researcher*, 46(1), 93-112. <https://doi.org/10.1007/s13384-018-0282-y>
- [3]. Bloom, B. S., et al. (1994). Excerpts from the "Taxonomy of educational objectives, the classification of educational goals, handbook I: Cognitive domain." In L. W. Anderson & L. A.
- [4]. Bonwell, C. C., & Eison, J. A. (1991). *Active Learning: Creating Excitement in the Classroom*. 1991 ASHE-ERIC Higher Education Reports. ERIC Clearinghouse on Higher Education, The George
- [5]. Branson, S., Boss, L., Fowler, D.L. (2016). Team-based learning: application in undergraduate baccalaureate nursing education. *J. Nurs. Educ. Pract.* 6 (4).
- [6]. Bransford, J. (2000). *How people learn*. Washington D.C.
- [7]. Branney, J., & Priego-Hernández, J. (2018). A mixed methods evaluation of team-based learning for applied pathophysiology in undergraduate nursing education. *Nurse Education Today*, 61, 127-133. <https://doi.org/10.1016/j.nedt.2017.11.014>
- [8]. Burgess, AW, McGregor, DM, Mellis, CM. (2014) Applying established guidelines to team-based learning programs in medical schools: a systematic review *Acad Med*, 89, p. 678.
- [9]. Clark, M.C., Nguyen, H.T., Bray, C., Levine, R.E. (2008). Team-based learning in an undergraduate nursing course. *J. Nurs. Educ.* 47 (3), 111–117.
- [10]. *Experiential Learning: Theoretical Underpinnings*. (2020).
- [11]. Fatmi, M., Hartling, L., Hillier, T., Campbell, S., & Oswald, A. E. (2013). The effectiveness of team-based learning on learning outcomes in health professions education: BEME Guide No. 30. *Medical teacher*, 35(12), e1608–e1624. <https://doi.org/10.3109/0142159X.2013.849802>
- [12]. Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the National Academy of Sciences of the United States of America*, 111(23), 8410–8415. <https://doi.org/10.1073/pnas.1319030111>

- [13]. Garrison, D. R., Anderson, T., & Archer, W. (2000). Critical Inquiry in a Text-Based Environment: Computer Conferencing in Higher Education. *The Internet and Higher Education*, 2, 87-105. [http://dx.doi.org/10.1016/S1096-7516\(00\)00016-6](http://dx.doi.org/10.1016/S1096-7516(00)00016-6)
- [14]. Ghorbani, N., Karbalay-Doust, S., & Noorafshan, A. (2014). Is a Team-based Learning Approach to Anatomy Teaching Superior to Didactic Lecturing? *Sultan Qaboos University medical journal*, 14(1), e120–e125. <https://doi.org/10.12816/0003345>
- [15]. Haidet, P., Kubitz, K., & McCormack, W. T. (2014). Analysis of the Team-Based Learning Literature: TBL Comes of Age. *Journal on excellence in college teaching*, 25(3-4), 303–333.
- [16]. Karaman, M. A., & Sari, H. İ. (2020). Psychological and familial factors as predictors of first year university students' positive orientation. *Journal of Adult Development*. doi:10.1007/s10804-020-09349-x
- [17]. Khan, Arshia & Egbue, Ona & Palkie, B. & Madden, J. (2017). Active learning: Engaging students to maximize learning in an online course. *Electronic Journal of e-Learning*. 15. 107-115.
- [18]. Kim, H.R., Song, Y., Lindquist, R., Kang, H.Y., 2016. Effects of team-based learning on problem-solving, knowledge and clinical performance of Korean nursing students. *Nurse Educ. Today* 38, 115–118.
- [19]. Koles, P. G., Stolfi, A., Borges, N. J., Nelson, S., & Parmelee, D. X. (2010). The impact of team-based learning on medical students' academic performance. *Academic medicine: journal of the Association of American Medical Colleges*, 85(11), 1739–1745. <https://doi.org/10.1097/ACM.0b013e3181f52bed>
- [20]. Lein DH Jr, Lowman JD, Eidson CA, Yuen HK.(2017). Cross-validation of the Student Perceptions of Team-Based Learning Scale in the United States. *Journal of Educational Evaluation for Health Professions*. 14:15. DOI: 10.3352/jeehp.2017.14.15.
- [21]. Livingston, B., Lundy, M., & Harrington, S. (2014). Physical therapy students' perceptions of team-based learning in gross anatomy using the Team-Based Learning Student Assessment Instrument. *Journal of educational evaluation for health professions*, 11, 1. <https://doi.org/10.3352/jeehp.2014.11.1>
- [22]. Loftin, C., & West, H. (2017). Evaluating Self-Efficacy After a Team-Based Learning Activity. *The journal of physician assistant education: the official journal of the Physician Assistant Education Association*, 28(2), 96–102. <https://doi.org/10.1097/JPA.0000000000000119>
- [23]. Deslauriers, L., McCarty, L.S., Kelly Miller, K., Callaghan, K., Kestin, G. (2019). “Measuring actual learning versus feeling of learning in response to being actively engaged in the classroom.” *Proceedings of the National Academy of Sciences*, 116, 39, Pp. 19251–19257. <https://doi.org/10.1073/pnas.1821936116>.

- [24]. Langan, A., & Harris, W. (2019). National student survey metrics: where is the room for improvement?. *Higher Education*, 78(6), 1075-1089. <https://doi.org/10.1007/s10734-019-00389-1>
- [25]. Madhuri, G. V., Kantamreddi, V. S., & Prakash Goteti, L. N. (2012). Promoting higher order thinking skills using inquirybased learning. *European Journal Of Engineering Education*, 37(2), 117-123
- [26]. McLeod, S. A. (2013). Kolb - Learning Styles. Retrieved from www.simplypsychology.org/learning-kolb.html.
- [27]. Mennenga H. A. (2013). Student engagement and examination performance in a team-based learning course. *The Journal of nursing education*, 52(8), 475–479. <https://doi.org/10.3928/01484834-20130718-04>
- [28]. Michaelsen, LK, Sweet, M. (2008) Fundamental principles and practices of team-based-learning. <https://www.med.illinois.edu/facultydev/tbl/readings/MichaelsenSweetEssentialsTBL2008.pdf>
- [29]. Parmelee, D. X., & Hudes, P. (2012). Team-based learning: a relevant strategy in health professionals' education. *Medical teacher*, 34(5), 411–413. <https://doi.org/10.3109/0142159X.2012.643267>
- [30]. Poll, K. & Weller, S. (2014). Six Instructional Best Practices for Online Engagement and Retention. Retrieved 16th October 2020.
- [31]. https://ecommons.luc.edu/cgi/viewcontent.cgi?article=1030&context=english_facpubs
- [32]. Reimschisel, T., Herring, A. L., Huang, J., & Minor, T. J. (2017). A systematic review of the published literature on team-based learning in health professions education. *Medical teacher*, 39(12), 1227–1237. <https://doi.org/10.1080/0142159X.2017.1340636>
- [33]. Rotgans, J., Schmidt, H., Rajalingam, P., Hao, J., Canning, C., Ferenczi, M., & Low-Ber, N. (2017). How cognitive engagement fluctuates during a team-based learning session and how it predicts academic achievement. *Advances In Health Sciences Education*, 23(2), 339-351. <https://doi.org/10.1007/s10459-017-9801-2>
- [34]. Swanson, E., McCulley, L. V., Osman, D. J., Scammacca Lewis, N., & Solis, M. (2019). The effect of team-based learning on content knowledge: A meta-analysis. *Active Learning in Higher Education*, 20(1), 39–50. <https://doi.org/10.1177/1469787417731201>
- [35]. Sisk R. J. (2011). Team-based learning: systematic research review. *The Journal of nursing education*, 50(12), 665–669. <https://doi.org/10.3928/01484834-20111017-01>
- [36]. Thierry Troosters, Nathalie Tabin, Daniel Langer, Chris Burtin, Michelle Chatwin, et al 2019. Introduction of the harmonised respiratory physiotherapy curriculum. *Breathe* 2019 15: 110-115; DOI: 10.1183/20734735.0124-2019

- [37]. Topbas, E. (2013). A comparison of teacher training programs in Turkey and Finland. *International Journal of Academic Research Part B*, 5, 111–120.
- [38]. Weimer. (2002). *Learner-Centered Teaching: Five Key Changes to Practice*.
- [39]. Wenger, E. (2010). *Communities of Practice and Social Learning Systems: The Career of a Concept*. In C. Blackmore (Ed.), *Social Learning Systems and Communities of Practice* (pp. 179-198). London: Springer. https://doi.org/10.1007/978-1-84996-133-2_11
- [40]. 2019. 21st Century Skills: Evidence Of Issues In Definition, Demand And Delivery For Development Contexts. [online] Available at: <https://assets.publishing.service.gov.uk/media/5d71187ce5274a097c07b985/21st_century.pdf> [Accessed 15 August 2019]

SD Perumal. "Hybrid Team- Based Learning in Cardiorespiratory Physiotherapy Higher Education." *IOSR Journal of Research & Method in Education (IOSR-JRME)*, vol. 10, no. 6, 2020, pp. 19-35