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Adaptive Learning in the Age of COVID-19: Exploring Psychomotor and Cognitive Impacts on Open and Distance Learning (ODL)

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ABSTRACT

The pandemic, which prompted a nationwide shutdown in Malaysia in 2020, has profoundly influenced education delivery modalities. This transition marked a shift from the conventional face-to-face instructional approach to remote teaching and learning methods. The adoption of these alternative approaches has had significant implications for various components of the academic curriculum, including fieldwork, practical sessions, laboratory work, and the conduct of final examinations, particularly for students pursuing a Diploma in Geomatics Science. This study investigates the repercussions of the open and distance learning (ODL) approach on the attainment of psychomotor skills (PLO3) and cognitive competencies (PLO1 and PLO2) among students. Specifically, the study examines students' academic performance over two successive semesters: October 2020 to July 2022 (during the COVID phase), and October 2022 to February 2023 (post-COVID phase). The findings substantiate the notable impact of alterations in educational delivery methods on the achievement of PLOs. The research outcomes presented herein offer valuable insights and serve as pivotal data for educators and policymakers within the academic realm.

Keywords: Psychomotor, pandemic, cognitive, Program Learning Outcome (PLO)

INTRODUCTION

With the pandemic's arrival, education experienced a major change that forced both students and educators into the unfamiliar realm of online learning. This shift necessitated an investigation into how different teaching and learning activities affect students' performance as we explored this new territory. This research initiates a comprehensive examination of the intricate relationships between educational strategies and student outcomes.

This study focuses on student performance during the chaotic pandemic era and the subsequent transition from online to face-to-face teaching and learning activities, analyzed through the lenses of both the cognitive and psychomotor domains. This dual perspective allows for an evaluation of the complex effects of changes in teaching on students' overall development. Our research focuses on AP120 Diploma in Geomatics Science students, covering the spectrum of cognitive and psychomotor development. This study aims to provide insights into the dynamic relationship between education and performance in these extraordinary circumstances by meticulously examining and assessing the impact of pedagogical strategies and learning activities on students' abilities.

The extraordinary global health pandemic impacted every aspect of humanity. The education sector has been among the most significantly affected. Students of all ages faced a new and challenging educational environment as the world dealt with lockdowns, social isolation, and the shift to remote learning. Due to this change's immediate and long-term effects on student achievement, teachers, administrators, and academics are now intensely examining how the pandemic has affected academic achievement and psychological well-being (Yadav, 2020). Students had to manage an unexpected shift from conventional educational environments to virtual learning settings during this time of instability and adaptation. The sudden change disrupted established structures, introduced new technological challenges, and placed students under significant emotional and psychological stress. Furthermore, the pandemic created massive disparities in resource access, exacerbating educational inequities among diverse socioeconomic and demographic groups (Onyema et al., 2020). The transition to online learning and evaluation has significantly impacted students' practical and cognitive abilities (Singh et al., 2022). Depending on several factors, including the inherent nature of online education, students' adaptability, and resource accessibility, these effects can be both positive and negative (Magomedov et al., 2020).

Students may have become attached to the ease and accessibility of their home environments after long periods of online learning. This comfort zone could lead to disruption if they must return to a regular classroom setting, potentially causing initial distress or anxiety. When reverting to conventional methods, students who have grown highly dependent on technology might face an adaptation process (Glantz & Gamrat, 2020). Handwritten notes, physical textbooks, and other non-digital resources might require some adjustment. Excessive use of technological devices during online learning could have resulted in reduced attention spans and screen fatigue. Students may initially find it challenging to focus for extended periods in a face-to-face setting. Different assessment techniques are used for online and in-person learning, and it can be difficult for students to adjust to traditional examination approaches that demand memory and instant problem-solving once they are accustomed to online assessments, such as open-book exams or more lenient approaches (Pertuz et al., 2022).

As we investigate the impact of the pandemic on student achievement, it becomes clear that its consequences extend far beyond the classroom. This inquiry examines all aspects of students' academic lives, from learning disabilities and mental health issues to innovative teaching methods in a post-pandemic society. Understanding these complex processes will better equip us to fulfil children's educational needs now and in the future as we strive for a more resilient and equitable education system. It is expected to promote more effective approaches to student development by educating educators, policymakers, and stakeholders, helping them navigate the constantly evolving educational landscape in a post-pandemic world.

METHODOLOGY

Figure 1 provides an overview of the methodology employed in this study. The investigation focuses on the cohort of students admitted in October 2020 for the intake of 20204. At the commencement of their academic term, fully online instructional methods and assessments were adopted. All academic activities, including lectures, laboratory and fieldwork, tutorials,

examinations, and tests, were conducted via online platforms such as UFuTURE, Google Meet, Webex, and Zoom, facilitating instructor-student connectivity. Based on Pekeliling 2/2022, all instructors at UiTM were recommended to provide online materials to facilitate teaching and learning activities. The implementation of blended delivery for teaching and learning activities, combining ODL and F2F methods, was initiated in October 2021 and continued until the semester ending in March 2022.

The semester of 20204 was designated as the pandemic phase, during which learning, and evaluation were conducted entirely online from the start of semester 20204 to 20214. Since the commencement of the semester in October 2022 (20224), there has been a notable transition in the mode of conducting final assessments, tests, and other relevant evaluations. Specifically, there has been a complete shift from online assessments to face-to-face (F2F) assessments, known as the post-pandemic phase.

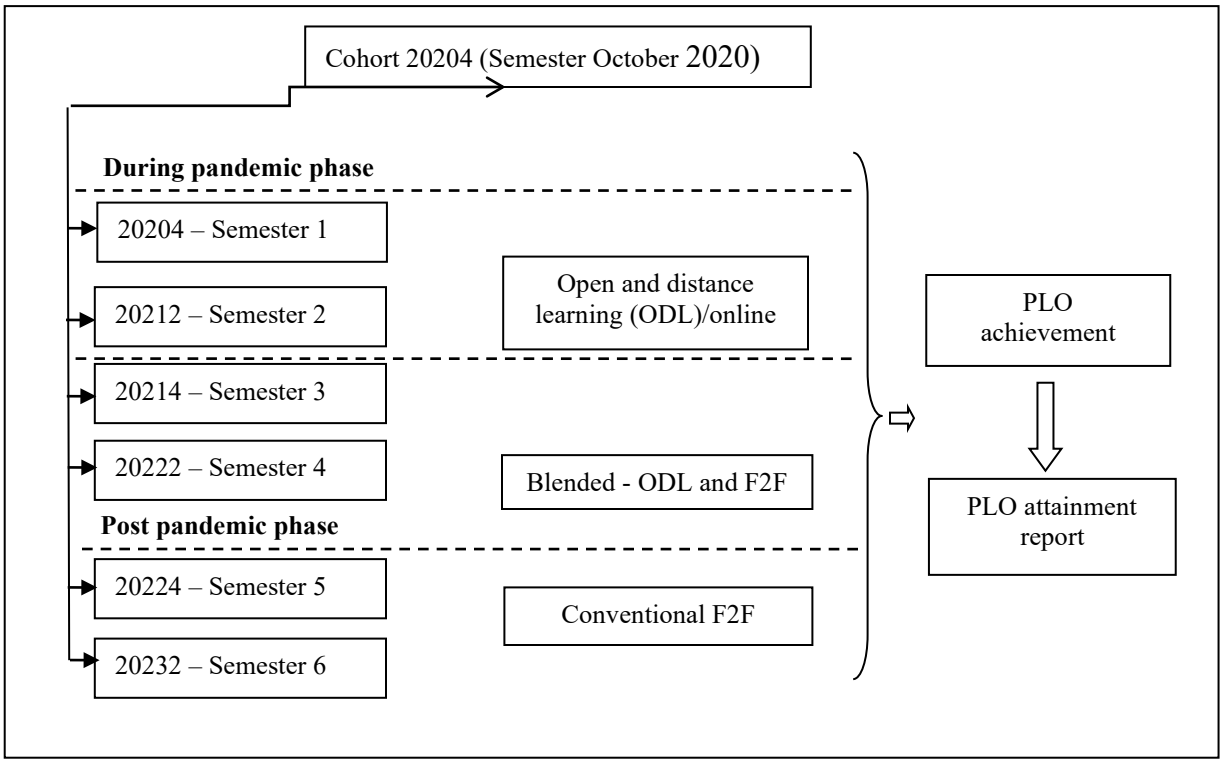

Figure 1. Methodology flowchart

The assessment methods utilized for measuring the achievement of PLO 1 encompass both tests and quizzes. PLO 2 includes various assessment methods such as final examinations, case studies, written tests, and essays. Diverse assessment methods are employed to evaluate the attainment of PLO 3, including practical tests, instrument tests, site observations, laboratory or field reports, projects, and other suitable means. The attainment of learning outcomes about the psychomotor and cognitive domains for AP120 students is determined through the assessment of their grades and performance. The report on the attainment of PLOs is generated from the Student Information Management System (SIMS) following the official release of the students'

final results. The attainment report of the AP120 admission cohort from October 2020 is then mapped and analyzed.

RESULT AND ANALYSIS

This section provides a comprehensive overview of achievements within the psychomotor and cognitive domains across the during-pandemic and post-pandemic phases, structured in a semester-by-semester basis.

Psychomotor and Cognitive domain achievement of during pandemic phase

The achievement of cognitive learning outcomes (specifically, PLO1 and PLO2) and psychomotor learning objectives (particularly, PLO3) among students of the 20224 cohort, who started their studies in October 2022, is considered in light of the data shown in Figure 2. Additionally, their first semester of education began two weeks before the implementation of the Movement Control Order (MCO) due to the pandemic outbreak. The courses GLS100, GLS130, MAT133, and PHY120 were taught using fully online methods throughout this first semester. The results of the subsequent evaluation show a range of achievement, with scores in the cognitive and psychomotor domains varying from 65% to 79% and 74% to 82%, respectively.

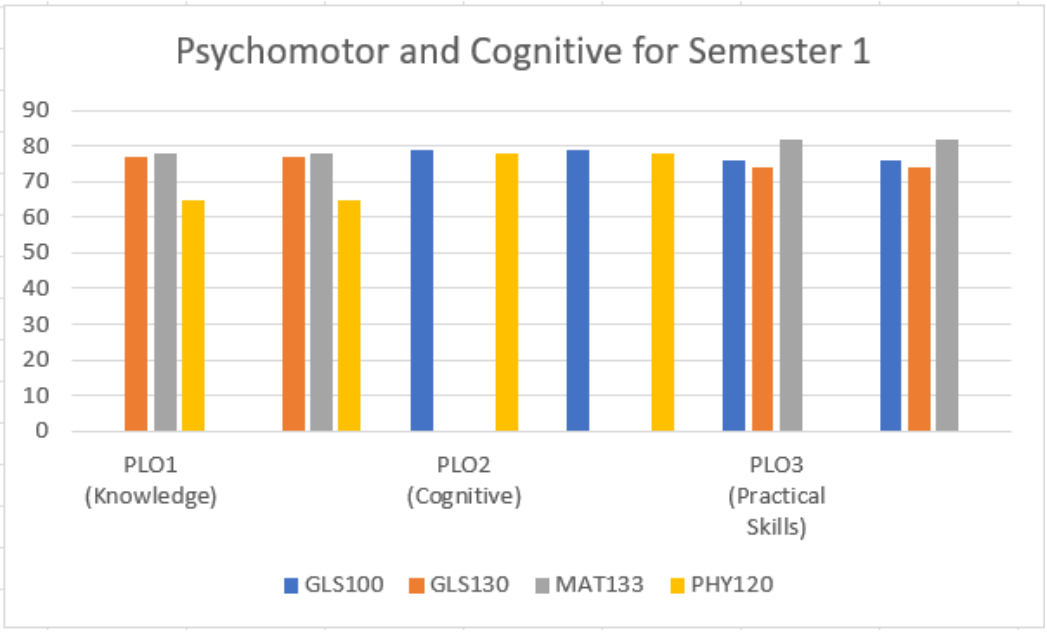

Figure 2. Psychomotor and Cognitive achievement for semester 1

For the majority of the GSS150, GSS160, GSS184, and MAT183 subjects, the online learning delivery method was implemented beginning in March 2021, as depicted in Figure 3 at the start of semester 2 (20214). The data show PLO1 success rates of 73% to 83% and PLO2 success rates of 59% to 77%, indicating rising trends in the cognitive domain compared to the previous semester. PLO3 success rates range from 73% to 77%. The PLO1 results for the third semester ranged from 71% to 77%, PLO2 results from 64% to 78%, and PLO3 results from 69% to 76%.

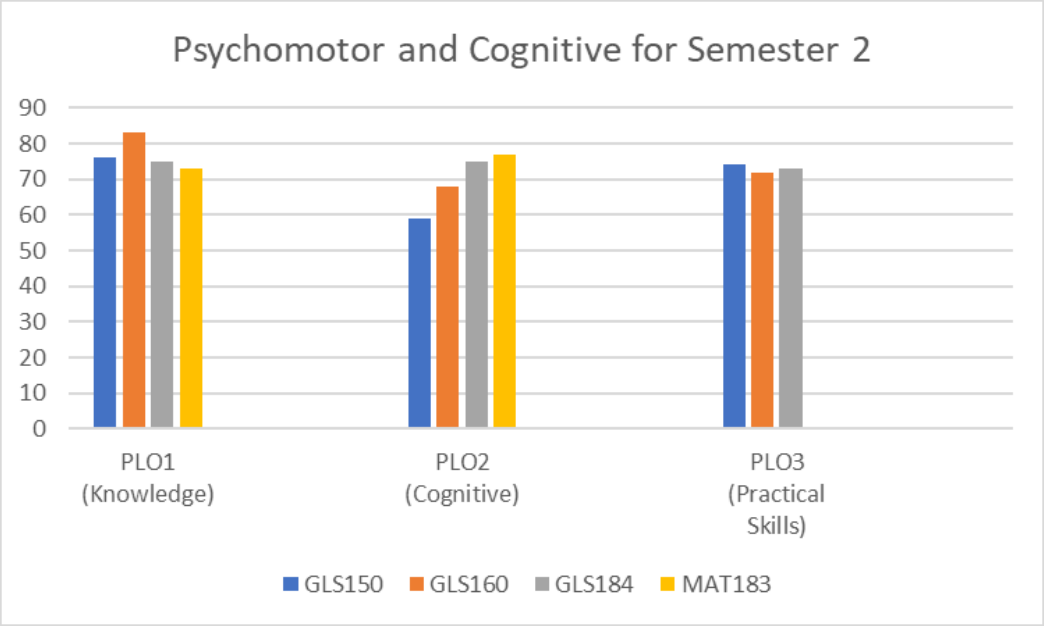

Figure 3. Psychomotor and Cognitive achievement for semester 2

During the pandemic, for semester 20214, the achievement of cognitive and psychomotor skills varied. At this time, some core subjects in the program implemented full face-to-face instruction for both lectures and practical sessions. Conversely, some minor subjects continued to operate online. As reflected in Figure 4, the achievement in the cognitive domain ranged from 71% to 77% for PLO1 and 64% to 78% for PLO2 across four subjects. Meanwhile, PLO3 achievement ranged from 69% to 76% in the psychomotor domain.

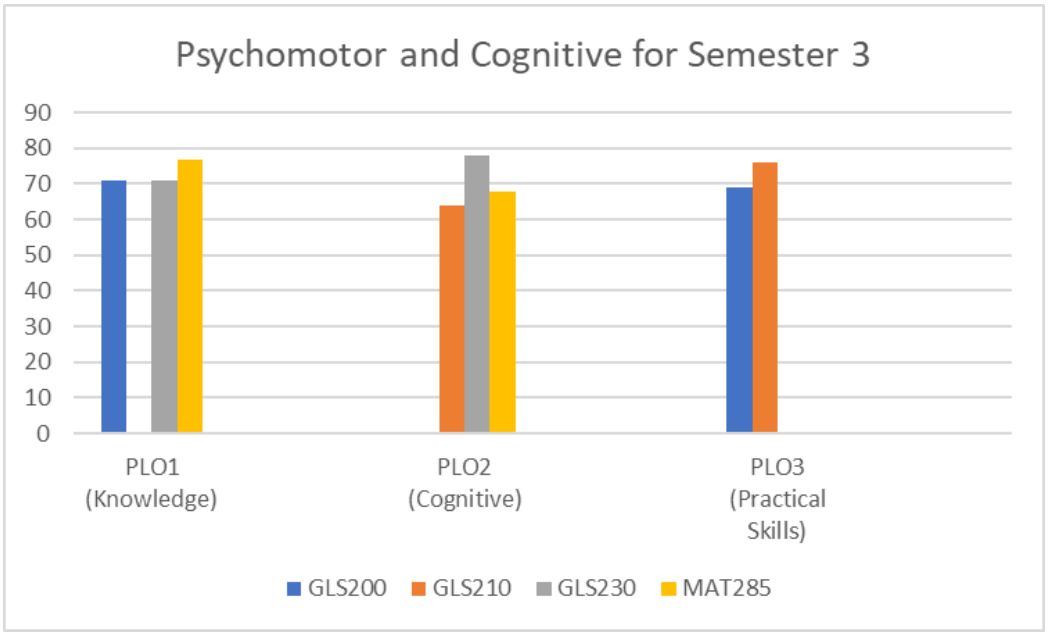

Figure 4. Psychomotor and Cognitive achievement for semester 3

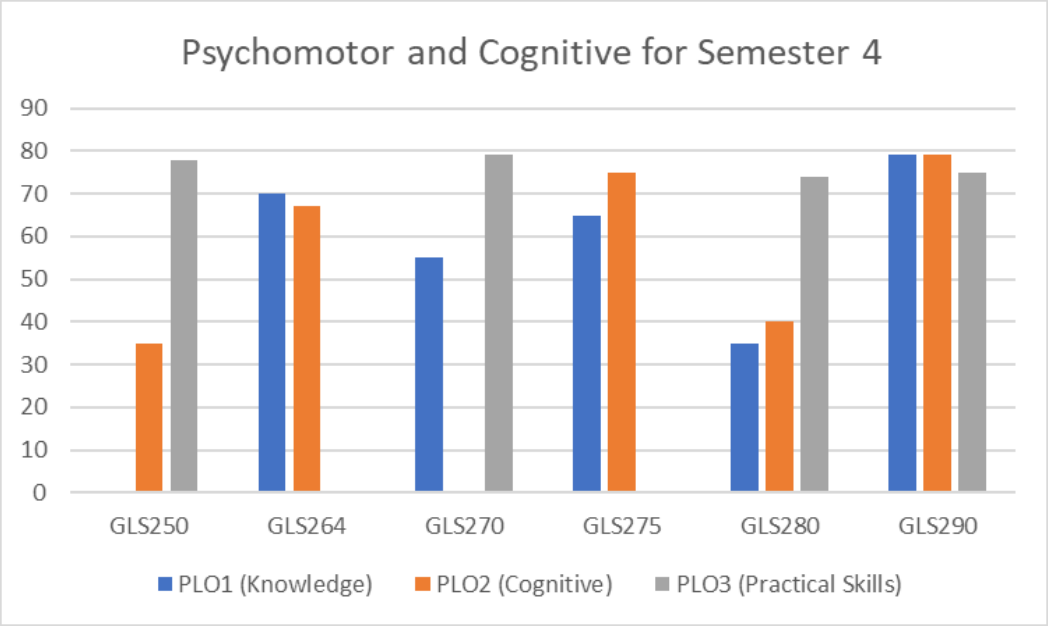

Figure 5. Psychomotor and Cognitive achievement for semester 4

As shown in Figure 5, it is important to consider the levels of achievement for the fourth semester for both psychomotor and cognitive learning outcomes. For example, when evaluating the academic performance in the fourth semester of the courses GLS250, GLS264, GLS270, GLS275, GLS280, and GLS290, achievement in the cognitive domains (PLO1 and PLO2) ranges from 35% to 79%. On the other hand, accomplishment in the psychomotor domain (PLO3) has generally been between 74% and 79%. It is apparent from the data that for subjects GLS250 and GLS280, the accomplishment levels for PLO1 and PLO2 are below the 50% requirement. The administration of final exams and evaluations in a face-to-face (F2F) format is the reason for this imbalance. By contrast, PLO3 achievement scores show a more encouraging trend, with the majority exceeding the 60% threshold.

Psychomotor and Cognitive domain achievement of post pandemic phase

The educational strategy involving full face-to-face (F2F) instruction, learning, and assessment delivery was implemented beginning in October 2022. Figure 6 depicts the achievement levels in the subjects GLS310, GLS315, GLS320, GLS335, GLS337, GLS340, and GLS362, showing that PLO 2 attainment ranges from 39% to 61%, while PLO 3 attainment ranges from 76% to 83%. The implementation of face-to-face final examinations and test assessments for all courses within this structure may have contributed to the decrease in attainment for PLO 1. Conversely, face-to-face, hands-on laboratory, and field work assessments increased PLO 3 achievement. These approaches allow students to engage with and utilize the instruments essential to their fieldwork and assignments.

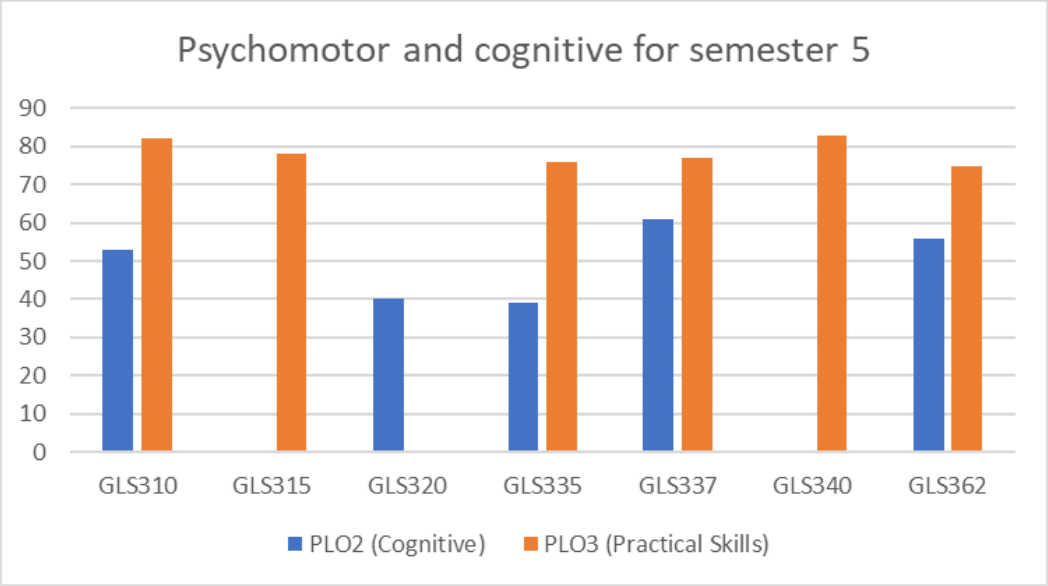

Figure 6. Psychomotor and Cognitive achievement for semester 5

The practical assessment conducted during the sixth semester focused on evaluating the attainment of PLO3 within the psychomotor domain, as illustrated in Figure 7. This assessment yielded a noteworthy achievement range spanning from 85% to 89%. It is crucial to emphasize that students had the opportunity to participate in practical training at their chosen workplace, involving 100% physical engagement. The assessment of this achievement was conducted exclusively by the employer in question.

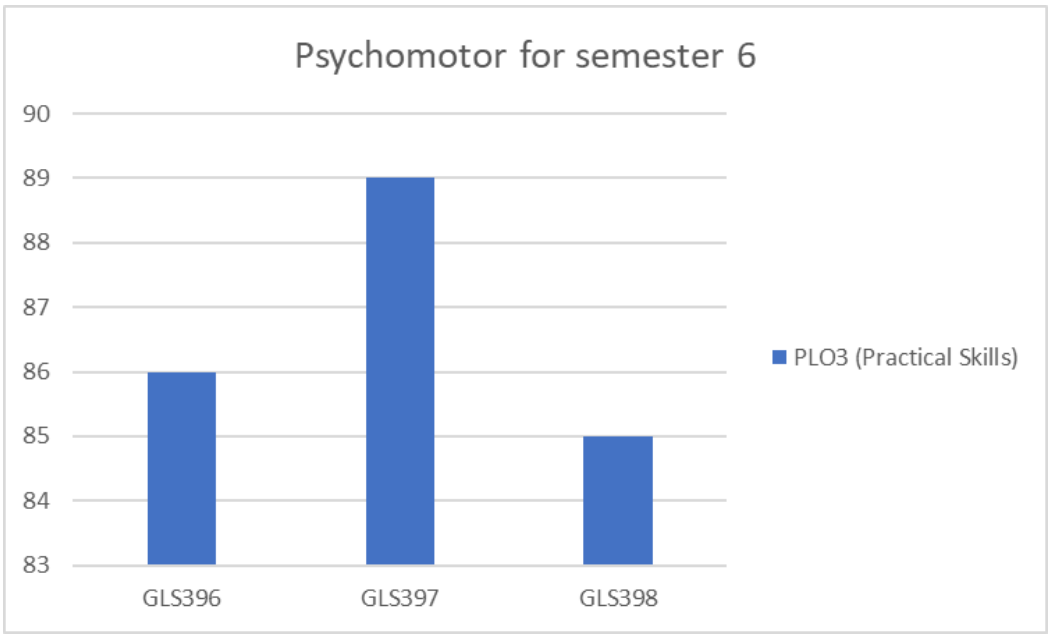

Figure 7. Psychomotor achievement for semester 6

PLO attainment report for Psychomotor and Cognitive domain

Table 1 provides a comprehensive overview of the attainment of Program Learning Outcomes (PLOs) across one full cohort cycle, spanning from semester 1 to semester 6, for the intake of students in 20204. Notably, attainment is increased from 75% to 77% during the transition from face-to-face (F2F) to online delivery methods in semesters 1 and 2. However, it is important to note that a declining trend emerges for PLO1 beginning in semesters 3 and 4, with attainment levels ranging from 73% to 61%. This decline can be attributed to the blended approach that combines face-to-face and online assessment modalities such as tests and quizzes.

Since the start of the pandemic until this semester, there has been a noticeable decrease in PLO2 achievement. The adoption of face-to-face final examinations, in accordance with the principles specified in Pekeliling 1/2023, is principally responsible for this decline. Particularly, the performance of students in subjects like GLS280 and GLS320 has significantly impacted the attainment of PLO2, falling below the 50% threshold.

In contrast, the performance trend for PLO3 has consistently improved, with achievement levels gradually rising from 73% to 87% during and after the pandemic phase. This improvement underscores the value of using face-to-face (F2F) instructional methods for practical and laboratory evaluations in the context of the AP120 student program. Increased proficiency and comprehension have resulted from employing this strategy. Overall, the attainment levels for PLO1, PLO2, and PLO3 are 71%, 65%, and 78%, respectively. While each of these PLOs achieves above 50% attainment, it is crucial to highlight that several still fall below the acceptable requirement.

Table 1. PLO achievement

PLO/Semester	PLO1 (Knowledge) (%)	PLO2 (Cognitive) (%)	PLO3 (Practical Skill) (%)
1	75	79	79
2	77	70	73
3	73	70	73
4	61	59	77
5		50	79
6			87
Total	**71**	**65**	**78**

Figure 8 represents the PLO achievement for the psychomotor and cognitive domains. It shows a declining trend for PLO1 and PLO2 during and after the pandemic outbreak. This decline is attributed to the implementation of online assessments for tests and final examinations, which decreased PLO achievement following the shift to physical assessments. Conversely, the growth of PLO3 has been observed after the implementation of face-to-face (F2F) field surveys and laboratory assessments, indicating that online delivery methods are not suitable for technical programs such as AP120. The use of F2F delivery for assessments involving instruments and laboratory tasks is crucial.

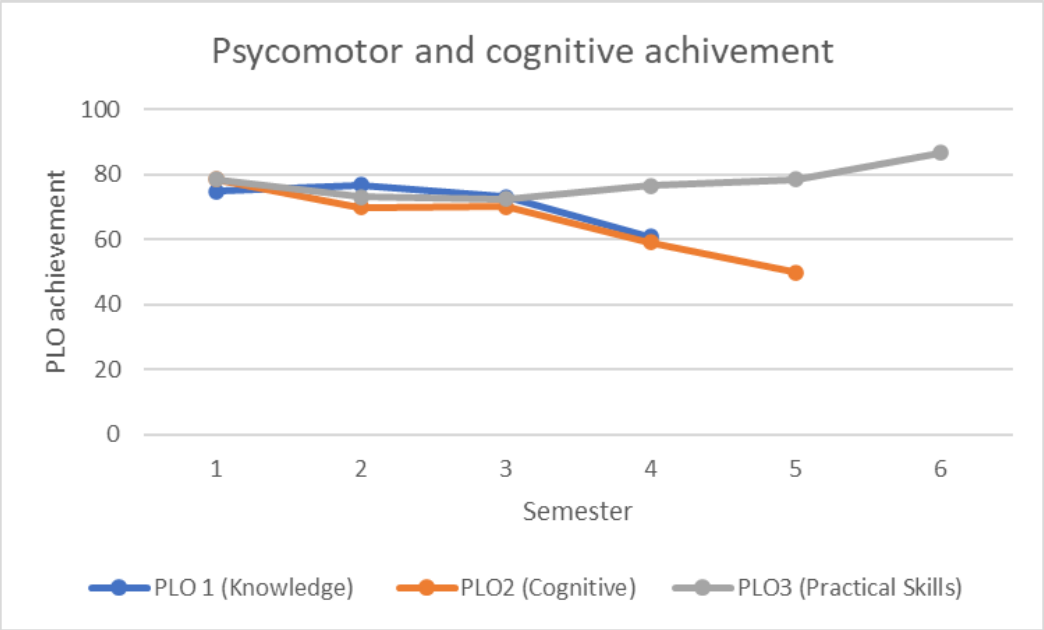

Figure 8. Psychomotor and Cognitive achievement cohort 20224 intake October 2022

CONCLUSION

The results indeed reveal an intricate and fascinating pattern. Traditional education, which often emphasizes cognitive capacity, appears to have declined during this period. In contrast, there has been a noticeable growth in the psychomotor domain, marking a striking and thought-provoking trend. This shift indicates a change in how students engage with and apply knowledge in practical, real-world situations. This dynamic underscore the evolving nature of education and emphasizes the importance of flexibility in adapting to unforeseen circumstances.

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Conflict of Interest

The authors reported no potential conflicts of interest.

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Authors' Contributions

The authors affirmed that there is no conflict of interest in this article. Author 1 carried out the field work, prepared the literature review and overlook the writeup of the whole article. Author2 and author 3 was responsible for developing the study technique and conducting the data entry process. The statistical analysis and data interpretation were conducted by Author 3, 4 and 5.

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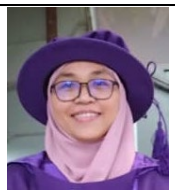	**Dr Faradina Marzukhi** is a PhD holder in Geospatial Information Sciences from Universiti Sains Malaysia (USM). She is currently serving at Universiti Teknologi MARA Perlis. Her expertise in the field of Geographic Information System (GIS), remote sensing and machine learning regression-based analysis.
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