Pedagogical Effects on High-Stakes Summative Exams

Michael Andreas

Department of Education, University of the People

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Dr. Peter Hipple – Instructor

Abstract

In developing nations, such as the Lao People's Democratic Republic (Lao PDR), the value of English-language, high-stakes summative exam scores increases as the exams permit overseas opportunities to enhance the individual's educational choices and provide the opportunity to build capacity in the nation when the students return. Often, immersive-English, teacher-centered, rote-learning pedagogy and teaching to the exam are traditional and favored in developing countries to achieve summative exam mastery as they require less training for instructors and focus purely on success with the examinations. According to evidence-based research, more active, multilingual, learner-centered pedagogy practiced in authentic, collaborative, experiential learning activities such as project-based learning (PjBL) and problem-based learning (PBL) frameworks can potentially maximize student agency, self-efficacy, motivation, critical thinking skills, and metacognitive skills conducive to life-long learning (Bransford et al., 2000; Holt et al., 2015; Baeten et al., 2010). This research analyzes the pedagogical effects of multilingual learner-centered activities vs. monolingual teacher-centered practice, on IGCSE and AS-Level summative Cambridge International Assessment examination outcomes, in varying degrees of learner-centered physics courses, compared to more exam-focused biology, chemistry, and mathematics courses. Can active learning enhance holistic learning outcomes without negatively impacting high-stakes exams? This initial research suggests the affirmative. Quantitative analyses of high-stakes exam scores of multiple cohorts over five years and qualitative studies in the form of student surveys investigating a cohort's learner-centered conceptualizations and experiences provide support for learner-centered pedagogy in an exam-focused milieu.

Keywords: Cambridge International, active learning, high-stakes summative exams

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This action-based research investigates the educational effects of multilingual, learner-centered active learning pedagogy vs. more monolingual teacher-centered practice on specific types of summative Cambridge International Assessment physics examination scores in Lao People's Democratic Republic (Lao PDR), a low-resource developing nation. The research involves the collection and analysis of quantitative and qualitative student data.

First, quantitative student data is explored, consisting of science, technology, engineering, and mathematics (STEM) subject high-stakes summative exam scores of *distinct pedagogical physics cohorts* A-E (graduation years 2017-2021). A variation in learner-centered vs. exam-focused experiences spans grade levels. The IGCSE Exam usually occurs in all subjects in Grade 10, and AS and A-Level exams in Grade 11 and 12. Different amounts of exposure to active learning paradigms in physics have occurred due to the cohort's time with the author as an instructor (students have confirmed physics active learning activities were extremely limited in scope or non-existent before attending the author's class and in other subjects are limited to short, exam-focused practical labs). Cohort A participated in learner-centered physics for one school year, cohort B for two, C for three, D for four, and currently E for three and a half school years (exam scores are limited to these cohorts as COVID caused the postponement of many exams or their replacement with predicted grades). Newer cohorts such as F, currently in Grade 11, have participated for two and a half years and cohort G for one and a half. The author's current Grade 9 students, Cohort H, have studied physics for half a school year. As mentioned, cohorts F-H do not have examination scores available yet to contribute. Each year, the author has increased experiential, active learning, problem-based learning (PBL), and project-based learning (PjBL) activities. Collecting contiguous exam scores provides insight into the effect of new learner-centered pedagogical changes or long-term exposure to more experiential and active environments that may correlate with performance changes on those exams. The quantitative research also compares one learner-centered physics cohort's exam performance vs. other subjects with more traditional, exam-focused pedagogy in similar STEM courses attended by the same students preceding the same exam series. Specifically, physics, biology, chemistry, and mathematics exams are compared for *the same students* within and across cohorts. A comparative investigation into exam score and exam type (multiple subject-specific IGCSE and A-Level exams) for a cohort are collected, analyzed, and presented. The non-physics STEM courses median scores are combined into an average median "STEM score" for the same physics students.

The IGCSE (Grade 10) and AS Level (Grade 11 and 12) physics examination scores regularly exceeded the cumulative STEM scores taken by the same physics students for a given exam series. A cumulative physics average of median IGCSE and separately, AS-Level scores, for all cohorts 2015-2020 also exceeded that of the STEM average across multiple cohorts by significant percentages. These initial quantitative results suggest that learner-centered pedagogy minimizing the amount of teaching directly to the exam does not significantly negatively impact summative Cambridge physics examination performance on average, as shown in Figure 1, Figure 2, Figure 3, and Figure 4. A large data set is currently pending due to COVID restrictions, which can enhance ongoing studies of the same cohorts in the future. Discussion of this preliminary study's limitations and plans and new interventions based on the results will occur after the presentation and data analysis.

Qualitative student feedback for all cohorts, including graduated students, and those who have not yet contributed exam data but currently attend learner-centered physics courses, were collected and coded. This data has helped the author discern if the more conscious learner-centered environment's different pedagogical methods were understood, perceived as valuable, and experienced by students across varying perceived learning domains and potential outcomes. The data included unexpected results regarding students' views on their self-efficacy, perceived cultural value, and multilingual classrooms yet ultimately affirmed the learner-centered environment.

The collection of qualitative data occurred via online questionnaires with a range of numerical Likert grading scales assessing students' perceived pedagogical impact, conceptualization, motivations and understanding regarding multilingual, PBL/PjBL learner-centered pedagogy's effect on *a positive learning environment (PLE), valuation of learner-centered ideas (VLC), agency (A), preparation for the high-stakes summative exam (PFE), preparation for life (PFL), and student self-efficacy (SE); all considered core aspects of a learner-centered classroom (LCC) with the possible exception of PFE.* (Bransford et al., 2000; Calnin, 2017; Harpe et al., 2015; McLeod, 2008**;** Holt et al., 2015; Van Brockern & Wenger, 1999). Additionally, students provided feedback on their Cambridge examinations valuation, though these Likert values did not contribute to the learner-centered conceptualization averages of median scores examined in Figure 5, Figure 6, and Figure 7.

Area of Focus

Evidence-based research suggests that active learning such as PjBl and PBL may enhance other learning outcomes such as critical thinking skills, self-efficacy, motivation, and metacognitive skills while providing opportunities for STEM students to actively practice authentic scientific inquiry (Bransford et al., 2000; Calnin, 2017; Harpe et al., 2015; Oberg, 2010; Schwartz, 2012; Van Brockern & Wenger, 1999). Painter (1999) explains that applied action-based research benefits teachers, students, and the wider educational community through the systematic collection, analyses, and presentation of data to investigate a research question that can directly lead to enhanced learning outcomes through conscious pedagogical changes. The specific goal of this research is to maximize the educational results in the milieu of a developing nation through active learner-centered activities without impacting high-stakes summative examination performance, particularly Cambridge International Assessment exams in physics and other STEM subjects.

Context: Problem Statement and Background

The local teacher-centered pedagogy in Lao PDR results from the overlapping combination of politically sanctioned cultural traditions, low-resources, and past French colonial influence undervaluing critical thinking and student agency (Bunce, 2017; Lao PDR MoES, 2018). Except for the one International Baccalaureate (IB) school, and the Lycée Français, which only foreigners and elite Lao nationals attend due to their cost, rigor, and lack of focus on official Lao culture, Lao international schools teach the government's required Lao National Curriculum in the dominant ethnic Lao Loum Language concurrently, with separate immersive English, Cambridge International Assessments. The students attend two full school sessions of class each day in different languages with divergent curricula. The Lao international hybrid schools are not internationally accredited, so students who wish to attend higher education outside of Laos must rely on Cambridge examinations, or similar international assessments, to validate their learning if they cannot enroll in the expensive IB or French schools. Also, many of these English only international schools have meager expectations of the students, encouraging them to complete the IGCSE assessments in Grade 12, which British students would complete in Grade 10 before accomplishing the A-Level examinations in Grade 12 (Cambridge International, 2019). A small number of privileged graduating IGCSE Lao students are then encouraged to enter an international 'foundations course' overseas at great expense to complete A-Levels and hopefully prepare them for a foreign university, further alienating the average Lao international hybrid school student.

The students in most Lao international hybrid schools have obstacles that European Cambridge curriculum students do not, leading to inequity in outcomes and expectations in need of rectification, but with a recognition of the researcher's responsibility to avoid any significant degradation of the current status of the students, staff, and community (U.S. Department of Health, Education, and Welfare, 1979).

In the Lao National Curriculum, as mentioned, rote-learning in the mother-tongue is dominant. In some ways, this pedagogy has carried over to the tandem international curriculum, where the foreign teacher's qualification is often an unrelated bachelor's degree and native English skills, due to lack of resources for a typical qualified international educator's wage. As a result of the lack of resources, the Cambridge International Assessment curriculum courses in Laos often practice similar immersive English and summative examination drills to the rote learning Lao National Curriculum classrooms, with Cambridge International course materials intentional flexible design catering to this reality yet acknowledging that mastery requires critical thinking and creativity (O'zden, 2019). There is minimal alignment between the two curricula apart from a lack of 'best practice.' All stakeholders are disadvantaged by the lack of alignment and resources. In Lao PDR, professional development is a rarity, and the realities of life are at odds in many ways with implementing the pedagogy promoted by educational theorists, recommended but not required, by Cambridge International Assessment curriculum (O'zden, 2019). One aspect of multilingual, learner-centered environments is the increased importance of formative evaluation over summative examinations for an accurate assessment. Yet, Lao students and stakeholders of international schools have a strong desire to perform well on summative exams to enhance the otherwise inaccessible opportunities for overseas educations that would benefit individuals and build capacity in the country when the students returned.

In this unique, under-resourced environment, one must ensure that summative examinations, seen as necessary by all local stakeholders due to the international opportunities they provide, are not negatively impacted by pedagogical changes embracing active learner-centered more experiential activities such as PBL or PjBL. According to Holmes (2017), applied research not only “validates” but “enhances” basic research (p. 2). Many educational theorists and other stakeholders often question the validity of summative examinations, but they are a reality in a developing milieu, not only in Lao PDR (Kaufman et al., 2015; The Great Schools Partnership, 2014). Therefore, unlike basic research, this applied research has a practical application maximizing learning outcomes without impacting exam scores, generally undervalued in a typical learner-centered model. Looney (2011) encourages educators to find ways of integrating formative and summative assessments. Collecting, analyzing, and presenting assessment data in mixed model learning environments is utilized by this study in combination with qualitative student perceptions to clarify if PBL, PjBL, and other active learning experiential activities will be counterproductive in a developing context, therefore shaping any further pedagogical changes.

Problem Prior Interventions

Before this proposed action research intervention, various levels of active learning have been partially trialed in the author’s Grade 9-10 IGCSE and Grade 11-12 AS/A-Level physics cohorts, which the author has perceived to have positive results with regards to formative assessments of student motivation, agency, critical thinking, and summative examination scores setting the stage for this research.

While multiple studies referenced and discussed later in this proposal have found a wide-range of positive outcomes regarding learner-centered pedagogy such as PjBL, PBL, and other experiential, active learning activities, the majority are for university-level students or are from different linguistic and cultural backgrounds than the proposed participants in this study, and different exam types (Baeten et al., 2010; Beecher & Sweeny, 2008; Harpe et al., 2012). When from a similar milieu and age range, the studies do not have a primary focus on summative examination results (Darsih, 2018).

Participant Description

The student population is mostly native Lao language speakers with varied English language capability levels in every classroom; any non-Lao speakers are also English Language Learner (ELL) students from China, Korea, and other Asian countries with a tiny number of European students. The age range upon which the author based this initial study involves fifty-six current and previous age 14 to 19-year-old physics students spanning Grades 9-12 who also attended other STEM courses such as biology, chemistry, and mathematics for the qualitative study of which 18 of those students have a mix of available IGCSE and AS-Level examination scores for the quantitative comparison. The classrooms are equally mixed-gender environments. These students have chosen to take advanced A-Level physics as an elective, are highly motivated, and are generally above average compared to their classmates with mathematical and scientific capabilities, though not necessarily in English language capability, ranging from novice to fluent.

Participant Justification and Benefits

The students are chosen for their age, maturity, academic capability, and interest in STEM. Later studies can involve a broader range of student capabilities and grade-levels. The author hypothesized that the participants in this study would benefit from the pedagogical changes according to the author's preliminary incremental evaluations and the supporting research referenced throughout this proposal in the Area of Focus and the Literature Review.

The author hypothesized before this study's initial confirmational results that if the learner-centered pedagogy has no statistically significant negative effect, or a positive effect on summative exam scores, the outcome then encourages the continued utilization of PBL, PjBL, and other experiential, active learning paradigms. Positive student feedback further supports this assertion.

Learner-centered pedagogy provides potential maximization of other holistic gains beyond exam scores. The outcomes supported by evidence-based research include motivation, self-efficacy, and the facilitation of differentiated and culturally responsive positive learning environments (Baeten et al., 2010; Bransford et al., 2000; Holt et al., 2015). The goal of maximizing potential affective development and cognitive capabilities such as critical thinking and the metacognitive skills required by free agents and life-long learners should be a universal one. Whatever pedagogy evidence-based research recommends should then be facilitated to achieve these humanistic outcomes. Coding of learner-centered parameters into the qualitative measurements is in the design instruments. This study provides initial evidence of learner-centered practice meeting the performance on high-stakes exams achieved via teaching to the test. According to research, teaching to the test ultimately minimizes more self-actualized, holistic outcomes requiring differentiation, and active learning (Tomlinson & Imbeau, 2010).

More comprehensive, in-depth learning outcomes that do not interfere with high-stakes exam performance could significantly affect school-wide practice and enhance the student experience.

Literature Review

This literature review provides context and current academic consensus areas that this study initially appears to support and expand upon, rather than contest, in addition to a methodological research model for the creation of the instrumentation involved in data collection, presentation, and analyses (Kinsley, 2012). Educational environments and associated pedagogies correlate with specific outcomes. Kaput (2018) gives an American historical overview where the desired outcome by educational stakeholders was preparing citizens for efficient industrialized systems with a top-down hierarchy setting standardized "rules and procedures" for factory workers to follow; this goal corresponded with a similar hierarchy and learning environment in the classroom (p. 5). An alternative model seeking an outcome of reflective, creative, critical, independent, life-long learners possessing self-efficacy requires a pedagogy more focused on the individual's characteristics (Kaput, 2019). Learner-centered pedagogy links to constructivist models of learning influenced by educational theorists like Bandura, Bruner, Dewey, Vygotsky, and Piaget, along with psychologists in the American Psychological Association (APA) whose constructivist principles inspired education reform (Schunk, 2012, pp. 228-276). The constructivist paradigm is an evidence-based learning framework describing how diverse individuals construct new understanding through environmental interactions that lead to the synthesis of novel experiences with existing unique conceptions; this pedagogy requires differentiated or individualized teaching methods that facilitate authentic, independent inquiries by students (Bransford et al. 2000; Schunk, 2012; Kaput, 2019). In addition to a long list of sociologists, linguists, and humanistic thinkers interested in maximizing learning outcomes, neurological and cognitive researchers such as Hebb and Begley have completed evidence-based studies advocating for learner-centered models (Calnin, 2017; Schunk, 2012). If maximization of deep-learning, student self-efficacy, agency, critical thinking, creativity, metacognition, collaboration, and independent life-long learning are the desired outcomes, then student-centered pedagogy is evidenced as ‘best practice’ (Calnin, 2017; Kaput, 2019; Van Brockern & Wenger). Kaput (2019) has assembled over one hundred references from peer-reviewed, scholarly sources to support this assertion. Schwartz (2012) suggests that authentic, open-ended, student-designed, experiential, collaborative projects inquiring into problems with self-assessed and peer-assessed solutions are ideal for facilitating a learner-centered environment; this is called project-based learning. Oberg (2010) cites research that suggests authentic experiential curriculum such as PjBL, when combined with ongoing formative assessments providing feedback to the student and facilitator, can maximize performance “results on high-stakes exams,” and overall learning outcomes (p. 1). Politically, traditional high-stakes exams are popular with stakeholders that emphasize efficiency and accountability for teachers, students, and institutions whose goals do not prioritize agency and critical thinking as the desired outcome (Aydin et al., 2017). The three main assessment types according to WNCPCE (2006) are *assessment of learning* (traditional, summative, usually a written exam measuring knowledge or processes for memorization), *assessment for learning* (ongoing formative assessments where instructors observe or interact with active students and improve instruction based on individual student feedback), and *assessment as learning* (formative assessments made by students themselves or peers based on environmental and instructor feedback). According to Beecher & Sweeny (2008), active learner-centered pedagogies such as PjBL or PBL naturally utilize *assessment for learning* and *assessment as* *learning* models that provide ongoing targeted feedback for the student and teacher, found to increase learning outcomes, motivation, and self-efficacy as they provide differentiated learning opportunities for diverse students exercising agency. Beecher and Sweeny (2008) also suggest that *assessment of learning* can improve in a learner-centered paradigm, but when the summative assessment model drives a teacher-centered pedagogy, such as with the United States of America's "No Child Left Behind Act (NCLB) … achievement gaps among culturally, linguistically, ethnically, and economically diverse groups" were measured (pp. 502-504). High-stakes summative assessments do not necessarily measure the capabilities and outcomes sought by humanistic, learner-centered educators facilitating life-long learners with agency for all diverse student populations but have traditionally been used to assess hierarchical teacher-centered or knowledge-centered rote-learning environments catering to the non-existent 'average student' (Au, 2012). High-stakes summative assessments and traditional teacher-centered pedagogies are subpar at assessing diverse student populations (Aydin et al., 2017). According to Aydin et al. (2017), NCLB "has been almost universally acknowledged as a failure," with poor learning outcomes; yet, high-stakes summative examinations are here to stay, especially for students in developing nations or neighborhoods, with low resources, lack of governance, and subpar educational institutions (Aydin et al., 2017, p. 81). Despite the research suggesting the limited value of high-stakes summative assessments, such as the Cambridge International Assessment examinations, these exams are a way for international institutions to assess individual student readiness when coming from low-resource environments where the international school may lack proper accreditation and verifiable resources (O'zden, 2019). The Cambridge International Assessment examinations recommend learner-centered pedagogies as best-practice while acknowledging that these methods are not practical in every environment;

Cambridge has designed the assessments to be mostly knowledge-centered and flexible while still creating a range of written examination types with practical elements attempting to test higher-order thinking (O'zden, 2019). Researchers such as Keyes, Puzio, and Jiménez (2014) emphasize the value of leveraging multilingual students' utilization of their mother-tongue and cultural knowledge in collaborative academic environments to increase overall learning outcomes. Experiential, active learning activities, such as PjBL and PBL, allow ELL students with the same mother-tongue to scaffold one another and better leverage existing capabilities as they collaborate on authentic projects driven by their interests and personal cultural paradigms. The alternative being quietly listening to lectures in a teacher-centered environment that may prohibit the use of mother-tongue. Planas's (2014) research into the performance of small collaborative groups of bilingual STEM students "confirm the relevance of language-as-resource in the understanding of mathematics learning by students whose dominant language is not the language of instruction," which is a finding directly relevant to the majority of physics students in the author's milieu whose native tongue is Lao Loum yet learn in English (p. 64).

The following studies more directly correlate to the proposed action research questions. The first source examines challenges to learner-centered instruction in a similar low-resource South East Asian milieu. Darsih's (2018) research illuminates challenges with implementing constructivism in low-resource environments due to defined hierarchies and a deemphasis on critical thinking and agency; Darsih found success with individual teachers and cohorts yet acknowledged challenges for successful institutional pedagogical changes. Harpe et al. (2012) have very similar research to the author's as it compares the outcomes in teacher-centered vs. learner-centered statistics classrooms with an identical summative examination in a qualitative and quantitative study. The findings of Harpe et al. (2012) are somewhat inconclusive but suggest that learner-centered models do not harm summative exam performances and positively influence motivation and self-efficacy, which is further supported by the research in this paper. Keiler (2018) indicates that STEM courses must be taught in student-centered classrooms to adequately prepare students for the 21st Century problem-solving skills required in the modern workplace and that teachers' identities closely align to pedagogy; constructivist pedagogy increases teacher and student motivation and self-efficacy. Finally, Guido (2013) found that student attitudes and motivation towards learning physics are essential to success in the subject and that traditional teaching methods require alteration to promote the metacognition and problem-solving strategies fostered with constructivist pedagogy.

Harpe et al. (2012) created a useful methodological model informing this study while providing evidence, and a context, for further investigations into PBL and PjBL active learning pedagogical effects on exam outcomes. The action research study by Harpe et al. (2012) compares the results experienced by students in a learner-centered statistics course (P2), with students taking the same course utilizing a traditional pedagogy that was instruction-centered (P3). The P2 students had the agency to influence the course 'grading scheme' and had the opportunity to complete assignments of their choice. In contrast, the P3 students passively listened to lectures and could not contribute to crafting the course policies. The curriculum, syllabus, and sequence were the same for P2 and P3, including the summative course examinations. "Students' statistical self-efficacy, attitudes toward statistics, statistical knowledge, and course perceptions were measured at the beginning and end of the course also" (Harpe et al., 2012, p. 247). The data collection techniques used in the study examined both the cognitive and affective outcomes of each environment and collected demographic information.

The study compares performance on statistical knowledge examinations before and after the class to measure cognitive outcomes. The affective outcomes were measured using questionnaires given before and after the class grouped by statistical self-efficacy (two surveys CSSE and SELS), attitudes toward statistics (SATS-36) broken down into the domains of affect, cognitive competence, value and difficulty, and a course perceptions questionnaire (Harpe et al., 2012). Each survey utilized Likert rating scales with a range of numbers from 1-6 for the CSSE and SELS self-efficacy questionnaires; where 1 represents ‘no confidence’ and 6 signifies ‘complete confidence’ in the ability to understand statistical concepts (SELS) or perform statistical tasks (CSSE) (Harpe et al., 2012; Harpe, 2015). The higher the numerical sum of scores represents a higher self-efficacy. The questionnaire by Harpe et al. (2012) on student attitudes towards statistics asked questions such as: “Statistics should be a part of my professional training,” or “I will find it difficult to understand statistical concepts” (p. 249). The questions have an associated Likert rating scale ranging from 1-7 from ‘strongly disagree’ to ‘strongly agree,’ where more considerable sums indicate more positive attitudes towards the subject (Harpe et al., 2012, p. 249). Finally, students surveyed on their perceptions of learner-centered course attributes such as, “I was provided with multiple opportunities to demonstrate that I had learned the material,” with a range from 1-5 from ‘strongly disagree’ to ‘strongly agree’ (Harpe et al., 2012, p. 249). Descriptive statistics generated for all the questionnaires and data samples generate mean and median scores and percentage difference calculations informing the cumulative tabular and graphical data structures (Harpe, 2015; Trochim, 2006).

Comparative analyses of the descriptive statistics for each class occurs with a five percent threshold of difference set to define the statistical significance of one result over another in a quantifiable manner, which is called a p-value in addition to multiple parametric and non-parametric techniques (Harpe et al., 2012; Harpe 2015).

The results suggested that self-efficacy and attitudes towards statistics increased for P2 and P3, but there was no statistical difference between classes at the end. The P2 (learner-centered course) had significant increases in knowledge as the P2 students had less expertise, to begin with, despite reaching the same goal. The P2 perceptions of the class were significantly better as well, with regards to learner-centered parameters such as differentiated assessment, feedback, and agency.

The author's methodological model was informed by the research of Harpe et al. (2012). The importance of including student feedback on affective outcomes, in addition to examination scores, is evident. The statistical techniques utilized by the same author in another paper explaining Likert analyses in detail also informed this study (Harpe, 2015).

Research Questions

The following applied research questions listed below seek to investigate the overall explicit impact of multilingual active learning, experiential pedagogy on learning outcomes, both affective and those measured via high-stakes summative exams, by analyzing the pedagogical effects of multilingual learner-centered classrooms emphasizing active learning vs. monolingual examination-focused practice on Cambridge International Assessment high-stakes summative exam scores. Can active learning enhance some learning outcomes without negatively impacting high-stakes exams?

- What effect (positive, negative, or inconsequential) will different degrees of non-prescriptive, collaborative, student-led, differentiated, multilingual, active learning environments have on specific types of summative Cambridge International Assessment physics examination outcomes (IGCSE, and AS Level examinations) as compared to other pedagogical cohorts' performances, on the same physics exams taught in English-only, traditional, prescriptive, classrooms focused on learning the exam for specific time-periods prior to the exams?

- How will the same multilingual, learner-centered cohort of English Language Learner (ELL) physics students' performances compare with their examinations in other STEM subjects for specific types of summative Cambridge International Assessments IGCSE, and AS exams in physics, math, biology, and chemistry with more monolingual, prescriptive, exam-focused pedagogy?
- What are student conceptualizations and understandings of learner-centered pedagogy regarding its perceived impact on a positive learning environment (PLE), valuation of learner-centered ideas (VLC), agency (A), preparation for the high-stakes summative exam (PFE), preparation for life (PFL), and student self-efficacy (SE) within a pedagogically learner-centered classroom (LCC)?

Harm, Protection, and Removing Bias

The U.S. Department of Health, Education, and Welfare's (1979) Belmont Report emphasizes the importance of ensuring the wellbeing and minimizing any stress our harm on research participants. The Belmont Report provides guidelines for applying ethical principles when designing a study, including "informed consent, risk/benefit assessment, and the selection of subjects of research" (U.S. Department of Health, Education, and Welfare, 1979, p. 6)

Pedagogical changes can cause stress and confusion for students if not properly introduced. This stress could adversely impact examination scores, which are critical to the desired outcomes in the realities of the low resource, developing milieu. Preparing students in advance for changes with detailed explanations can mitigate this disruption and any potential harm.

As the Lao program at the school of study is almost entirely rote-learning, avoiding any insult based on bias against existing classroom techniques and student experiences is paramount to prevent harm to other staff members and students who are participating in the teacher-centered courses parallel to the learner-centered cohorts mentioned in previous participant descriptions discussed in more detail in instrumentation and data sources. By structuring the study to avoid bias, one can mitigate negative feelings towards new pedagogies, potentially improving stakeholder outcomes.

It is also of utmost importance to procure explicit consent from parents, students, and any other participants in the study in addition to administrative clearance in a formalized manner (U.S. Department of Health, Education, and Welfare, 1979, p. 6). See Appendix A, Appendix B, and Appendix C.

All the above harmful adverse outcomes require protection as detailed in the subsections below: Protection, and Bias; removing bias will not only protect participants from harm, but it also ensures the quality of the study itself and seeks to let the data collected guide the results.

Protection

The students involved in the research undergo a potentially stressful pedagogical change if uninformed that the change is coming, what the difference will be, and why it is beneficial. All participants in the study experience specifically developed lessons teaching the students ‘what, how, and why’ of learner-centered PBL classroom pedagogy, including peer-reviewed evidence supporting the research and its possible benefits. Teaching best practice educational theory, demonstrating methods, and providing proof to attain student ‘buy-in’ is a critical part of the initial first few weeks of a cohort experiencing a significant pedagogical transformation**.** Students' survey data support this endeavor's success as they demonstrate an understanding and positive conceptualization of learner-centered attributes. See Figure 5.

One could conceive that the new pedagogy may have adverse effects on the students' high-stakes summative examination scores. Adverse effects on exam scores could cause harm as these scores are especially crucial for the further education of students in a low-resource, developing environment, which is the milieu in Lao PDR (Lao PDR MoES, 2018; UNDP Lao PDR, 2015). Regardless of one's opinion of high-stakes examinations, they are a critical reality to all stakeholders in Lao PDR, and developing the capability for high-achievement on these exams is paramount. It is an optimized outcome if high exam achievement and the learner-centered results of critical thinking, self-efficacy, agency, metacognition, reflective thinking, and life-long problem-solving skills are possible. But, if learner-centered pedagogy interferes with the exam results despite other benefits, many would feel this is unacceptable harm to the students' future development opportunities, interfering with Lao capacity building. Learner-centered pedagogy involves ongoing documentation of formative assessments of student-led active inquiries daily, which in turn consists of a pivot in educational methodology to differentiate and maximize learning for all students; the pedagogy is a practice of ongoing action-research into the students' needs to achieve better educations (Lamprianu, & Athanasau, 2009). The intent has been to maximize student capability; if examinations are part of this capability, facilitating experiences to achieve this end, and any other goals, are required. According to Holt et al. (2015), the benefits of learner-centered practice are well documented and researched as well as supported by their study:

> We found a clear link between more learner-centered in-class pedagogies and improvements in students' critical thinking (Fig 3). This finding, however, is not new. Previous work in the science, education, and psychology literature has resoundingly demonstrated that more active, learner-centered approaches can improve student performance [11–16, 18], reduce failure rates [11], improve metacognition and motivation [83–84], and promote critical thinking [44, 85]. (Holt et al., p. 13)

The multitude of evidence-based research from over 100 years suggests that students can learn the necessary skills and information in a typical physics syllabus through facilitated discovery with test-taking skills creatively incorporated into projects and student-directed collaborative learning. Harpe et al. (2012) compared the outcomes in teacher-centered vs. learner-centered statistics classrooms with an identical summative examination in a qualitative and quantitative study, evidencing no statistically significant change in test scores in addition to increased motivation, self-efficacy, and student perceptions of learning. The author found that, on average, learner-centered physics students met or exceeded examination results achieving both aims; best-practice pedagogies documented benefits and performance on high-stakes exams. See Figures 1-7 and Tables 1-10.

The author's original hypothesis was that if student motivations improve and master independent, active learning, they can discover and learn the content to the degree reflected in a summative exam without necessarily being solely focused on explicitly aligned exam content. The existing research and the author's personal experience incrementally trialing learner-centered activities supported the likelihood of the positive outcome currently reflected in the initial data before undertaking the research.

Bias

It is important to consciously avoid a preconceived bias to replace rote-learning, teacher-centered, monolingual classrooms in the author's environment with a multilingual, learner-centered, PBL pedagogy, which the author has come to regard as best-practice. Educational stakeholders in Laos often conceptualize non-prescriptive pedagogy as unrealistic and counterproductive to a school's goals and the political culture. Navigating an applied research proposal requiring collaboration between groups beyond a single classroom is critical for useful data collection and the conscious affirmation of the experiences and conceptions of all staff, students, and the broader community to avoid harm and undue stress.

The research focus, in the current context, must target testing the potential positives of multilingual, student-driven, experiential, active learning activities such as PBL and PjBL, instead of explicitly comparing the pedagogy with previously assumed negatives of teacher-centered curricula, despite the necessity of differentiating between existing pedagogy and new pedagogy and many findings discussed in the literature review. Unbiased research looks at both situations equally and allows the data to speak for itself, and this study embodies this structure. The thesis, therefore, concentrated on assessing the possibility of maximizing physics and other science, technology, engineering, and math (STEM) learning outcomes via multilingual experiential learning such as PBL and PjBL, with regards to motivation, critical and metacognitive thinking, and authentic scientific inquiry without harming summative exam scores. Other school pedagogical practices' results and effects are for baseline quantitative comparison only, while qualitative investigations target the "positive" thesis.

Intervention

As the most active, learner-centered cohorts have no negative impact on high-stakes STEM exams and students describe a positive learning environment, pedagogical interventions within the physics classroom and potentially other STEM courses should proceed. Further, cross-disciplinary research is warranted. Possible interventions within STEM departments involving professional development regarding PBL, PjBL, and learner-centered pedagogy, along with mentoring by research participants of colleagues, and the formation of a working group to study ways in implementing pedagogical changes as per school policy may be warranted in the future after more data collection and analysis strengthens the current results.

Methods Instrumentation and Sources of Data

The reasoning behind the methodology

Table 13 contains the implemented data collection plan for investigating the effects of contrasting pedagogical models on high-stakes examination performance, with an additional investigation into types of Cambridge International Assessment examinations such as IGCSE and AS examinations across disciplines. Particularly Cambridge International Assessment examinations in physics and other STEM subjects such as math, biology, and chemistry. Cambridge International Assessment markets their tests as flexible with regards to pedagogical models required by diverse international milieu, but specific stakeholders in the author's learning community suggested it is not possible to cover material in the syllabus properly using student-driven experiential, active learning pedagogies such as PjBL, and PBL without impacting summative exam performance (O'zden, 2019). The table contains the applied research questions from above, the data collection instruments, where, and how data collection occurred for the proposed applied research.

This action-research methodology utilizes both qualitative and quantitative data collection techniques for analyzing learner-centered pedagogical effects on specific types of high-stakes, summative STEM exams, along with students' environmental perceptions regarding outcomes and the environment. Effectively, high-stakes summative exams are quantitative, and learner-centered teaching relies on ongoing formative qualitative and quantitative feedback for analyses by instructors and the students themselves (WNCPCE, 2006). This study seeks to align its data collection methods with the action research and the pedagogy itself**;** by aligning the mixed research methodology with a mix of pedagogy and assessment types, the author gained a more in-depth understanding of the advantages or disadvantages that pedagogy might have on summative assessments and overall learning outcomes.

The possible inferences from the qualitative and quantitative results when comparatively analyzed may improve outcomes in a learner-centered manner as the study itself is an exercise in learner-centered *assessment for learning* and *assessment as learning* techniques combined with the quantitative *assessment of learning* paradigms reflecting the hybrid models in practice (WNCPCE, 2006).

Instrumentation and Sources of Data – Quantitative Analysis of Examination Scores

Limitations

The first step consisted of gathering all available IGCSE and AS-level physics, biology, chemistry, and mathematics exam scores supplied by Cambridge for each student in *pedagogical physics cohorts* A-E (graduation years 2017-2021). Cohort E is the author's current Grade 12 physics class, and A was the author's first. Cohort E only supplied results for IGCSE exams taken in grade 10. The AS-exams only occurred in November 2020 during this study. Under normal circumstances, the data set would also include cohort F's IGCSE scores, meant to be taken in June 2020, but they were postponed until November 2020 due to COVID and will be processed and supplied in late January 2021. Regrettably, as the cohort sizes have steadily grown year by year, the missing data sets would be some of the largest. However, disruptions to regular learning such as online learning periods and delay of examinations may be another unforeseen factor affecting these results when they do finally arrive. While all physics students chose to take the actual physics exams over predicted grades, some physics students received predicted grades in other STEM courses, which the author feels would not be appropriate to include for comparison. The analysis of A-Level exam scores (consisting of the cumulative of 3 AS scores and two additional exams) underwent exclusion due to a minimal amount of available data because of COVID delays and the recent adoption of A-levels in other STEM courses, further limiting the data set.

Methods of Analyses and Classification

Specifically, the quantitative effects of learner-centered vs. teacher-centered pedagogies on scores were contrasted and compared utilizing both descriptive and inferential statistics (mean, mode, median, standard deviation, and percent difference) (Trochim, 2006). The distribution of test-scores for differing pedagogical cohorts initially suggests that learner-centered pedagogy has no adverse effect on exam performance. Tables 1-9 contain the available quantitative data summaries (median values, averages, standard deviations, and modes where applicable) of Cambridge International examination scores for all participating IGCSE and AS-Level exam-taking physics students.

The 18 learners who completed IGCSE exams between 2015 and 2019, cohorts A-E, all continued to take learner-centered AS/A-Level physics, ultimately culminating in corresponding AS level examinations in the study. Five of the physics students from cohort A and cohort B had minimal learner-centered experiences before taking their IGCSE exams (see Figure 1), with cohort B being the only physics cohort to underperform the cumulative average median of non-physics IGCSE STEM courses. These different cohorts of students (A and B vs. C, D, and E) experienced different types or amounts of classroom pedagogy, but the same physics curriculum, syllabus, and types of summative IGCSE examinations. The learner-centered AS cohorts of physics students, cohorts A-D, are compared with the same students' concurrent performance in other Cambridge International STEM subjects taught in teacher-centered environments, as are the learner-centered IGCSE cohorts C-E (See Figures 1-4). By examining percent differences between IGSE physics median exam scores and average IGCSE STEM median scores for the same cohort and comparing them to AS physics median exam scores and average AS STEM median scores, one can make inferences about performance changes. If the cohorts experiencing more learner-centered pedagogy as they progress from IGCSE to AS level have consistent influences on their percent differences, the length of exposure to learner-centered practice may correlate. Are performance gaps accentuated or minimized over time? A factor to be considered is the complexity of the exams as well. This methodology is one reason only IGCSE students that continued to AS level participated in the study.

The quantitative analyses of student scores are necessary for a quantitative assessment, such as high-stakes summative exams. The bar charts in Figures 1-4 allow a large dataset for various types of written test results to be presented graphically for descriptive purposes; the descriptions clarify the inferential analyses regarding the effect of pedagogy on the summative exam scores providing more insight than merely a table of values (Trochim, 2006)

Instrumentation and Sources of Data – Qualitative Learner-Centered Student Survey

Methods of Analyses and Classification

Tables 10-12 contain the coded, qualitative questions regarding learner-centered conceptualizations collected via online surveys utilizing Google Forms. The qualitative data was quantified using Likert scales that allow a numerical value to be assigned, assessing an overall favorable or unfavorable value regarding understanding, importance, and relevance of the students' learner-centered experiences. The author constructed questions so that affirmative responses result in a higher learner-centered value (Harpe et al., 2012; Harpe, 2015). See Figures 5-7 in addition to Table 10.

According to CSU Long Beach (n.d.), qualitative student data will provide more in-depth insight over simple quantitative exam score distributions by giving the students a voice in their pedagogical experience. The qualitative questionnaires using numbered Likert grading scales allow researchers to quantify and compare student qualitative observations (Harpe, 2015). Qualitative data can supplement quantitative comparisons of examination outcomes for competing pedagogical models. The qualitative survey querying the students on their conceptualizations of learner-centered pedagogy was critical in assessing the environmental impact on students' perceptions regarding understanding and value. According to CSU Long Beach (n.d.), research utilizing qualitative data collection methods allows participants to shape and share the study's meaning.

The author suggests a learner-centered study should attempt to include qualitative learner-centered research along with quantitative analysis. The questions in Table 10 and Figure 5 seek to evaluate students' opinions for each pedagogy regarding its impact on *a positive learning environment (PLE), valuation of learner-centered ideas (VLC), agency (A), preparation for the high-stakes summative exam (PFE), preparation for life (PFL), and student self-efficacy (SE) within a pedagogically learner-centered classroom (LCC).* In the future, improved versions of this questionnaire can be given at each term's end and after the summative examinations as an ongoing learner-centered assessment to pivot instruction for an individual cohort. The data were analyzed both as a cumulative data set encompassing all cohorts and then evaluated cohort by cohort. Each cohort's data aligned with the other cohorts despite differences in student age and learner-centered experience; though, a mild increase of affirmative responses correlated with exposure and age. See Tables 10-12 and Figures 5-7.

Limitations

Likert scales have the benefit that they allow qualitative data to be quantified, but there is always the risk that the questions will be misunderstood, especially by ELL students. Most surveys occurred during class-time, and confusion could be clarified, apart from the participating graduates. Coding affirmative responses to positive learner-centered conceptualizations resulted in some questions using negated structures, potentially confusing some ELL students. As is the nature of qualitative data, some questions may have multiple meanings or overlap codes. There is a certain amount of unavoidable subjectivity with data of this type, especially in multicultural environments.

Data Analysis – Examination Scores

Cohort A and Cohort B (Graduation years 2017 and 2018) have provided learner-centered AS level scores experiencing one year (cohort A) and two years (cohort B) of mild learner-centered instruction, respectively. Associated IGCSE exams are linked with exam-focused, traditional learning environments only for cohort A and cohort B. Students in cohorts A and B had confirmed only participating in prescriptive, virtual physics labs before their IGCSE exams with no collaborative active learning activities and reported being discouraged from speaking in their native tongues (mostly Lao language) during class time.

Cohort C received one year of learner-centered physics activities before completing their IGCSE exams, and three years, including Grade 10, preceding AS examinations.

Cohort D students participated in learner-centered activities from Grade 9 to Grade 12 with a steady increase in learner-centered activities and more specific training in learner-centered pedagogy independent of the physics curriculum. Students who did not choose to continue with A-level physics after Grade 10 were not included in the cohort IGCSE averages or AS level exam scores. Cohort E has participated in three and a half years of learner-centered physics and has recently (2020) completed their AS exams with results pending and only contributed their IGCSE scores. The median, average exam score value for each cohort, the standard deviations for each subject, and a cumulative STEM score were also generated by averaging the medians for math, biology, and chemistry. In cases with enough data, recording of the mode value occurred. With the standard deviation, a better understanding of the spread and diversity of scores can occur.

In all cases, physics cohorts that received at least one year of learner-centered activities preceding an IGCSE or AS examination met or exceeded the combined STEM average median per cohort and in a cumulative average of all cohorts' results (See Figures 1-4).

Cohort A, consisting of two physics students, exceeded the average median STEM scores in both IGCSE without any learner-centered physics pedagogy preceding the exam, and in AS STEM with one year of mild learner-centered physics pedagogy preceding the physics exam. The IGCSE physics median of 3.5 outperformed the IGCSE STEM average median of 3 by 15.3% for the two students' four STEM exams compared to their two physics scores. When the four AS STEM scores contribute to an AS STEM average median of .5 is compared to the two physics scores median of .75, the percent difference is 40% in favor of learner-centered physics.

An increase in performance favored learner-centered physics over the courses with minimal focus on active learning activities. See Table 1(IGCSE) and Table 6 (AS-Level). This data set is relatively small and not as relevant when examined alone.

Cohort B, consisting of three students, which received no learner-centered activities preceding the IGCSE exam, was the only cohort where their physics average median of 2, *underperformed* the IGCSE STEM average median of 2.7 for six IGCSE STEM exams by 29.8%. When taking AS exams, after one and a half years of learner-centered activities, Cohort B, with an average AS median of 1, exceeded the STEM average median of .75 for six exams by 28.6% on the much more challenging AS exams. The cohort went from underperforming to overperforming the STEM average median after exposure to learner-centered activities. See Table 2 (IGCSE) and Table 7 (AS-Level) along with Figures 1-4.

After one year of learner-centered physics instruction, Cohort C's median physics IGCSE score of 3.5 (two exams for two students) was equal to the STEM average of medians (six exams for the same two students), equaling 3.5. After two more years of learner-centered physics instruction, Cohort C scored a median value of 2, which outperformed the average median STEM AS-Level score of 1.25 by 46.2%. See Table 3[IGCSE] and Table 8 [AS Level] and Figures 1-4.

Cohort D, consisting of four physics students, outperformed the IGCSE STEM average of median scores valued at 2.3 for nine exams, with a learner-centered physics median of 2.5 for the four physics exams. An 8.3% difference, still significant as it exceeds 5% (Harpe et al., 2012; Harpe 2015). Cohort D achieved an equal score to the STEM average of AS-Level Medians of 1 for six exams. While individually outperforming their own AS chemistry scores by 28.6% and AS biology by 120%. Exceptionally high scores on mathematics, the least similar STEM subject lacking in any practical type exam, raised the AS STEM group's average median to parity with AS physics. Large standard deviations for this cohort also demonstrate the range of student capabilities within the cohort.

Cohort E, consisting of seven students, achieved a median IGCSE physics score of 3 for seven physics exams, with a mode equal to 4 that outperformed their STEM scores incorporated into the IGCSE STEM average median of 2.3 for nineteen STEM exams, by 26.4%. See Table 5 and Figure 1.

When comparing an overall average median across all learner-centered physics cohorts to individual cross-cohort median averages for biology, chemistry, math, and the combined STEM score for the same students, learner-centered physics exceeds all subjects apart from mathematics exceeding the STEM score for all cohorts in both IGCSE and AS-level exams. IGCSE STEM has an average median score of 2.7 that is outperformed by the physics average median score of 3, with 1-2 full years of learner-centered physics per cohort resulting in a percent difference of 10.5% in favor of learner-centered physics comparing the average of thirty-three STEM median scores with the thirteen physics students' average median of their thirteen scores.

After 1-3.5 years of learner-centered physics per cohort, the average median AS physics score of 1.2 outperforms the AS STEM average median score's value of .75 overall. The increase results in a percent difference of 46.2% in favor of learner-centered physics with respect to the average median of nineteen AS STEM scores in biology, chemistry, and mathematics. See Figure 2 and Figure 4.

According to the cumulative and individual cohort data, learner-centered physics does not negatively impact examination scores in IGCSE or AS-Level physics as students' physics scores exceed their other scores in STEM. The current trend (with the caveat of many small datasets) suggests examination outcomes improve as a cohort experiences more learner-centered years or increases in age. Three out of four cohorts overwhelmingly improve performance, including when cohorts IGCSE and AS scores comparisons combine into one larger dataset.

Data Analysis – Learner-Centered Survey Scores

Fifty-six students across cohorts A (graduated 2017) to H (graduating 2024) all answered the learner-centered survey questions detailed in Table 10 and Figure 5 to assess their learner-centered conceptualizations with regards to an understanding of learner-centered concepts (VLC, PFL, PFE, A), favorability towards these concepts (VLC, PFL, PFE), and experiences within the physics classroom (PLE, A, PFE, SE, LCC). The average median and mode for the entire dataset across all questions result in a mode value of 4 (Agree) and a median value of 4, suggesting that overall, students agree across cohorts with a positive conceptualization of learner-centered pedagogy regarding their experiences, favorability, and understanding. No median or mode values for any single question are below 3 (Neutral/Uncertain). See Figure 5 and Table 10.

When the same cumulative median survey score across questions is calculated by cohort, as in Figure 6 and Figure 7, no cumulative score lies below 3.7. The percent difference between the maximum and minimum cohort scores of 4.43 for cohort B and 3.71 for cohort E is 17.7%. If one examines Figure 7 and Table 11, a slight peak occurs as one moves from cohort H to the right and cohort A to the left. Cohorts A and H have the least amount of exposure to learner-centered pedagogy in the classroom, which increases towards the center of the graph. A minor upward trend in overall favorability corresponds to learner-centered exposure with an additional bump for age seen with cohort A. As cohort A corresponds to a Grade 12 class and cohort H corresponds to a Grade 9 class, it suggests that the students' ages and experiences may also contribute to their favorability for, and acceptance of, learner-centered pedagogy due to the higher initial value in the trendline.

When examining the individually coded groups of questions, some exciting clusters appear unexpectedly in the complete data set and remain consistent across individual cohort data. Though no median or mode scores fall below 3 in the cumulative scoring for all cohorts, the lowest consistently clustered scores pertain to student self-efficacy and agency with neutral or uncertain student evaluations. See Table 10 and Table 12. While the students reliably agree on an overall positive inclination towards a classroom that encourages agency, their confidence in being able to solve problems on their own, independently learn new things, and surprisingly, in managing their own time are steadily some of the lowest scores in every cohort with a neutral or undecided answer. See Table 12. Also, students in every cohort regularly were undecided if their culture was valued, and a significant amount strongly disagreed over the importance of speaking their native tongue in the classroom. Students seemed to desire more one-on-one and small group learning activities. Ultimately, the author considers it positive if students want more learner-centered activities.

A smaller group of students were unsure if their physics class opinion had improved, but this was not a very clearly defined question. The author queried many students who claimed that they knew they would like physics from the start. This group may be inclined towards STEM, as evidenced by their heavy load of STEM courses. Another question with a neutral median of 3 across many cohorts showed a lack of solid affirmation of the value of assignments that contained no explicit physics content as helpful for physics (The example given was studying COVID gradients). Many of the opinions critical of learner-centered practice were taken by younger cohorts with little experience. The above overall uncertainty is reflected by the cohorts' median values' alignment with the cumulative median values. See Table 12. Other cohorts had some uncertainty specific to their group, which is reflected in their median being below that of the combined median and seems to be unique to a few individuals within a cohort instead of systematic uncertainty across cohorts.

Cohort D is an anomaly in many ways, but there are some reasons for this. The first Grade 9 cohort to experience the school's learner-centered model underperforms despite graduating after four years of learner-centered physics. Two possible explanations suggested by the author are that the first learner-centered cohort received less conscious and consistent guidance in the "how" and the "why" of active learner-centered environments than other later cohorts that benefitted from their initial uneasy experience, which may have persisted. This cohort is deeply affected by graduating during COVID. The current limitations on their future regarding travel and university outside Laos have shattered many of their plans. They are taking a survey at a particularly miserable time devoid of options; many have expressed the uselessness of their hard work. Lao students are at a disadvantage, to begin with, even those with resources; the pandemic has exacerbated their challenges.

Discussion of Findings and Areas of Future Study

Findings - Interpretation of Results

The initial research results lack a negative statistical effect on examination scores. Combined with the positive survey results, they support the assertion that STEM classrooms should consider active and experiential learner-centered tools such as PjBL and PBL to increase motivation, self-efficacy, and student satisfaction within a positive learning environment as these benefits ultimately can coincide with achievement on high-stakes summative examinations (Holt et al., 2015). While specific survey scores were noticeably lower than others, such as those coded with self-efficacy, most scores were not below three, even for individuals. A neutral view is not necessarily a negative one. Still, student conceptualizations of self-efficacy require investigation. It is possible, the emphasis on collaborative learning has caused the students to feel unsure about their individual capabilities and may be due to the wording of the questions. Lao culture is a collaborative one. The students' inclinations to merge with the whole group may be incorrectly masking confident problem-solving, self-management, and agency capability.

As learner-centered pedagogy potentially achieves many other constructive outcomes beyond success with high-stakes examinations such as motivation, self-efficacy, critical thinking, and metacognitive skills in addition to affective, cognitive, and even psychomotor development necessary for life-long learning, not impacting exams negatively is a justification for use (Holt et al., 2015). The author explored what effect non-prescriptive, student-led, differentiated, multilingual, active learning activities such as PjBL and PBL have, if any, on exams and found no significant negative influence in this initial study. Initial results suggest that a more extended learner-centered experience can improve examination performance relative to non-learner-centered pedagogy. Additionally, the accompanying student survey suggests learner-centered environments align with important positive outcomes according to the students. Interestingly, the vast majority of students do not value their multilingual environment. The author wonders if the "common sense" view standard in Asia equating immersive English with best practice that contradicts research, such as Planas (2014) and Keyes et al. (2014) should be engaged in the community. Another finding requiring exploration is the uncertainty around the valuation of one's culture in the classroom. The anonymous data structure may still support the assertion that individuals' abundance of neutral scores in this area may coincide with European, Chinese, Korean, Japanese, and Filipino minorities in the classroom as extensive Lao cultural opportunities seem to be abundant. Some students, when informally queried, thought physics had nothing to do with cultural activities. Though, the author may be making some cultural mistakes also. This area also warrants further investigation. The author will investigate these areas further in the spirit of increasing outcomes via *assessment for learning* feedback loops (WNCPCE, 2006).

Areas of Future Study

More data is needed. The ongoing collection of examination scores from different pedagogical cohorts for specific types and subjects of summative Cambridge International Assessments such as IGCSE and AS exams should also include the additional two exam-types culminating in the A-Level certification when appended to AS scores. Some of the various Cambridge International tests for each subject are Multiple-choice, Theory, Practical, Structured Questions, and Planning and Evaluation. Further research into the performance on specific exam-types that may be affected differently by pedagogical changes is warranted. The current data sets for advanced AS and A-Level exams were too sparse due to COVID restrictions and delays to examine granular test types adequately. Still, the present study provides confidence that future, more expansive datasets may continue to support the learner-centered paradigm within an environment that values high-stakes examinations. Student conceptions of self-efficacy and multilingual learning environments require exploration and relevant multicultural activities in the physics classroom.

Conclusion

This action research involved detailed analyses of physics students' particular Cambridge International Assessment exam outcomes in multilingual, collaborative, learner-centered, active learning environments compared to similar STEM subjects and past student performance on the same exams under more exam-focused pedagogical models. The exploration of qualitative student data assessing other possible positive student outcomes affecting motivation, agency, critical thinking, relevance to current and life-long learning goals, and self-efficacy constitutes a second component of the investigation. Previous research on the effect of multilingual, learner-centered pedagogy and PBL and PjBL on high-stakes summative physics assessments is limited to inconclusive analyses of other STEM subjects suggesting continued research, professional development, and eventual pedagogical interventions. Suppose this ongoing research indicates that summative high-stakes assessments are not impacted negatively, especially in the low-resource milieu. In that case, collaborative, multilingual active learning activities such as PjBL and PBL are likely to benefit all participants and should be researched further with more comprehensive operational implementation to maximize outcomes.

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Figure 1

IGCSE Exam Data by Cohort A-E

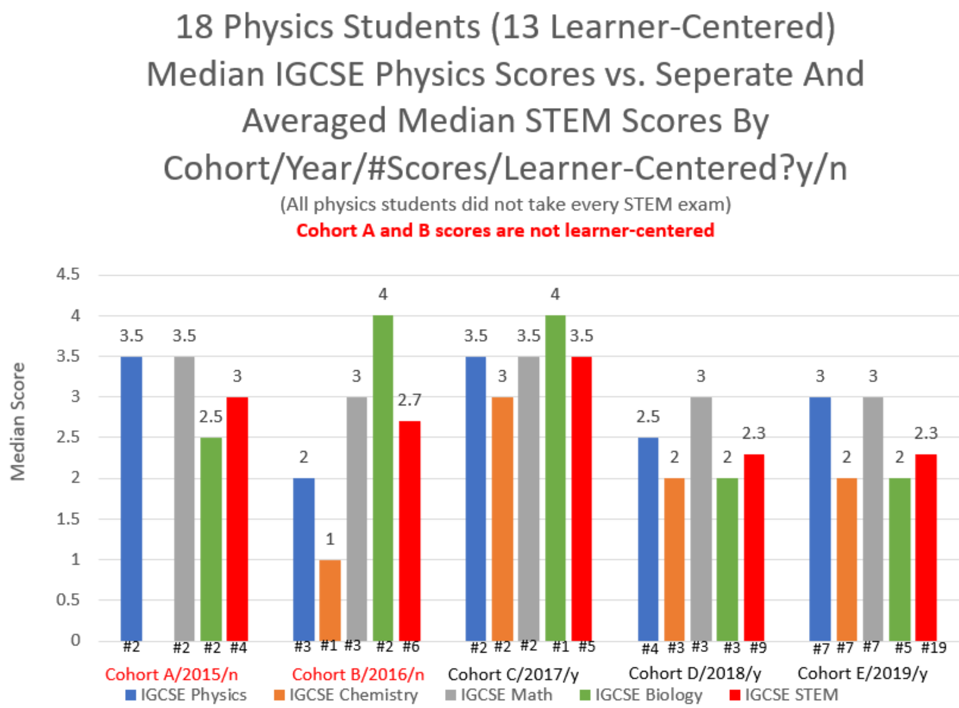


Figure 2

Cumulative IGCSE Exam Data for Learner-Centered Physics Cohorts C-E

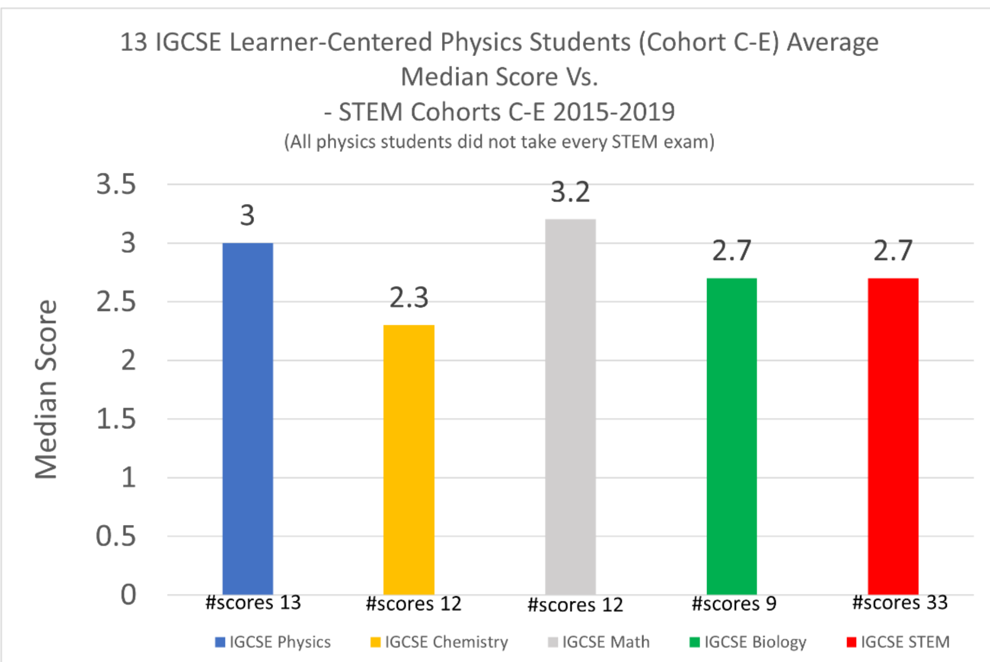


Figure 3

AS Exam Data by Cohort A-D

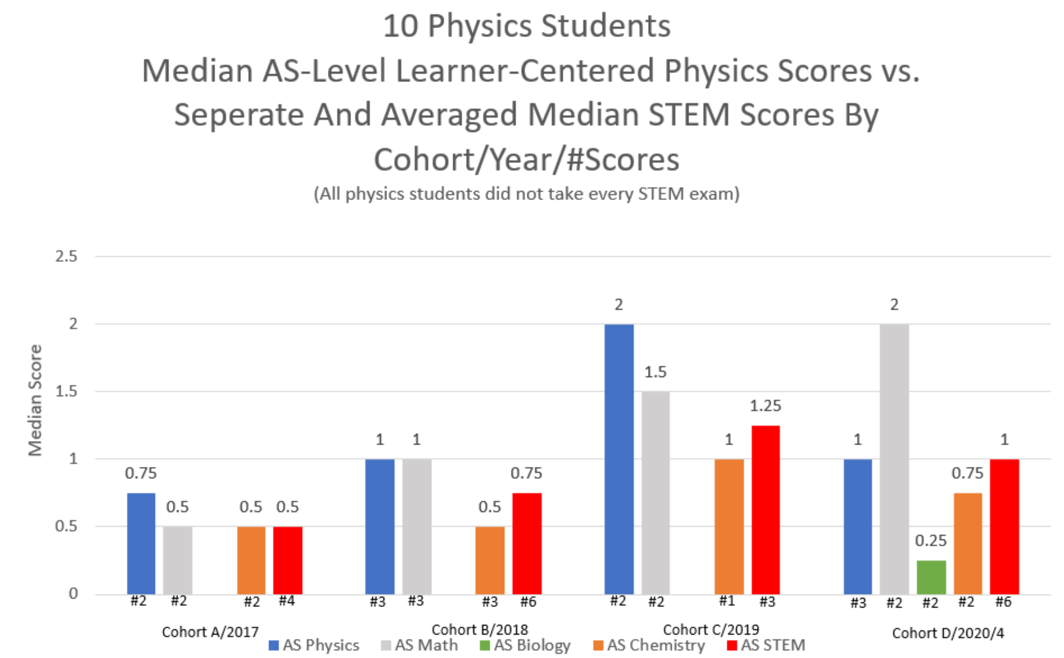


Figure 4

Cumulative AS Exam Data for Learner-Centered Physics Cohorts A-D

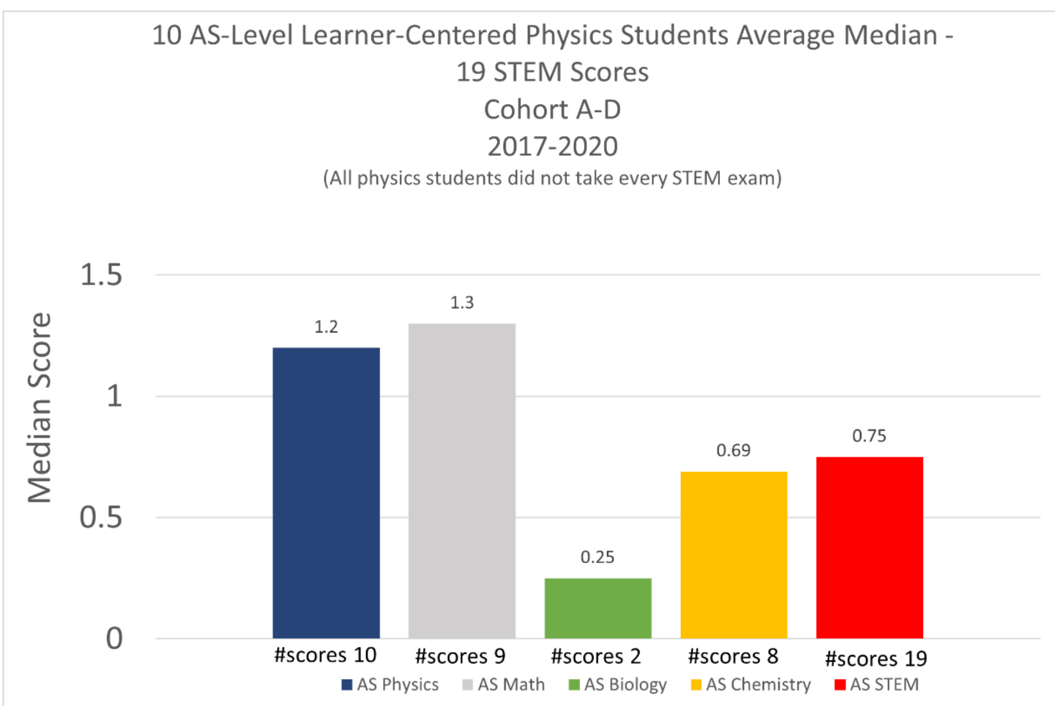


Figure 5

Student Learner-Centered Conceptualizations Survey

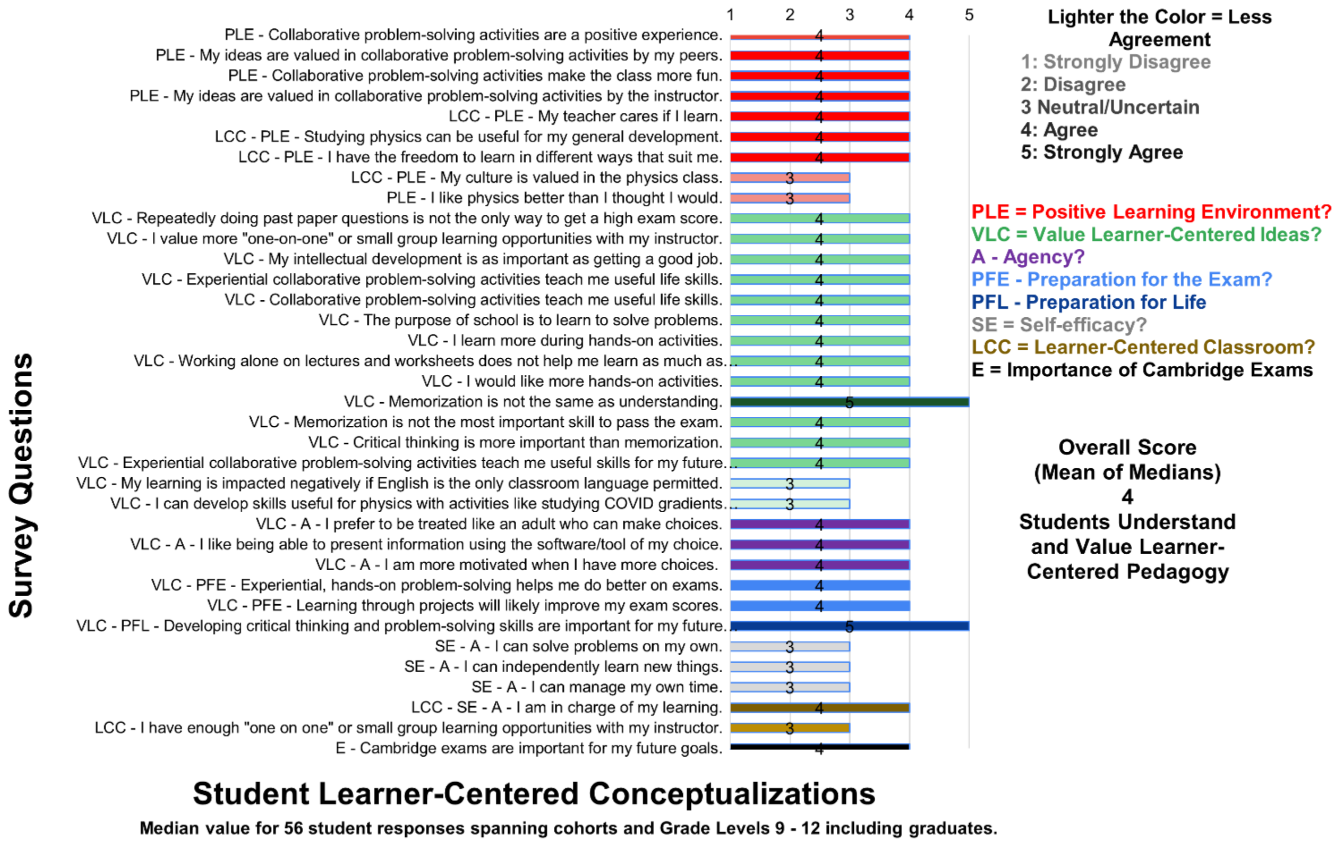
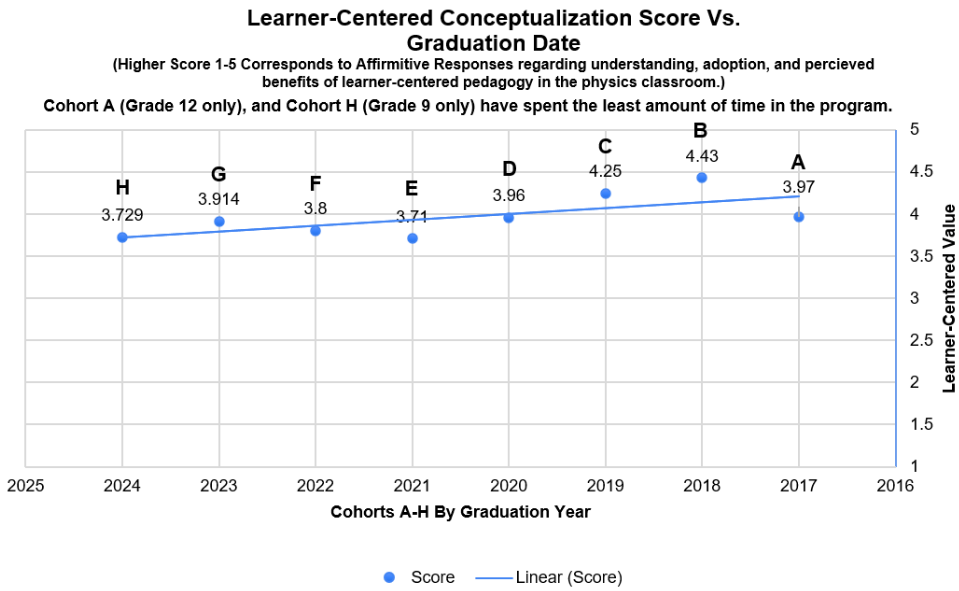


Figure 6

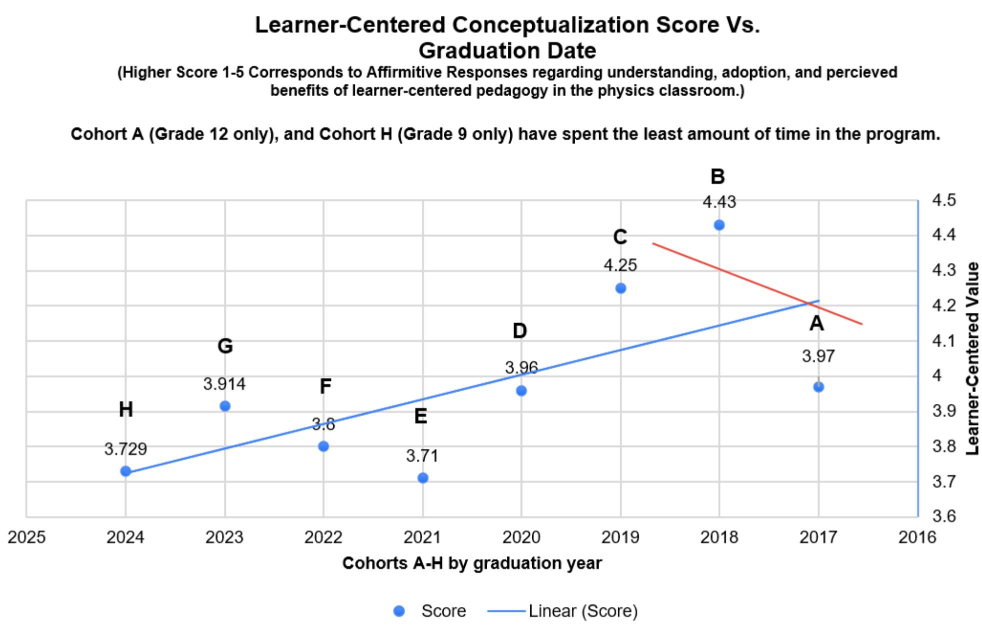
Average Median Student Learner-Centered Scores Per Cohort



Note. Scores above 3 suggest positive conceptualizations.

Figure 7

Student Learner-Centered Scores Increase with Exposure



Note**.** Cohort A (Grade 12) and Cohort H (Grade 9) have spent one year only in the program.

Table 1

*IGCSE Data Analyses for Cohort A *not learner-centered prior to IGCSE exams*

Letter Grade/Score A*/4.5, A /4, B/ 3, C/ 2, D /1, E /.5, F /.25, G/ .1, U/ 0.

Cohort/Test Year/ Learner-Centered Terms at Exam /Graduation Year	**Subject/Grade Level**	**Scores: Average/Median/Mode/Std Dev**	**Number of Scores**
A/2015/0/2017	IGCSE Physics/10	3.5/**3.5**/None/0.7	2
A/2015/0/2017	IGCSE Chemistry/10	NA	0
A/2015/0/2017	IGCSE Biology/10	2.5/2.5/None/0.7	2
A/2015/0/2017	IGCSE Math/10	3.5/3.5/None/0.8	2
Standard Deviation Physics Vs. STEM Average Medians	**0.35**	**STEM Average of Medians For Biology, Chemistry, Math/Number of Scores**	**3/4**

Raw Scores Source: Cambridge International Examinations

Table 2

*IGCSE Data Analyses for Cohort B *not learner-centered prior to IGCSE exams*

Cohort/Test Year/ Learner-Centered Terms at Exam /Graduation Year	**Subject/Grade Level**	**Scores: Average/Median/Mode/Std Dev**	**Number of Scores**
B/2016/0/2018	IGCSE Physics/10	2.3/**2**/None/1.5	3
B/2016/0/2018	IGCSE Chemistry/10	1.0/1.0/None/0	1
B/2016/0/2018	IGCSE Biology/10	3.5/4.0/None/0.7	2
B/2016/0/2018	IGCSE Math/10	2.5/3.0/None/2.3	3
Standard Deviation Physics Vs. STEM Average Medians	**0.47**	**STEM Average of Medians For Biology, Chemistry, Math/Number of Scores**	**2.7/6**

Raw Scores Source: Cambridge International Examinations

Table 3

IGCSE Data Analyses for Cohort C

Cohort/Test Year/ Learner-Centered Terms at Exam /Graduation Year	Subject/Grade Level	Scores: Average/Median/Mode/Std Dev	Number of Scores
C/2017/1/2019	IGCSE Physics/10	3.5/**3.5**/None/0.7	2
C/2017/0/2019	IGCSE Chemistry/10	3/3/None/1.4	2
C/2017/0/2019	IGCSE Biology/10	4.0/None/None/None	1
C/2017/0/2019	IGCSE Math/10	3.5/3.5/None/0.7	2
Standard Deviation Physics Vs. STEM Average Medians	**0**	**STEM Average of Medians For Biology, Chemistry, Math/Number of Scores**	**3.5/5**

Raw Scores Source: Cambridge International Examinations

Table 4

IGCSE Data Analyses for Cohort D

Cohort/Test Year/ Learner-Centered Terms at Exam /Graduation Year	Subject/Grade Level	Scores: Average/Median/Mode/Std Dev	Number of Scores
D/2018/2/2020	IGCSE Physics/10	2.6/**2.5**/None/1.5	4
D/2018/0/2020	IGCSE Chemistry/10	2.8/2.0/2/1.4	3
D/2018/0/2020	IGCSE Biology/10	2.8/2.0/2//1.4	3
D/2018/0/2020	IGCSE Math/10	3.2/3.0/None/1.3	3
Standard Deviation Physics Vs. STEM Average Medians	**0.12**	**STEM Average of Medians For Biology, Chemistry, Math/Number of Scores**	**2.3/9**

Raw Scores Source: Cambridge International Examinations

Table 5

IGCSE Data Analyses for Cohort E

Cohort/Test Year/ Learner-Centered Terms at Exam /Graduation Year	Subject/Grade Level	Scores: Average/Median/Mode/Std Dev	Number of Scores
E/2019/2/2021	IGCSE Physics/10	2.5/**3**/4/1.4	7
E/2019/2/2021	IGCSE Chemistry/10	2.2/2.0/3/1.2	7
E/2019/2/2021	IGCSE Biology/10	2.4/2.0/2//0.55	5
E/2019/2/2021	IGCSE Math/10	2.9/3.0/4/1.4	7
Standard Deviation Physics Vs. STEM Average Medians	**0.47**	**STEM Average of Medians For Biology, Chemistry, Math/Number of Scores**	**2.3/19**

Raw Scores Source: Cambridge International Examinations

Table 6

AS Data Analyses for Cohort A

Letter Grade/Score A /4, B/ 3, C/ 2, D /1, E /.5, F /.25, G/ .1, U/ 0.

Cohort/Test Year/ Learner-Centered Terms at Exam /Graduation Year	Subject/Grade Level	Scores: Average/Median/Mode/Std Dev	Number of Scores
A/2017/1/2017	AS Physics/12	0.75/0**.75**/None/0.35	2
A/2017/0/2017	AS Chemistry/12	0.5/0.5/None/0	2
A/2017/0/2017	AS Biology/12	NA	0
A/2017/0/2017	AS Math/12	0.5/0.5/None/0.7	2
Standard Deviation Physics Vs. STEM Average Medians	**0.18**	**STEM Average of Medians For Biology, Chemistry, Math/Number of Scores**	**0.5/4**

Raw Scores Source: Cambridge International Examinations

Table 7

AS Data Analyses for Cohort B

Cohort/Test Year/ Learner-Centered Terms at Exam /Graduation Year	**Subject/Grade Level**	**Scores: Average/Median/Mode/Std Dev**	**Number of Scores**
B/2018/2/2018	AS Physics/12	1.8/**1.0**/None/1.9	3
B/2018/0/2018	AS Chemistry/12	0.5/0.5/None/.5	3
B/2018/0/2018	AS Biology/12	NA	0
B/2018/0/2018	AS Math/12	1.5/1.0/None/1.3	3
Standard Deviation Physics Vs. STEM Average Medians	**0.18**	**STEM Average of Medians For Biology, Chemistry, Math/Number of Scores**	**0.75/6**

Raw Scores Source: Cambridge International Examinations

Table 8

AS Data Analyses for Cohort C

Cohort/Test Year/ Learner-Centered Terms at Exam /Graduation Year	**Subject/Grade Level**	**Scores: Average/Median/Mode/Std Dev**	**Number of Scores**
C/2019/3/2019	AS Physics/12	2/**2.0**/2/0	2
C/2019/0/2019	AS Chemistry/12	1.0/None/None/None	1
C/2019/0/2019	AS Biology/12	None/None/None/None	0
C/2019/0/2019	AS Math/12	1.5/1.5/None/0.7	2
Standard Deviation Physics Vs. STEM Average Medians	**0.53**	**STEM Average of Medians For Biology, Chemistry, Math/Number of Scores**	**1.25/3**

Raw Scores Source: Cambridge International Examinations

Table 9

AS Data Analyses for Cohort D

Cohort/Test Year/ Learner-Centered Terms at Exam /Graduation Year	Subject/Grade Level	Scores: Average/Median/Mode/Std Dev	Number of Scores
D/2020/4/2020	AS Physics	1.8/**1.0**/None/1.9	3
D/2020/0/2020	AS Chemistry	0.75/0.75/None/1.4	2
D/2020/0/2020	AS Biology	0.25/0.25/None/0.35	2
D/2020/0/2020	AS Math	2 /2/None/1.4	2
Standard Deviation Physics Vs. STEM Average Medians	**0**	**STEM Average of Medians For Biology, Chemistry, Math/Number of Scores**	**1.0/6**

Raw Scores Source: Cambridge International Examinations

Table 10

Student Learner-Centered Survey

Questions Please answer the questions: *1 Strongly Disagrees,* *2 Disagrees,* *3 Undecided or Neutral,* *4 Agrees* *5 Strongly Agrees.*	**Codes** *PLE = Positive Learning Environment?* *VLC = Value Learner-Centered Ideas?* *A - Agency?* *PFE - Preparation for the Exam?* *PFL - Preparation for Life?* *SE = Self-efficacy?* *LCC = Learner-Centered Classroom?* *E = Importance of Cambridge Exams?*	**Median Score** *Median Cumulative Score for Cohorts A-G, consisting of 56 Grade 9-12 students age 14-19*	**Mode** *The most common score*
1. Collaborative problem-solving activities are a positive experience.	**PLE**	4-Agree	4
2. My ideas are valued in collaborative problem-solving activities by my peers.	**PLE**	4-Agree	4
3. Collaborative problem-solving activities make the class more fun.	**PLE**	4-Agree	5
4. My ideas are valued in collaborative problem-solving activities by the instructor.	**PLE**	4-Agree	4
5. My teacher cares if I learn.	**LCC-PLE**	4-Agree	4
6. Studying physics can be useful for my general development.	**LCC-PLE**	4-Agree	4
7. I have the freedom to learn in different ways that suit me.	**LCC-PLE**	4-Agree	4
8. My culture is valued in the physics class.	**LCC-PLE**	3- *Undecided or Neutral*	3
9. I like physics better than I thought I would.	**PLE**	3- *Undecided or Neutral*	3
10. Repeatedly doing past paper questions is not the only way to get a high exam score.	**V*LC***	4-Agree	4
11. I value more “one-on-one” or small group learning opportunities with my instructor.	**V*LC***	4-Agree	4

12.	My intellectual development is as important as getting a good job.	**V*LC***	4-Agree	4
13.	Experiential collaborative problem-solving activities teach me useful life skills.	**V*LC***	4-Agree	4
14.	Collaborative problem-solving activities teach me useful life skills.	**V*LC***	4-Agree	4
15.	The purpose of school is to learn to solve problems.	**V*LC***	4-Agree	4
16.	I learn more during hands-on activities.	**V*LC***	4-Agree	4
17.	Working alone on lectures and worksheets does not help me learn as much as collaborating with others in “real-world activities.”	**V*LC***	4-Agree	4
18.	I would like more hands-on activities.	***VLC***	4-Agree	3
19.	Memorization is not the same as understanding.	**VLC**	5- *Strongly Agree*	5
20.	Memorization is not the most important skill to pass the exam.	**VLC**	4-Agree	4
21.	Critical thinking is more important than memorization.	**VLC**	4-Agree	5
22.	Experiential collaborative problem-solving activities teach me useful skills for my future study and career.	**VLC**	4-Agree	4
23.	My learning is impacted negatively if English is the only language permitted in the classroom.	**VLC**	3- *Undecided or Neutral*	3
24.	I can develop skills useful for physics with activities like studying COVID gradients around the world.	**VLC**	3- *Undecided or Neutral*	3
25.	I prefer to be treated like an adult who can make choices.	**VLC - *A***	4-Agree	4
26.	I like being able to present information using the software/tool of my choice.	**VLC - *A***	4-Agree	3
27.	I am more motivated when I have more choices.	**VLC - *A***	4-Agree	5
28.	Experiential, hands-on problem-solving helps me do better on exams.	**VLC - *PFE***	4-Agree	4
29.	Learning through projects will likely improve my exam scores	**VLC - *PFE***	4-Agree	4
30.	Developing critical thinking and problem-solving skills are important for my future goals.	**VLC - *PFL***	5- *Strongly Agree*	5

31. I can solve problems on my own.	**SE-A**	3- *Undecided or Neutral*	3
32. I can independently learn new things.	**SE-A**	3- *Undecided or Neutral*	3
33. I can manage my own time.	**SE-A**	3- *Undecided or Neutral*	3
34. I am in charge of my learning.	**LCC-SE-A**	4-Agree	4
35. I have enough "one on one" or small group learning opportunities with my instructor.	**LCC**	3-Undecided or Neutral	3
36. Cambridge exams are important for my future goals.	**E**	4-Agree	4
All questions are required and limited to one answer		**Overall Median Score: 4**	**Overall Mode Score: 4**

Source: Online Surveys Per Cohort [A-G] Created Using Google Forms

Table 11

Cumulative Median Learner-Centered Survey

Scores by Cohort/Graduation Year

Cohort	Cumulative Score	Length of Learner-Centered Pedagogy in School Years
A 2017	3.97	1
B 2018	4.43	2
C 2019	4.25	3
D 2020	3.96	4
E 2021	3.71	3.5
F 2022	3.80	2.5
G 2023	3.91	1.5
H 2024	3.73	.5
Max/Min %Diff=17.7%		

Source: Individual Cohort Responses

Table 12

Student Learner-Centered Survey Questions Median Below 3.5 across cohorts

Questions	Cohort/Median < 3.5 /Mode	Median All Cohorts	Code
My learning is impacted negatively if English is the only language permitted in the classroom.	**A/3/3; B/3/0; C/2/2; D/1/1; E/3/3; F/2.5/3; G/2/1; H3/1**	3	VLC
I can develop skills useful for physics with activities like studying COVID gradients around the world.	**B/3/3; D3/3; E3/3; F/3/3; G/3/3; H3/3**	3	VLC
I can manage my own time.	**A/3/3; B/3/3; E3/2; F3/4; G3/1; H3/3**	3	SE-A
I can solve problems on my own.	**B/3/3; D3/3; F/3/3; G/3/3; H3/3**	3	SE-A
I have enough "one on one" or small group learning opportunities with my instructor.	**A/3/3; D3/3; E2/2; G3/2; *H3/3***	3	LCC
My culture is valued in the physics class.	**A/3/3; E3/3; F/3/3; G3/3; H/3/3**	3	LCC-PLE
I can independently learn new things.	**B/3/0; G/3/3; H3/3**	3	SE-A
Cambridge exams are important for my future goals.	**A/3/3; B/3/0; C3/3; D2/1**	4	E
I like physics better than I thought I would.	**D/3/3; G/3/3; H3/3**	3	PLE
Learning through projects will likely improve my exam scores	**E/3/2; G3/3; H3/3**	4	VLC-PFE
My ideas are valued in collaborative problem-solving activities by the instructor.	**E/3/3; H/3/3**	4	PLE
The purpose of school is to learn to solve problems.	**E/2/2; *H3/1***	4	V*LC*
I am in charge of my learning.	**E/3/2; H3/3**	4	LCC-SE-A
Working alone on lectures and worksheets does not help me learn as much as collaborating with others in "real-world activities."	**E3/2; F3/4**	4	V*LC*

I would like more hands-on activities.	**C/3/3; F/3/3**	4	VLC
I am more motivated when I have more choices.	**D/3/3; *F/3/3***	4	VLC-A
My ideas are valued in collaborative problem-solving activities by my peers.	**H3/3**	4	PLE
I have the freedom to learn in different ways that suit me.	**A/3/3**	4	LCC-PLE
My intellectual development is as important as getting a good job.	**H3/3**	4	VLC
I like being able to present information using the software/tool of my choice.	**H3/3**	4	VLC-A
Experiential collaborative problem-solving activities teach me useful skills for my future study and career.	**E3/3**	4	VLC
Experiential collaborative problem-solving activities teach me useful life skills.	**E/3/4**	4	VLC
Memorization is not the most important skill to pass the exam.	**E/2/2;**	4	V*LC*

Source: Online Surveys Per Cohort [A-G] Created Using Google Forms

Table 13

Data Collection Process and Instruments

Applied Research Questions	Data Collection Instrument	Where and How Will the Data Be Collected?
What effect (positive, negative, or inconsequential) will different degrees of non-prescriptive, collaborative, student-led, differentiated, multilingual, active learning environments have on specific types of summative Cambridge International Assessment physics examination outcomes (IGCSE, and AS Level examinations) as compared to other pedagogical cohorts' performances, on the same physics exams taught in English-only, traditional, prescriptive, classrooms focused on learning the exam for specific time-periods prior to the exams?	Cambridge International Assessment examination scores for Grade 9-12 students IGCSE and AS physics examinations organized by pedagogical cohort. Three multilingual cohorts with varying degrees of student-driven active learning projects before participation in IGCSE Exams. Two monolingual, IGCSE physics cohorts underwent traditional prescriptive pedagogy only before exams. Four cohorts with varying degrees of student-driven projects before participation in the AS portions of the Cambridge International A-Level exams. The total cumulative score data for the two cohorts are presented and compared.	Individual physics scores for each participating student were collected from the culminating summative exams at the end of zero to four years of study under specific pedagogy for each cohort. Investigation of the learner-centered cohort vs. the traditional cohort's pedagogical environments' possible correlations with performance below the mean of median values for a specific pedagogy. Inferential statistics for a positive, negative, or inconsequential statistically significant relationship. (Trochim, 2006). Where appropriate, mean, median, mode, and standard deviations for specific collections of scores, grouped by score, and pedagogical cohort are graphically presented, followed by percent differences from the median for comparison where performance might fall below the median (Trochim, 2006).
How will the same multilingual, learner-centered cohort of English Language Learner (ELL) physics students' performances compare with their examinations in other STEM subjects for specific types of summative Cambridge International	The scores will be broken down by individual examination type (IGCSE vs. AS), yet for the same cohort taking multiple simultaneous STEM courses (Biology, Chemistry, and Mathematics).	Individual physics scores and STEM [biology, chemistry, and mathematics] scores for each participating student were collected from the culminating summative

Assessments IGCSE, and AS exams in physics, math, biology, and chemistry with more monolingual, prescriptive, exam-focused pedagogy?	The total cumulative scores for a single cohort for each STEM subject undergo analysis.	exams at the end of zero to four years of study under specific pedagogy for each cohort. Investigation of the PBL physics course outcomes vs. the traditional STEM courses summative outcomes undergoes collection for the same cohort's Cambridge International Assessment IGCSE and AS portions of the A-Level exams. The pedagogical environment's possible correlations with specific examination scores will commence via descriptive and inferential statistics for a positive, negative, or inconsequential statistically significant relationship across subjects and like exam types (Trochim, 2006). Frequency distributions of physics and STEM examination scores, grouped by exam type score, and pedagogical course-type displayed graphically. Means, medians, modes, standard deviations, and percent differences are recorded where appropriate (Trochim, 2006).
What are student conceptualizations and understandings of learner-centered pedagogy regarding its perceived impact on a positive learning environment (PLE), valuation of learner-centered ideas (VLC), agency (A), preparation for the high-stakes summative exam (PFE), preparation for life (PFL), and	Students voluntarily answer qualitative research questions in the form of an online survey created in Google Forms. Classification or coding a positive vs. a negative vs. 'no impact' experience will rely on	All physics students currently taking IGCSE or A-Level Physics [Grade 9 - 12], in addition to graduated students with exposure to a minimum of 1 year of learner-centered physics, participated

student self-efficacy (SE) within a pedagogically learner-centered classroom (LCC)?	numerical Likert Grading Scales (Harpe, 2015)	[cohorts A-H], resulting in 56 completed surveys. Answers range on a scale of 1-5. High scores for each impact rating quantify student perceptions of impact, compared across courses for statistical significance (CSU, Long Beach, n.d.; Harpe, 2015).

Appendix A

Letter of Authorization for Research

VIENTIANE PATTANA SCHOOL INTERNATIONAL

Souphanouvong Rd., Khoun Ta Village
Sikhottabong District, Vientiane
Tel. 219497-8; Fax 219497
Email:vps4peter@gmail.com

01/08/2020

Letter of Authorization for Research

To whom it may concern,

Michael Andreas, Physics Department Head and Grade 9-12 instructor, is authorized to collect, analyze, and present student Cambridge IGCSE and A-Level examination data for research purposes. Also, anonymous student survey data is permitted to be collected, analyzed, and presented.

Kind Regards,

Peter Crosthwaite
VPSI – Secondary Principal and Head of Centre
vps4peter@gmail.com
+856 21 219 496

P. Crosthwaite

Vientiane Patana School inter-national

Appendix B

Parent and Student Email

Dear VPSI Physics Students and Parents,

To better maximize all physics students' successful learning, I am engaging in anonymous student surveys to assess their understanding and experiences with my classroom teaching methods. In addition to the study, all physics, biology, chemistry, mathematics IGCSE, and AS-level test scores will be analyzed from 2015 until the present for each test-taker group. The compiled results are statistical, and individual student scores are not revealed. I am excited about discussing the results with parents, students, and staff of VPSI in the near future.

Kind Regards,

Mr. Andreas

Michael Andreas

Physics Department Head, IGCSE/A-Level Physics Instructor

Vientiane Pattana School International

Secondary Department

mike@vpslao.com| +856 020 7697 4456 | www.vpslao.com

Appendix C

Student and Parent Consent Form

Candidate privacy policy

Cambridge Assessment (also known as the University of Cambridge Local Examinations Syndicate) is part of the University of Cambridge. We offer various education-related products and services, including academic and vocational qualifications and the exams that underpin them, training services for teachers and others involved in education and a wide range of research aimed at educators and policy makers. We do this through three different examination boards: Cambridge Assessment English, Cambridge Assessment International Education and Oxford, Cambridge and RSA Examinations. Our address is The Triangle Building, Shaftesbury Road, Cambridge, CB2 8EA.

In order to provide these products and/or services we need to use personal data. That means that we may need to use information about you, for example your name, address, email address, phone number, date of birth, exam results, voice or video recording or other information by which we can tell who you are. We might collect the data from you directly or from your school or centre of learning.

Sometimes we might even need to hold special personal data about you, for example information about your health. But we would only hold this type of special information if we have a clear reason for doing so, such as to make special arrangements. Where appropriate, we would seek permission first. If you are 16 years of age or more then you would need to give us that permission, but if you are younger than that we would need to get permission from your parent or guardian.

It is important to us that we protect your privacy and any personal data that we hold about you. This Policy describes the way we use personal data so that you can know how you might be affected. If you have any questions about this, you can contact us at data.protection@cambridgeassessment.org.uk.

Purposes for which we use Personal Data

Sometimes we may need to use your personal data where it is necessary to fulfil the requirements of a contract that you may be a party to. Apart from that we will only use personal data where we have what is known as legitimate interests. What that means is that if we use your personal data it is either because it is necessary in order to provide products and/or services to you or for other reasons that you might reasonably expect an organisation like us to use your personal data (without unfairly affecting your privacy or any other rights you may have).

The following activities require the use of personal data in order for us to provide our products and/or services. We may have to withdraw the provision of such products and/or services if we cannot use your personal data.

- Developing and delivering academic and vocational qualifications/programmes, including the development of assessment materials (such as exam questions and marking guidelines), the collection, marking and grading of exam scripts, the administrative systems used to support these processes, the issuing of awards and certificates.
- Developing and delivering publications and other resources that support learning in connection with such academic and vocational qualifications.
- Monitoring the performance of those involved in the provision of such academic and vocational qualifications.
- Investigating allegations of misconduct in relation to the sitting of exams.
- Ensuring the appropriate examination facilities are available to those with specific requirements.
- Checking that an individual (e.g., a candidate) is who they say they are.
- Handling complaints.

The following are examples of other activities which involve our use of personal data:

- Carrying out research in the field of education and qualification delivery, setting standards and other activities that are required to ensure that our services are delivered to a high standard and that candidates are protected
- Understanding the needs of candidates and other users of our services (including qualifications).
- Providing training to individuals, such as teachers and examiners, in connection with our services
- For purposes connected with our internal business, including understanding and protecting ourselves from risks, protecting any personal data that we hold, internal record-keeping and carrying out business checks

We may use personal information provided by you to carry out marketing and market research. We will only do this where we have your consent to contact you for these purposes. You can opt out of these contacts at any time.

We may sometimes use a method known as profiling. In part, this method involves automatically collecting certain information in order to understand how people might behave, but we will not make decisions based on this without some human involvement. We occasionally use this method when someone is doing a test on a computer where his or her activity has been questioned, or to assist with test itself.

We may also use profiling for marketing purposes and to improve the quality of our services.

Transferring Personal Data

We may share personal data:

- with Cambridge University and other affiliated businesses and organisations which are owned by it;
- with people and organisations that represent us (such as examiners);
- with other people and/or businesses who provide services on our behalf;
- with other schools or educational establishments which you attend;
- with the Universities and Colleges Admissions Service, other universities and other organisations/businesses, in order to help candidates that are making applications; and
- where we are required to do so by law.

The United Kingdom and countries inside the European Economic Area have specific laws which protect the way personal data is used. We may transfer personal data to countries outside of the European Economic Area where personal data is not protected in the same way (usually to other businesses who provide services on our behalf). In such cases, we will make sure that suitable safeguards are in place to protect the personal data. What that means is that whoever we transfer data to will have to agree to protect the personal data in an appropriate way. You can request further information about this by emailing data.protection@cambridgeassessment.org.uk

General

We may keep personal data only for as long as necessary to fulfil the purposes for which we are processing your personal information unless the law permits or requires longer. For example, we might need to keep your personal data for quality assurance of the service we have provided, or we might need to keep it to defend future legal claims.

We may use cookies on the Site. This enables us to personalise a User's experience of our Site by recording details about use of the Site as a file on a User's device. Users may disable the use of cookies but this may limit the functionality of web pages on our Site, or your access to our Site.

Depending on the country in which you live, you may have certain rights over any personal data of yours which we hold. If so, you will be informed of these rights before your personal data is collected or as soon as is reasonable afterwards.

If you think that we have used your personal data unfairly then you may have the right to complain about us to the authority in your country which is responsible for guarding data protection laws.

Changes to this Policy

We may make changes to this Privacy Policy and will let you know about these changes by displaying them on this website. Changes will begin to have effect at the time they are displayed. The version of the Privacy Policy that will apply to you is the one which is current at the time you use this website or purchase our goods and/or services or are entered by your school or centre for one of our qualifications.

Source:
http://www.cambridgeinternational.org/privacy-and-legal/data-protection-and-privacy/candidate-privacy-policy/

- [x] I have read and agree to the privacy policy
- [ ] I have read and do NOT agree to the privacy policy

Name ______________________ Date of birth:__________

Signature:______________

Parent's/Guardian's Signature (If younger than 16yrs):______________

Date:______________